Sport Sci Health (2024) 20:S1–S180
https://doi.org/10.1007/s11332-024-01174-z

ABSTRACT

XIV National Congress SISMES

Validity of commercial wearable sensors measuring respiratory frequency in soccer players

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Purpose: Evidence suggests that respiratory frequency (f_R) is a good marker of physical effort during different exercise modalities, including running-based activities characterized by supramaximal intensities, accelerations, decelerations, and changes of directions commonly performed in soccer and other team sports. Important technological advances have been made in recent years and some commercial wearable sensors are currently available, but it is unclear if they are suitable for measuring f_R in soccer. We assessed the validity of three strain-based commercial wearable sensors during soccer-specific exercises.
Methods: In two separate visits to the soccer pitch, ten male soccer players performed the same 30-min validation protocol characterized by soccer movements and activities, including running with the ball and intermittent shuttle runs. During the two visits, participants were asked to wear either a ComfTech vest (Howdy Senior, ComfTech s.r.l. ®, Monza, Italy) or a Bioharness™ 3.0 strap (Medtronic, Boulder, CO, USA) and a Tyme Wear™ vest (Boston, MA, USA). In both visits, a custom-made wearable mask integrating a temperature sensor was used as a reference system for validating f_R values extracted from the respiratory waveform recorded with the three commercial devices.
Results: The time course of f_R obtained with the ComfTech vest and the Tyme Wear™ vest fairly resembled that obtained with the reference system, even during intermittent shuttle runs, where fast changes in f_R to the alternation of work and rest phases were observed. The mean absolute error was generally lower than 3 breaths•min^{-1} for both the ComfTech vest and the Tyme Wear™ vest, while it was higher than 5 breaths•min^{-1} for the Bioharness™ strap in some participants. The error of measurement was affected by the algorithm used to extract f_R from the respiratory waveform, and a considerable degree of interindividual variability was found for all three devices.
Conclusions: Different wearable sensors are potentially suitable to monitor f_R in soccer, but their performance may change substantially based on the algorithm used to compute f_R. The specific measurement challenges posed by the soccer scenario should be carefully considered when developing devices and algorithms aiming to monitor f_R in this context.

Validity of two new RPE-scales to assess physical and psychological load of training and competition

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Purpose: The purpose of this cross-over randomized study was to investigate the discriminant validity of two new RPE-based scales to assess physical and psychological load of training and competitions.
Methods: 30 young physically active adults (10 females) were tested on a treadmill in a single laboratory visit. After a preliminary test to establish the speed correspondent to 50–60% HRmax (Low Physical Load, LPL) and 80% HRmax (High Physical Load, HPL), participants were tested in four different conditions: LPL, HPL, LPL + Cognitive Load (LPL + CL) and HPL + Cognitive Load (HPL + CL). In all conditions participants ran for 5 min with 10 min rest between runs. The cognitive load was added by asking the participants to perform a free-memory recall task whilst running. At the end of each run, participants were asked to rate how mentally and physically demanding the task was, using the NASA-TLX scales, overall RPE scale and the two new RPE scales in a random order. The Physical RPE scale concerned the muscular and respiratory effort experienced during the task. The Mental RPE scale concerned the subjective cognitive, emotional and motivational demands of the task. Heart rate was monitored continuously during all tasks. Fully 2 by 2 Repeated Measure ANOVAs were used to assess differences between conditions (known-differences validation method). Within-subjects correlation coefficients between the new RPE scales and the criterion (NASA-TLX scales) were calculated using Bland Altman method.
Results: The physical RPE scale and the Mental RPE scale were significant correlated with the physical demand NASA-TLX scale ($r = 0.704$, $p < 0.001$) and the mental demand NASA-TLX scale ($r = 0.903$, $p < 0.001$), respectively. There was a significant Physical x Cognitive Load interaction on the Physical RPE scale ($p = 0.007$).

Follow up tests revealed that Physical RPE was significantly higher in the high physical load conditions (HPL vs LPL and HPL + CL vs LPL + CL). A significant effect of cognitive load was found only in the high physical load condition with Physical RPE lower during HPL + CL vs HPL. Non significant Physical x Cognitive Load interaction was found on Mental RPE. However, there were significant main effects with higher Mental RPE during conditions of high physical load ($p = 0.007$) and high cognitive load ($p < 0.001$).

Conclusions: The new RPE scales have good criterion validity. Furthermore, the scales are able to discriminate between different physical and cognitive loads.

Effect of long-term strength training exposure on motor unit discharge properties and estimated neural drive during rapid contractions

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Purpose: Recent cross-sectional studies reported no differences in motor unit (MU) discharge properties during slow submaximal and maximal contractions between long-term strength-trained (LT-ST) and untrained (UT) individuals (1,2). However, MU adaptations in LT-ST during rapid contractions are less clear. Here we concurrently assessed changes in rate of force development and MU discharge properties during rapid contractions after multiple years of strength training exposure.

Methods: Thirteen LT-ST (> 6 yr training practice) and twelve UT individuals performed maximal voluntary isometric contractions (MVC) and a series of rapid-hold elbow flexion contractions where they had to achieve the 80% of MVC as quickly as possible. Concurrently, myoelectrical activity from biceps brachii was recorded with two high-density surface EMG grids. EMG recordings from rapid-hold contractions were decomposed into individual MU discharge timings. Absolute (RFD_{ABS}) and normalized (RFD_{REL}) rate of force development, motor unit discharge rate in the initial (MU $DR_{INITIAL}$) and plateau (MU $DR_{PLATEAU}$) phase of contractions, and estimated neural drive to the muscle were extracted and compared between groups.

Results: LT-ST individuals had a greater MVC (+ 59%, $p < 0.001$) and produced greater RFD_{ABS} in all time windows (0-50 ms: + 55%; 0-100 ms: + 52%; 0-150 ms: + 59%; 50-100 ms: + 51%; 100-150 ms: + 59%; $p < 0.001$ in all cases) compared to UT, but these differences were eliminated with respect to RFD_{REL}. Similarly, LT-ST individuals exhibited a greater MU $DR_{INITIAL}$ (+ 19%, $p = 0.021$) and estimated neural drive to the muscles (+ 16%, $p = 0.020$) in the first 50 ms from contraction onset. However, no between-group differences were observed for MU $DR_{PLATEAU}$.

Conclusions: We assessed for the first time the rate of force development and motor unit discharge characteristics during rapid contractions in individuals with multiple years of strength training experience. LT-ST exhibited greater RFD_{ABS}, enhanced MU $DR_{INITIAL}$ and estimated neural drive to the muscle. Interestingly, these neural differences did not result in a greater RFD_{REL}, likely due to the opposing effect of prolonged strength training on slowing of the intrinsic contractile muscle properties (3). Overall, the present study provides novel evidence about the capacity and adaptability of the nervous system to generate force rapidly after years of strength training exposure.

References

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Never too late to get a black-belt: psychophysiological impact of a judo grading examination in older adults

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Purpose: Stress-related effects of sport competitions and examinations have been studied in youth populations (Filaire et al., 2001). This study aims to investigate the psychophysiological impact of simulated and actual black belt grading evaluation on older judo practitioners.

Methods: The experimental group encompassed six brown belt examinees (Tori) undergoing black belt examination (F = 2, M = 4; 75.6 ± 4.5 yr) and six 2nd-5th Dan black belt partners (Uke; M = 6; 36.5 ± 10.8 yr). Salivary alpha-amylase [sAA] and cortisol [sC]), perceived anxiety, effort and enjoyment were evaluated in 2 experimental conditions (simulation, exam) and in a rest day. Cotton swabs were used to collect saliva samples at awakening (T0), pre (T1) and post (T2) exam, and at 15' (T3), 30' (T4), and 60' (T5) of the recovery phase and at the same time during simulation and rest. Enzyme immunoassay and kinetic enzyme assay kits were used to assess sC and sAA, respectively. For the anxiety, the participants completed the STAI-Trait questionnaire at rest, whereas the STAI-State was administered before and after the experimental sessions. The 10-point Rating of Perceived Exertion (RPE) and Enjoyment Visual-Analogue (ENJ) scales were administered after the experimental sessions. ANOVAs for repeated measures ($p < 0.05$) with Bonferroni corrections were applied.

Results: No differences emerged between Tori and Uke for sC, sAA, and anxiety. Differences were found for sampling and condition ($P < 0.05$). Post-hoc maintained differences only for the actual examination, with highest T2 values, returning at baseline levels at T3 for sAA and at T5 for sC. Trait and state anxiety were normal for age-reference population, with higher pre- state anxiety values during exam ($P < 0.05$). ENJ scores were higher for Tori and during simulation. RPE was higher for Uke during simulation and exam conditions.

Conclusions: Judo examination pose high psychophysiological strain in adults and older individuals. However, Tori enjoyed the black belt exam, substantiating that judo is suitable for older individuals (Palumbo et al., 2023). Ecological models are needed to evaluate the actual impact of psychophysical efforts in older individuals.

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Effects of upper- and lower-body muscle fatigue on swimming performance and biomechanics

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Purpose: To compare the effect of muscle fatigue between upper- and lower-limb on velocity and stroke mechanisms in front-crawl.
Methods: Ten swimmers (FINA points = 725 ± 74) were recruited for the crossover randomized and counterbalanced study design. The participants completed 4 experimental visits over 1 mth with a cadence of 7-day. During visit 1, swimmers completed a 7 × 200-m incremental protocol until exhaustion in front-crawl to determine velocity at lactate threshold (Dmax). In visits two to four, the experimental conditions were: 1) lower-body fatigue (LBF), 2) upper-body fatigue (UBF), and 3) control condition (CON). Pre- and post-condition, fatigue was measured using the 1RM test in the bench press and leg extension. Immediately after each condition, a 12 × 100-m at Dmax, and a 400-m maximal effort in front-crawl (5-min passive recovery between) were completed to test performance and biomechanics. Heart rate, lactate, RPE, stroke rate (SR) and stroke length (SL) as index of propelling efficiency were measured at the end of step 4, 8 and 12 of the incremental protocol and in the 1-min after for the maximal bout. The General Estimated Equations (GEE) were used to verify differences and interactions between variables and Bonferroni post-hoc correction was applied to significant variables ($p < 0.05$).
Results: For the 1RM values, there was an interaction between condition x time ($p < 0.001$). It revealed a significant 1RM reduction after both LBF ($p < 0.001$) and UBF ($p < 0.001$) conditions but not different from each other ($p > 0.05$). Regarding technical parameters for the 12 × 100-m test, significant differences between conditions for SR ($p < 0.001$) and SL ($p < 0.001$) were found. Then, swimmers after LBF ($p < 0.001$) and UBF ($p = 0.002$) presented higher SR and lower SL compared to CON. For the 400-m performance, a condition effect was found ($p < 0.001$). The UBF ($p = 0.002$) and LBF ($p < 0.001$) conditions presented a decreased performance compared to CTRL but not different from each other ($p > 0.05$).
Conclusions: Although the swimmer's propulsion is essentially generated by the arm pull, muscle fatigue induced in the lower limbs reduces the swimming performance and propulsive efficiency as well as that induced in the upper limbs.

Anaerobic power reserve, glycolytic power reserve and maximal aerobic power to prescribe high-intensity interval training: variability in performance and physiological responses

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Purpose: The aim of this study was to compare the inter-subject variability in performance and physiological responses during supramaximal interval training based on anaerobic power reserve, glycolytic power reserve and maximal aerobic power.
Methods: Twelve trained cyclists (VO_{2max}: 58.56 ± 9.70 ml × kg^{-1} × min^{-1}) completed a cardiopulmonary exercise test (CPET), a Wingate anaerobic test and three HIIT sessions until-exhaustion. Initially, both the CPET and Wingate tests were performed to determine the power associated with the VO_{2max} (MAP), the anaerobic peak power output (PPO) and the mean power output of the Wingate (MPO). Then, the Anaerobic power reserve (APR) was calculated as PPO-MAP, while the glycolytic power reserve (GPR) was as MPO-MAP. Subsequently, participants performed in a randomized order and separated by 72 h, three HIIT until-exhaustion sessions with 1 min of work phase and 1 min of active rest, based on APR ($HIIT_{APR}$: MAP + 10% APR), GPR ($HIIT_{GPR}$: MAP + 20% GPR) and MAP ($HIIT_{MAP}$: 120%MAP), respectively. In all HIITs, the rest period was fixed at 45%MAP. Variability in time to exhaustion (TTE), heart rate (HR), oxygen uptake (VO_2) and blood lactate concentration ($[La]^-$) was calculated as coefficient of variation (CV) and as mean of the square root of the squared difference between the individual value and the mean value. Then, values were compared between conditions via repeated-measures analysis of variance with a statistical significance set at $p \leq 0.05$.
Results: CV in TTE was lower in $HIIT_{MAP}$ (21%) rather than in $HIIT_{APR}$ (35%) (effect size [ES] = 0.47), and $HIIT_{GPR}$ (45%)(ES = 0.78). Mean CV in VO_2 was lower in $HIIT_{GPR}$ (6.7%) rather than in $HIIT_{MAP}$ (8.8%)(ES = 0.52) and $HIIT_{APR}$ (9.1%)(ES = 0.47). Mean CV in HR was similar (∼ 4.5%)(ES = 0.16) between conditions. Mean CV in $[La]^-$ was lower in $HIIT_{APR}$ (24.9%) rather than in $HIIT_{GPR}$ (28.1%)(0.36) and $HIIT_{MAP}$ (26.5%)(ES = 0.28). However, for all dependent variables, no significant difference in inter-subject variability was found.
Conclusion: Our findings indicate that HIIT based on APR and GPR does not reduce the inter-subject variability in performance and physiological responses compared to MAP-based prescription. In addition, our results potentially indicate that prescribing HIIT based on MAP could be a better prescription training method than APR and GPR in trained cyclists.

Breathe in, breathe out for acute post-exercise stress management

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Purpose: Changes in cardiac parasympathetic activity (CPA) can be evaluated by measuring heart rate variability (HRV), with the root mean square of successive differences (RMSSD) being a primary time-domain measure used to estimate vagally mediated changes in HRV. Controlled breathing (CB) during resting has a significant impact on HRV and serves as a strategy to influence CPA. However, the effects of CB on HRV and RMSSD after exercise remain poorly understood. Therefore, the objective of this study was to assess the effects of CB following a submaximal incremental treadmill exercise (SITE) on HRV and RMSSD.
Methods: 9 subjects (7 men; 2 women) performed 2 SITE with a 24-h recovery between sessions. SITE protocol included 3-min warm-up at a fixed slope of 1%, followed by a speed increase of 1 km/h

every 2-min. The exercise ended when the participants reached 95% of their maximal heart rate. 15-min before (PRE) and 15-min after (POST) each SITE, HRV and RMSSD were measured in a quiet and distraction-free room using a heart rate monitor connected to the "Elite HRV" app. During PRE, subjects were instructed to maintain a calm state and breathe freely for 5-min. In POST, two breathing conditions, uncontrolled breathing (UB) and CB following the guidance provided by the "Elite HRV" app, were randomized and performed by each participant. The CB pattern involved 6 breaths per minute with an inhalation/exhalation ratio of 1: 1, consisting of 5 s for inhalation and 5 s for exhalation, for a total of 5-min. Repeated measures mixed models were used to examine the effects of different breathing conditions (UB vs CB) on HRV and RMSSD. Statistical significance was set at $p < 0.008$.

Results: Significant differences ($p < 0.0001$) were observed, indicating lower HRV (49.5 ± 10.1 ms) and RMSSD values (29.8 ± 18.8 ms) in POST UB compared to all other UB (HRV PRE = 59.0 ± 8.8 ms; RMSSD PRE = 53.2 ± 27.4 ms) and CB (HRV PRE = 58.8 ± 7.3 ms; HRV POST = 57.7 ± 11.5 ms; RMSSD PRE = 50.1 ± 19.3 ms; RMSSD POST = 51.9 ± 31.4 ms) time points. On average, UB resulted in a decrease of 8.9 ms and 21.9 ms in HRV and RMSSD, respectively.

Conclusions: The study findings highlight the significance of CB in modulating CPA during stress-inducing conditions, such as exercise. Post-exercise HRV and RMSSD in the UB were markedly lower compared to CB. Consequently, practitioners and athletic trainers can employ slow and CB strategies, either during recovery or as a cool-down strategy after exercise, to enhance CPA and counterbalance excessive activation of the sympathetic branch.

The VO2 slow component in different exercise intensities and domains: association with markers of metabolic instability and muscle fatigue

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Purpose: The appearance of the slow component of VO_2 ($\dot{V}O_{2sc}$) in the heavy and severe exercise domains is explained by a combination of metabolic instability (measured with NIRS and hematochemical markers) and muscle activation (measured by EMG). To the best of our knowledge, no studies investigated how these parameters are associated with the $\dot{V}O_{2sc}$ in two different intensities of the moderate, heavy, and severe domains. Moreover, no studies have tested exercise intensities based on physiological thresholds: gas exchange threshold (GET), respiratory compensation point (RCP) and maximum oxygen uptake (VO_{2max}).

Methods: Eleven active men performed 6 × 9 min constant work cycling trials at 33% and 66% of the moderate ($> VO_2$rest/ $<$ GET; M1, M2), heavy ($>$ GET/ $<$ RCP; H1, H2) and severe ($>$ RCP/ $< VO_{2max}$; S1, S2) domain. During each session, VO_2, hematic markers (i.e. $[La^-]$, pH, HCO_3^-), as well as local muscle O_2 extraction (deoxyhemoglobin, [HHb]) and muscle activity (EMG) of the vastus lateralis were measured. We tested the hypothesis that the VO_{2sc} is intensity and domain-dependent and can be predicted by metabolic instability and muscle activation. More specifically, within the domains: (i) no presence of VO_{2sc} in the moderate; (ii) VO_{2sc} being larger with increasing intensity within the heavy domain with the only contribution of metabolic instability (iii) VO_{2sc} being larger with increasing intensity in the severe domain with both contribution of metabolic instability and muscle recruitment.

Results: The slope of [HHb] and RMS between minutes 3 and 9 were calculated and the relationship with $\dot{V}O_{2sc}$ evaluated by simple and multiple linear regressions. The post-hoc analysis comparisons between the six different intensities of [HHb] and RMS with $\dot{V}O_2$ beyond the third minute of exercise showed that [HHb] kept increasing significantly in all the intensities within severe and heavy, but not within the moderate domain. RMS increased significantly over time only in the S2. Moreover, beyond the third minute of exercise, VO_{2sc} was significantly correlated with the slope of [HHb] ($r = 0.56$, $p < 0.001$) and RMS ($r = 0.58$, $p < 0.001$) and both were significant predictors of the $\dot{V}O_{2sc}$ ($r = 0.68$; SSE 0.94% ml•min^{-2}, $p < 0.001$).

Conclusions: We confirmed the contribution (i.e., 68%) of both metabolic instability and muscle activation to the dynamic of the VO_{2sc} across different exercise intensities. However, the insurgence of the O_{2sc} in the heavy domain stem especially from metabolic instability, while in the severe domain it stem also from muscle activation.

The VO_2 slow component in different exercise intensities and domains: association with markers of metabolic instability and muscle fatigue

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Physical education to enhance health related-fitness in adolescents: a mediation analysis from the regional observatory of motor development and health prevention in apulia

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Purpose: The Regional Observatory of Motor Development and Health Prevention is a regional project involving secondary schools of first and second grade in Apulia aimed at (a) assessing the levels of physical efficiency and health status of children and young adolescents, and (b) defining national recommendations and guidelines for the practice of physical activity and healthy habits. Previous studies have showed that physical self-perception (PSP) and enjoyment are key factors to promote greater adherence to physical activity (PA), and PA is strictly linked to better physical fitness and inversely related to body mass index (BMI). In the light of these evidence, the present study aims to assess the mediation role of PSP and enjoyment in enhancing PA and physical fitness according to BMI values.

Methods: The sample (N = 180, age = 11–13 years; M = 90, Nw = 30, Ow = 30, Ob = 30; F = 90, Nw = 30, Ow = 30, Ob = 30) was recruited by the school that joined the Regional Observatory of Motor Development project with a simple randomization. The total sample was divided according to gender (male and female) and BMI group (normal weight, overweight, and obese). Physical efficiency was assessed with standing long jump (SLJ), Medicine Ball Throw (MBT), 10 × 5 shuttle run (10 × 5), One Mile Run Walking Test (MRWt), while three validated questionnaires were used for the evaluation of levels of physical activity, enjoyment and PSP. The assessment took place during curricular physical education lessons and was conducted by a team of Experts in Motor and Sports Sciences, and in Preventive and Adapted Motor Activities. The results of

the descriptive analyzes were reported in terms of mean ± standard deviation for all continuous variables considered. Analysis of variance (ANOVA) was performed to highlight the differences between variables, and Post Hoc Test was carried out to describe differences betweengroups. To detect and analyze the relationship between variables, the Pearson relationship coefficient (r) was calculated. Preacher and Hayes method was used to carry out mediation analysis between variables.

Results: The results of this study can be summarized as follows: Both normal weight boys and girls showed better motor performance for all variables considered (both physical tests and questionnaires); PSP represents a significant mediating variable between BMI and strength (SLJ), and between BMI and endurance (10 × 5 and OMRWt), while physical activity levels positively mediate the relationship between fun and physical sefl-perception.

Conclusions: This study suggests the importance of BMI, PAL, enjoyment and PSP in determining proper physical fitness as health status indicator. Due to the small sample involved, further researches are need to better understand the relation between these variables and (a) provide more generalizable results, (b) define best practice for physical education teachers and (c) develop regional and national recommendations and guidelines for health promotion in young adolescents.

Localized neuromuscular fatigue of postural muscles is efficiently compensated during a force-field motor adaptation task

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Purpose: Muscle fatigue (MF) is a physiological state that has transient impacts on performance. To date, effects of localized MF (i.e., single muscle) on neural processes of human postural control are still poorly understood. Motor adaptation processes allow to adapt motor outputs to unexpected changes of the environment or task parameters based on sensorimotor feedback integration. We want to study how fatiguing a postural muscle—contributing to the control of vertical posture—impacts on the motor adaptation mechanisms controlled by the central nervous system (CNS).

Methods: Participants (14 M; 14 F) were randomly assigned to fatigue (FAT) or control (CON) group. The task consisted of mediolateral hand reaching movements, using a KINARM End-point robot. Instructions were to reach as fast and accurate as possible the target. After familiarization, participants performed a block (n = 30 trials) of unperturbed reaching tasks (BASE). Before each of the following 10 blocks—they performed sustained, cyclical isometric exercise (40 s; 75% duty cycle) with their tibialis anterior muscles. Exercise intensity differed between groups (FAT: 65 ± 5%; CON: 7.5 ± 5% MVC). In the 8 successive blocks, the robot applied a viscous force-field perpendicular to the direction and proportional to the speed of the hand movement (ADAPT). The last 2 blocks of the protocol were unperturbed—washout (WASH). Three out of 30 trials in each ADAPT block were unperturbed (CATCH). Hand path, speed and force applied at the handle, force plate GRF and surface EMG data (12 muscles) were recorded. Variables were compared at different protocol stages: late baseline (LB), early adaptation (EA), late adaptation (LA), early catch (EC), late catch (LC), early washout (EW) and late washout (LW).

Results: Trajectory error, measured at different stages was similar between groups (LB: 0.9 ± 0.3 and 0.9 ± 0.4; EA: 6.6 ± 1.8 and 6.0 ± 1.9; LA: 1.2 ± 0.4 and 1.0 ± 0.3; EW: -3.8 ± 0.8 and -3.2 ± 1.1; LW: 0.9 ± 0.3 and 0.9 ± 0.3 cm, for CON and FAT, respectively). We found significant differences in upper limb EMG activity between the groups.

Conclusions: Despite comparable performance in the task, FAT group increased the activity of upper limb muscles, presumably to compensate for increased postural instability. Results suggest the processes within the CNS effectively compensate for the postural perturbation induced by MF under a force-field perturbation.

Assessment of biofeedback during attentional tasks using 3D virtual reality technology in young female elite volleyball players

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Purpose: The virtual reality system implies three characteristics: immersion, perception to be present in an environment, and interaction with it, allowing an experience similar to reality. The aim of this study was to assess the physiological responses during two attentional tasks in female elite volleyball players and to correlate these parameters with the attentional indexes obtained.

Methods: In this observational cross-sectional study 24 young female elite volleyball players (17, 7 ± 0, 9 years) performed two attentional tasks, based on "Multiple Object Tracking" paradigm, using 3D virtual reality technology with an immersive system. The program used allow to determine an attentional index for each task using the Staircase method.

The first task was based on the traditional "Multiple Object Tracking" paradigm with 4 targets and 4 distractors, instead in the second one there were 1 primary target, 2 secondary targets and 5 distractors. The speed of the targets was adaptive and based on the error rate. During these two tasks some parameters were measured with sensors placed on the left hand and a respiration belt: a) Heart rate; b) Blood volume pulse; c) Skin conductance level; d) Heart rate variability; e) Respiratory rate. These tests were conducted in a quiet room in the team's training center.

Results: Results showed a non-significant correlation between the attentional index in the first task and heart rate variability (r = – 0.12, p = 0.57); and between the attentional index of the second task and heart rate (r = 0.25, p = 0.23) as with the blood volume pulse (r = 0.26, p = 0.22). A moderate correlation has been noticed between the attentional index in the first task and heart rate (r = 0.38, P = 0.07) and respiration rate (r = 0.47, p = 0.02); and, in the same way, between the attentional index of the second task and skin conductance level (r = 0.41, p = 0.05) and respiration rate (r = – 0.37, p = 0.07).

Conclusions: In this study didn't emerge strong correlations, this is probably due to the fact that each player has a different way to deal with emotions, cardiac and neural activation during the tests. This could be helpful for trainers to understand how their players face a challenge, it reflects what happens during a match.

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Assessing body posture with artificial intelligence: applicability and reliability in healthy adult population

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Purpose: Musculoskeletal disorders are among the top causes of disability in young adults, as reported in the Global Burden of Disease. Timely postural analysis can identify significant changes and prevent acute or chronic discomfort. Traditional assessment methods, however, may be subject to operator bias or require advanced techniques. Digital solutions have surfaced as more accessible options for human motion analysis. One such solution is Google's MediaPipe Pose, a machine learning (ML) method that provides 3D estimations of human poses with standard digital cameras, eliminating the need for specialized equipment or settings. Hence, this study aims to validate the applicability and reliability of a digital approach for postural analysis.
Methods: We analyzed the posture of 100 males and 100 females, with an average age of 27.4 (SD ± 3.2) years. We collected a frontal and back photo with a camera placed on a tripod. A sample of 30 males and 40 females underwent the analysis twice to assess the reliability. We assessed the joint angles, as well as the horizontal and vertical angles using an algorithm capable of aligning the 3D position of the same landmarks in both the front and back photos.
Results: The postural parameters obtained matched the 3D parameters of the front and back images. They provided significant differences between males (m) and females (f) with a medium to large effect size for almost all the parameters. For the joint angles, the shoulder angle was m = 16.67° ± 2.49 vs f = 14.34° ± 1.98 ($p < 0.001$, d = 1.03, ICC = 0.83), elbow angle m = 8.54° ± 4.89 vs f = 4.64° ± 2.95 ($p < 0.001$, d = 1.03, ICC = 0.79), hip angle m = 10.03° ± 2.63 vs f = 7.02° ± 1.95 ($p < 0.001$, d = 1.30, ICC = 0.81), knee angle m = 2.91° ± 1.37 vs f = 2.39° ± 1.40 ($p = 0.014$, d = 0.37, ICC = 0.65). For the horizontal angles, the shoulders line was m = 1.33° ± 0.92 vs f = 1.35° ± 1.12 ($p = 0.701$, d = – 0.02, ICC = 0.11), hips line m = 1.26° ± 0.87 vs f = 1.68° ± 1.25 ($p = 0.085$, d =—0.40, ICC = 0.51), knees line m = 2.46° ± 1.51 vs f = 2.49° ± 1.70 ($p = 0.992$, d = – 0–01, ICC = 0.66). For the vertical angles the body balance was m = 1.03° ± 0.51 vs f = 1.27° ± 0.62 ($p = 0.079$, d = – 0.42, ICC = 0.66).
Conclusions: This machine learning method demonstrated significant results in postural analysis, revealing specific gender differences and a substantial to almost perfect agreement for reliability. This technique does not necessitate anatomical expertise since the algorithm automatically identifies and measures the angles. Upcoming studies will examine its validity to analyze athletic movements to prove its applicability also in the sports sciences. Due to its simplicity, it could be consistently employed by health professionals and biomechanics experts to track progress in rehabilitation and training.

Amplifying physical activity in primary schools: unleashing the potential of multistation exercise approach

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Purpose: Nowadays, it is recognized that physical activity is crucial for children's well-being. Despite this, many children do not meet the recommended levels (Carrel et al., 2005). While interventions promoting physical activity in primary schools exist, they often focus on time rather than quality (Errisunz et al., 2018). This observational study aimed to identify how different exercise set-ups affect the real "active time" of children's movement during a 60-min physical activity session.
Methods: Twenty third-grade students participated, and their active time of motion was recorded across three exercise formats. Each format was 10 min long and a 5-min break was ensured between each activity.
Results: The results revealed that the one-station format resulted in an average active time of 50.75 ± 6.46 s, the two-station design had 100.13 ± 10.78 s, and the four-station format had 148.71 ± 7.26 s. Data analysis demonstrated a significant difference among the forms ($p < 0.001$), with the four-station design yielding the most active time ($p < 0.001$; + 193%).
Conclusions: In conclusion, this study suggests that implementing a multistation exercise approach can enhance physical activity interventions in primary school children. Increasing the number of exercise stations leads to a substantial increase in active time spent by children during physical activity. By considering the exercise set-up, interventions can be tailored to optimize the amount of time children spend actively engaged in physical activity. These findings contribute to improving strategies aimed at promoting physical activity and overall health among young children.
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Could bia-derived phase angle be considered as a proxy of health-related musculoskeletal fitness? A cross-sectional study in young adults

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Purpose: Few evidence is available on the relationships between body composition and health-related physical fitness = HRF, in particular musculoskeletal fitness. Bioimpedance index = BI-index and phase angle = PhA (bioelectrical impedance analysis = BIA raw variables) are candidate predictors of HRF, being proxy of fat-free mass = FFM and body cell mass, respectively. We evaluated body composition, raw BIA variables and HRF in young adults and investigated their mutual relationships to identify predictors of muscle strength.
Methods: Two-hundred twenty-nine young adults (115 men and 114 women; 24.2 ± 3.0 years; body mass index 19–30 kg/m^2), participated in the study. Anthropometry was measured with standardized procedures. Whole-body BIA was performed (50 kHz) for impedance e PhA. FFM and percentage body fat = %BF were estimated by predictive equations, while BI-index was calculated as stature^2/impedance. Musculoskeletal fitness was assessed by handgrip strength = HGS, standing broad jump = SBJ, squat jump = SQJ and counter-movement jump = CMJ.
Results: In both sexes HRF showed stronger associations with BC compared to those with stature or weight. HGS was related to FFM and BI-index, while an inverse association with %BF emerged for SBJ, SQJ and CMJ. PhA directly correlated with HGS, SBJ, SQJ or CMJ. In multiple regression analysis PhA was an independent predictor of all HRF tests along with FFM (or BI-index) for HGS and with sex and %BF for the three jump tests.
Conclusions: The present study provides consistent information on the relationships between body composition and HRF in young adults. PhA emerged as a significant predictor of all HRF measures and might be useful for a more consistent assessment of musculoskeletal fitness.

Using force or enveloped emg feedback to modulate motor control output

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Purpose: The motor control system can modulate the muscle action level using both the generated output tension (force feedback, FF) or the global EMG activity (neural feedback, NF) as a visual feedback. In this study, muscle neuro-mechanics was investigated during triangular varying static contraction presenting two consecutive upgoing ramp (UGR) and down-going ramp (DGR). The aim of this study was to evaluate the possible influence of FF or NF in different muscles.
Methods: In 20 subjects (21.8 ± 2.26 yo), in both first dorsal interosseous (FDI) and tibialis anterior (TA), the envelope of EMG (eEMG) and the force signal (F) were detected. For FF the signal driving the motor control system was the F while the trailing signal was the eEMG. The opposite for NF. Each of the consecutive UGR and DGR lasted 7.5 s. The vertices of the effort triangles were 50% and 100% of F (FF) or eEMG (NF) measured during individual maximal voluntary activity. Each subject performed four different tasks for each muscle: FF50, FF100, NF50, and NF100. The areas beneath the F and eEMG signals were computed for UGR and DGR. Electro-mechanical coupling efficiency (EMCE) was calculated as the ratio between the F/eEMG area ratio during both UGR and DGR. Data from the different tasks were compared using a linear mixed model with Kenward-Roger's methods for post hoc analysis.
Results: DGR/UGR area ratio. *FDI*. FF50 data: eEMG = 0.84 ± 0.15. FF100 data: eEMG = 0.73 ± 0.17. NF50 data: F 1.18 ± 0.13. NF100 data: F = 1.17 ± 0.23. *TA*. FF50 data: eEMG = 0.88 ± 0.11. FF100 data: eEMG = 0.91 ± 0.17. NF50 data: F = 1.17 ± 0.21. NF100 data: F = 1.07 ± 0.19. The area ratio of the driving signals were always close to 1. The trailing signal area ratios were statistically different when NF and FF data were compared. The comparison between DGR-EMCE and UGR-EMCE indicated that the first one was always significantly higher in all the four tasks in both muscles.
Conclusions: The greater EMCE during DGR, caused by previous muscle increasing activity, may play an important role in the non-symmetrical behaviour of the trailing signals during triangular varying static contraction. With this in mind it can be concluded that the two types of feedback for investigating or training the motor output modulation capacity must be carefully chosen according to their specific features: FF or NF when the mechanical output accuracy or the global motor unit pool activation strategy are under study, respectively.

Motor unit discharge pattern of the hand extrinsic flexor muscles changes between fingers flexion and synergistic finger-thumb flexion tasks

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Purpose: Movement of the fingers requires a highly coordinated interplay of the hand extrinsic and intrinsic muscles, demanding complex control by the central nervous system. For instance, while the fingers do not flex in complete isolation, the opposable thumb has a high level of individuation and control. This suggests that there are potential differences in neural control between flexion of the fingers (fingers flexion task) and synergistic finger-thumb flexion (grasp task). In this study, we aimed to investigate the mean discharge rate of motor units recorded from the hand extrinsic flexor muscles during these two tasks using high-density surface electromyography (HDsEMG) signals.
Methods: HDsEMG signals were recorded from the distal and proximal parts of the extrinsic flexor muscles in 15 healthy subjects. Two different tasks were performed: fingers flexion task, involving simultaneous flexion of the four fingers, and grasp task, involving synergistic flexion of the four fingers and the thumb. Both tasks were performed at a submaximal isometric level of 5% of maximal voluntary contraction. HDsEMG signals were decomposed into motor unit spike trains using a convolutive blind-source separation algorithm, and motor units were tracked between tasks. The mean discharge rate (DR) of motor units was then calculated and compared between the two tasks. In addition, to assess force steadiness, the coefficient of variation (CoV) of force was computed.
Results: The analysis revealed significant changes in both force and motor unit mean discharge rate between fingers flexion and grasp

tasks. The grasp task showed a reduction in force CoV ($p = 0.006$), reflecting an enhanced force steadiness. This improvement was accompanied by a reduction in mean DR of motor units located at the distal region of the hand extrinsic flexor muscles ($p = 0.001$), while no significant differences were observed at the proximal region ($p = 0.505$).

Conclusions: Our findings indicate distinct neural control patterns between fingers flexion and grasp contractions. Importantly, our results suggest region-specific alterations in mean DR of hand extrinsic flexors, as differences were observed at distal motor units but not proximal. Moreover, our study demonstrates the feasibility of tracking and analyzing the same motor units in these specific tasks, offering methodological insights for future research.

Acknowledgments: European Research Council Consolidator Grant INcEPTION (no. 101045605).

Compressive garments and local muscle oxygenation kinetics during submaximal cycling exercises

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Purpose: Oxygenated hemoglobin (O_2Hb) level in active muscles depends by the local mismatch between O_2 supply and metabolic demand. Microvascular adaptations may determine the extent of this mismatch as well as in exercise induced muscle swelling. This last can be indirectly monitored by ultrasound (US) measurement of the muscle thickness. This study aimed to investigate the potential influence of wearing a compressive garment (CG) on the kinetics of [O_2Hb] and US estimated thickness of the muscle (USMT) during submaximal cycling.

Methods: Subjects: 9 males and 11 females, age 26 ± 4.5 yo. NIRS probe was placed over the distal 1/3 of the vastus lateralis (VL). Each participant visited the laboratory twice for CG or sham fabrics (SF) exercises. After 5' warm-up the subject performed 4' at 50, 100 and 150 W of cycling at 60 rpm. The time needed for basal heart rate recovery was allowed after the warm up and each exercise. The O_2HB dynamics during exercise and recovery periods was interpolated with an exponential decay or an exponential increment, respectively. VL USMT was measured in supine position before cycling and immediately after the recovery from the last effort. Values were reported as mean ± SD. The data from NIRS from CG and SF were compared using two ways ANOVA for repeated measures. Relative USMT changes were compared by paired T-test.

Results: The amplitude of [O_2HB] decrement from basal value was not influenced by CG or SF, but the requested wattage. Time constant for [O_2HB] decrease during cycling (τ_{on}) and increase during recovery (τ_{rec}) were significantly different among wattages (τ_{on}: $p = 0.003$, τ_{rec}: $p < 0.001$) and between trials performed with or without CG (τ_{on}: $p < 0.001$; τ_{rec}: $p < 0.001$). The τ_{on} and τ_{rec} always resulted shorter for CG trials being (in s): 50 W = τ_{onCG} 7 ± 8.6, τ_{onSF} 9 ± 6.9, τ_{recCG} 15 ± 10.2, τ_{recSF} 27 ± 20.7; 100 W = τ_{onCG} 7 ± 3.4, τ_{onSF} 12 ± 5.1, τ_{recCG} 18 ± 11.8, τ_{recSF} 39 ± 23.7; 150 W = τ_{onCG} 6 ± 2.9, τ_{onSF} 16 ± 7.4, τ_{recCG} 26 ± 12.7, τ_{recSF} 43 ± 14.9. The relative USMT changes resulted significantly larger ($p = 0.01$) after trials with SF (+ 5.3%) compared to CG trials (+ 0.3%).

Conclusions: Wearing a CG increases the rate of the [O_2HB] changes from basal to steady state value—and vice versa—indicating that the equilibrium between the O_2 request and availability is more rapidly reached. Smaller USMT changes when CG is used seems to link the above result to an effective support of microvascular function. Overall, wearing a CG improves the dynamics of O_2Hb, reducing local O_2 debt and potentially enhancing performance.

Anabolic steroid use among adolescent athletes: the SODA survey results

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Purpose: The Survey On Doping Among Adolescents (SODA) investigates the phenomenon of doping among young professional, non-professional athletes and non-athletes students. To collect data, the SODA survey 2017 followed the standardized methodology of ESPAD®Italia (European school Survey Project on Alcohol and other Drugs), a nationally representative cross-sectional survey conducted annually since 1999 in Italy, to investigate tobacco, alcohol and drug use as well as other risk behaviors among high school students. Here we present the analysis of data about 7, 390 students aged 15–19 years (53.8% male) who performed sports at various levels and completed all the SODA modules. In particular, we focused on the propensity to use anabolic steroids.

Methods: We aimed to evaluate associations of individual features (sex; school performance; type of sport played—individual, team sports -; sport engagement—professional and non-professional) and lifestyle habits (drunkenness propensity and cannabis use) with the likelihood of using anabolic steroids, using a binomial logistic regression model. Additionally, we included other variables in the model, such as participation in sports competitions (yes/no), the student's perception of his parents' beliefs on his commitment to sport (excessive or too low commitment, not interested in sporting achievements, satisfied, unclear perception), and the student's perception on his coach's style (autocratic, democratic, disinterested).

Results: Among young athletes, being male (OR: 1.9; $p < 0.0001$), having experienced drunkenness (OR: 1.7; $p = 0.002$) and cannabis use (OR: 2.1; $p < 0.0001$) showed a positive association with anabolic steroids use. Other factors associated were the student's perception of having parents who consider excessive his commitment to sport (OR: 1.6; $p = 0.04$), compared to the perception of having parents who are satisfied, as well as perceiving their coaches as being too severe (OR: 1.6; $p = 0.04$) or disinterested in their athletes' training or sporting achievements (OR: 2.4; $p = 0.001$), compared to perceiving coaches as open to athletes' suggestions (democratic). Playing a team sport showed a negative association compared to individual sports, even though it is not statistically significant (OR: 0.7; $p = 0.058$).

Conclusions: Our findings demonstrate the multifactorial nature of the risk of doping use among young athletes, where personal habits carry equal significance alongside factors such as family influences (parents' beliefs) and community influences (coaches' approaches) in shaping adolescents' identity and development.

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In-Vivo muscle relaxation rate, but not contraction, differs for sex

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Purpose: The function of skeletal muscle can be influenced by various factors, including the activation of central motor units, excitation–contraction coupling, fiber characteristics, and contractile elements within muscle cells. These factors are subject to variations depending on age, sex, disease, and training status. Noteworthy among these influences are sex hormones, like estrogen, which exert an impact on the number and function of cross-bridges cycling within a single muscle fiber, ultimately resulting in contrasting muscle contraction and relaxation patterns between males and females. This study aims to understand the in vivo muscle contraction properties in males' and females' lower limbs, and we hypothesize faster contraction and relaxation velocities in males.
Methods: Single potentiated twitches on the femoral nerve were electrically delivered at rest to the dominant leg of 26 young healthy subjects (13 M + 13 F) to assess muscle contractile properties. The quadriceps' muscle extensors cross-sectional area (CSA) was determined from panoramic ultrasound scans.
Results: The force of the single twitch was higher in males (68 ± 14 *vs.* 43 ± 8 Nm, $p < 0.001$) until normalization for the muscle CSA (0.7 ± 0.2 *vs.* 0.6 ± 0.1 Nm/cm^2, $p > 0.05$). Males exhibit faster contraction (3.2 ± 0.6 *vs.* 2.1 ± 0.4 Nm/ms, $p < 0.001$) and relaxation (-1.9 ± 0.3 *vs.* -1.1 ± 0.3 Nm/ms, $p < 0.001$). When accounted for the muscle CSA, the results showed no difference in the contraction rate (0.03 ± 0.01 *vs.* 0.03 ± 0.01 Nm/cm^2/ms, $p > 0.05$), which is in accordance with the lack of difference in the contraction time (65 ± 4 *vs.* 69 ± 9 ms, $p > 0.05$). The normalized relaxation rate was still slightly faster in males (-0.020 ± 0.004 *vs.* -0.016 ± 0.004 Nm/cm^2/ms, $p = 0.05$), similarly shown by the half relaxation time (69 ± 7 *vs.* 80 ± 16 ms, $p = 0.05$).
Conclusions: Our data partially confirm our hypothesis and agree with earlier reports of significant sex differences in muscle contraction properties. Muscle CSA accounted for the initial differences in contraction rate, however, muscle relaxation was still faster in males. Indeed, like other investigations [1,2], females had slower relaxation rates and half relaxation times during the electrically-elicited contractions. This has been seen to be linked to the SERCA pump activity, with consequent slower Ca^{2+} ions re-uptake into the sarcoplasmic reticulum and lower Ca^{2+}-ATPase activity in females unfatigued muscle.
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Evaluation of 4-week of training during post-season period on aerobic fitness, maximal aerobic speed, and sprint endurance in adolescent women soccer players

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Purpose: In adolescent women soccer players, studies describing the effects of training on aerobic fitness and sprint endurance are still limited. This study aimed to investigate the effects of a 4-week post-season training program on aerobic fitness, sprint endurance, and perception of effort in adolescent women's soccer.
Methods: Fifteen adolescent women soccer players (age 14.9 ± 1.6 years; weight 56.5 ± 7.7 kg; height 163.7 ± 6.6 cm) were recruited from a professional team. The training program consisted of a combination of aerobic and sprint endurance training sessions conducted twice a week. Aerobic endurance training involved small-sided games (SSG) of various format, while sprint endurance training included linear and change of direction sprint drills. Before and after the intervention period, participants underwent three testing sessions: 1st) Yo-Yo intermittent endurance level 1 (YYIE1), 2nd) 45–15 Test, to assess aerobic fitness, and 3rd) 30-s all-out shuttle run (30 s test), to measure sprint endurance. Borg's CR-10 scale was used to evaluate the perception of effort after each test. Training outcome measurements included heart rate (HR), blood lactate concentration ($[La]^+$), maximal aerobic speed (MAS), muscular (RPEm) and cardiorespiratory (RPEcr) rating of perceived exertion.
Results: A significant improvement in both YYIE1 and the 30 s test ($p < 0.001$) performance was reported. No significant changes were found in the 45–15 Test. HR and $[La]^+$ values were significantly higher in YYIE1 ($p < 0.01$), but no significant differences were found in both the 45–15 Test and the 30 s test post training intervention. RPEm and RPEcr significantly increased in YYIE1 ($p < 0.05$), whereas only RPEm value was significantly higher in the 30 s test ($p < 0.01$). No changes in RPE values were found in the 45–15 Test.
Conclusions: These results may be of interest, as they showed that, in adolescent women soccer players, after 4 weeks of dedicated training in the post-season, both aerobic and anaerobic endurance paradigms significantly improved. This improvement could potentially help limit fitness impairments during the transition period and enable players to start the pre-season with a satisfactory level of aerobic and anaerobic fitness.
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Motor competence in sport during childhood: differences between open skills sport and closed skills sport

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Purpose: Motor competence, in particular gross motor coordination, is an important parameter to consider in children for monitoring their development because is important for its relations both healthy and performance factors. The aim of this study was to investigate the effect of the practicing different sports (athletic for closed skills sport CSS; football and volleyball for open skills sport OSS) in 9- and 10-year-old children practicing that current sport at least one year

with continuity. The secondary objectives of this study was to find differences of GMC in biological sex, GMC-BMI correlation and GMC-physical activity correlation.
Methods: A sample of 103 children (M = 49, F = 54) were tested using the Körperkoordinationstest Für Kinder (KTK), the Physical Activity Questionnaire for Older Children (PAQ-C) and anthropometric measures (weight and height status). Groups were compared in statistics with deviation standards, T test, and R (Pearson) factor.
Results: In general, OSS group performed better than CSS group ($p < 0, 05$), boys practicing OSS typically showed values of GMC higher than CSS group ($p < 0, 01$) but no differences were relevant in girls.
We found a linear correlation between BMI-physical activity and a polynomial correlation were showed between GMC-BMI. In both case correlation are stronger in boys.
Conclusions: In KTK performance, the practice of open skills sport and closed skills sport seems relevant for differences in GMC. Looking at the results, it seems that closed skills sport is not as good as open skills sports in the acquisition of GMC in boys. We found an optimal interval of BMI (normal weight) for performing in GMC. This study also shows that the more people do physical activity, higher their GMC is.
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The role of preparticipation screening in detecting silent coronary artery disease in master athletes: a way to prevent exercise-related adverse cardiovascular events

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Purpose: Regular exercise reduces morbidity and mortality from cardiovascular diseases through cardiac and systemic adaptations including the increased coronary blood flow, an improved endothelial function, a slower progression of atherosclerotic processes as well as the stabilization of pre-existing lesions. However, long-term exercise is frequently associated with adverse cardiovascular events in 35-year older subjects because of a cardiac remodeling that predisposes to malignant arrhythmias and to an earlier atherosclerosis. Moreover, in athletes, ischemia is often silent with a higher risk of sudden cardiac death.The aim of our observational study was to evaluate the efficacy of preparticipation screening in identifying the presence of coronary artery disease (CAD) in a population of asymptomatic master athletes.
Methods: Between 2018 and 2019, 420 35-year older athletes (mean age: 55 ± 17) underwent a preparticipation screening at the University of Pisa. None of them reported cardiovascular risk factors or previous cardiovascular diseases. After a physical examination, all subjects were submitted to spirometry and ECG stress test.
Results: The ECG stress test demonstrated signs of myocardial ischemia (ST depression > 1 mm) in 41 subjects; 3 athletes showed a frequency-dependent left bundle-branch block; 24 subjects had exercise-induced premature ventricular complexes during the ECG stress test. These subjects underwent further evaluations (Tc-99 myocardial perfusion SPECT and coronary angio-CT) to detect the presence of perfusion defects or coronary abnormalities: 26 athletes had an important coronary atherosclerosis with significant stenosis in one or more vessels and later subjected to Percutaneous transluminal coronary angioplasty (PTCA) or to coronary artery bypass grafting (CABG). 5 athletes presented a coronary myocardial bridge and 1 subject was demonstrated to have an anomalous origin of the left coronary.
Conclusions: Preparticipation screening in 35-year-older athletes was able to detect the presence of obstructive coronary artery disease (CAD) in the 38% of suspected cases and anomalous origin or intramural coronary course in 8, 8% of cases that showed electric abnormalities during the stress test. Despite recent conflicting opinions about the scientific value of the preparticipation screening in young athletes, the present study demonstrated that it was fundamental to early detect silent conditions that could predispose master athletes to adverse cardiovascular events.

Cell free mtdna analysis and mild traumatic brain injuries in boxers

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Purpose: Several contact sports are characterized by mild traumatic brain injuries (TBIs) that could increase cell free mitochondrial DNA (cf-mtDNA) release in cerebrospinal fluid and plasma contributing to a state of systemic inflammation. Repeated mild TBIs lead to higher risk of developing dementia and chronic traumatic encephalopathy (CTE) in boxers. There is a strong association between high cf-mtDNA levels and a worst prognosis. Stressed or damaged mitochondria release mtDNA into the extracellular space, which activate the innate immune system, resulting in the release of pro-inflammatory cytokines and supporting the development of chronic inflammation. However, the role of cf-mtDNA in such sports is still poorly understood. Our study aims to investigate a possible correlation between mild TBIs, the release of cf-mtDNA, and inflammation.
Methods: Ten male non-professional boxers, aged 18–36 years, were selected to participate in one sparring match per week for three consecutive weeks. During all matches, we counted the blows sustained to the head and body by each boxer. Venous blood samples were collected immediately before and after each match and processed following standard blood separation protocols to avoid platelets contamination (total mtDNA). Plasma firstly was centrifuged at 18, 000 g for 30 min (mtDNA1); then plasma was subjected to ultracentrifugation at 100, 000 g for 2 h to obtain naked DNA (mtDNA2). Nuclear DNA and mtDNA were quantified by Droplet

Digital PCR (ddPCR). Light chain neurofilaments (NfL), pro-inflammatory cytokines (IL6, IL8, IL1b, TNFa) and anti-inflammatory cytokines (IL2, IL10, IL4, IL13) were quantified by ELLA.
Results: IL6 plasma concentration increased after each match and then returned to pre-match values. The other pro-inflammatory cytokines showed a similar trend, although not significant. The anti-inflammatory cytokines IL2 and IL10 showed a similar trend, although less pronounced, while IL4 and IL13 were below the detection limit. NfL concentration remained stable after each match. Total mtDNA, mtDNA1, and mtDNA2 concentrations increased after a match. Total mtDNA and mtDNA2 returned to baseline levels within the subsequent matches, while mtDNA1 progressively increased over the weeks.
Conclusions: Plasmatic mtDNA, regardless the form, increased after a sparring match, while NfL did not vary. The potential association between cf-mtDNA and mTBI could suggest the use of cf-mtDNA as a possible early marker of cell damage.
Acknowledgments: This work was supported by the UNIMORE project FAR Mission Oriented 2021 to Milena Nasi. The authors would like to thank all the boxers and coaches of the Boxe Academy Sassuolo SSD who partecipated to this study.

Proportionality comparison between young water polo and soccer players, according to the maturity offset

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Purpose: (1) To describe the anthropometrical characteristics of young water polo (WP) and soccer (SOC) players, and (2) to compare the anthropometric proportionality, with the Phantom model[1], according to biological maturity and practiced sport.
Methods: Forty young SOC (age: 13.88 ± 0.60 years) and twenty-four young WP players (age: 13.30 ± 0.55 years) participated in the study. Body mass (BM), stature, sitting height, arm circumference, waist circumference (WC), triceps, and subscapular skinfolds were measured. The percentage of fat mass (FM%) was derived by Slaughter's Eq. [2]. According to the maturity offset by the Mirwald Eq. [3], each participant was classified as growth peak not-achieved (GPNA) or growth peak achieved (GPA). The Analysis of Variance (ANOVA) was utilized to compare groups. The Phantom was used to characterize 1) the anthropometrical proportion of players and 2) compare them according to biological maturity and practiced sport.
Results: The BM significantly differed between sport groups (SOC: 54.81 ± 11.32, WP: 58.07 ± 10.41, $p = 0.020$) and according to maturity offset (PGNA: 48.96 ± 8.21, PGA: 61.54 ± 9.77, $p = < 0.001$). Similarly, the arm circumference significantly differed between sport groups (SOC: 24.11 ± 3.15, WP: 27.42 ± 2.95, $p = < 0.001$) and according to the maturity offset (PGNA: 24.38 ± 3.37, PGA: 26.11 ± 3.37, $p = 0.004$). The WC (PGNA: 68.58 ± 6.73, PGA: 72.43 ± 7.17, $p = 0.025$) and triceps skinfold (PGNA: 15.33 ± 6.10, PGA: 11.28 ± 5.42, $p = 0.009$) significantly differed between maturity offset groups. The WP players presented higher values in triceps (SOC: 11.55 ± 5.22, WP: 15.55 ± 6.56, $p = 0.019$), subscapular skinfolds (SOC: 7.97 ± 4.45, WP = 11.80 ± 5.45, $p = 0.005$), and FM% (SOC: 16.50 ± 7.28, WP = 22.70 ± 8.44, $p = 0.006$) respect the SOC. The comparison through the Phantom model produced similar results.
Conclusions: The study suggests that biological maturity influences anthropometrical characteristics and that WP players are physically more structured than SOC players and have higher FM%.
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Sand vs. track. surface-based training integration enhances vertical jumping peak power in u-15 track and field female athletes

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Purpose: Exercising on sand surfaces holds unique beneficial characteristics for athletic performance, such as augmenting pre-stretch mechanisms and stability in the quadriceps and calf muscles, increasing motor unit recruitment, and improving postural control, ultimately leading to optimized jumping mechanics. The purpose of this study was to inquire about the promising yet underutilized inclusion of sand-based training to enhance bio-motor development of the lower-limbs in youth female athletes.
Methods: We recruited 15 female track and field competitors at the U-15 national level (age 14 ± 1.1 years, height 162 ± 3.8 cm, body mass 52 ± 4.8 kg, World Athletics scoring tables of 634 ± 61), randomly and equally dividing them in 3 groups (i.e., sand, track, and mixed). The training intervention consisted of 7 weeks (two sessions per week, 1 h per session) of supplementary training, along with the usual regime of training and conditioning which was the same for the whole sample of participants. The surface-based training intervention consisted in a periodized bodyweight circuit, focused on plyometrics and power development of the lower limbs. Relative peak power (RPP, W / kg) performed in the counter movement jump test (CMJ) was employed as a measure of pre-post training intervention, and was calculated with a novel approach using the Physics Toolbox smartphone app.
Results: Wilcoxon signed rank test for matched pairs indicated that the median RPP in CMJ was significantly higher post-training than pre-training for the sand group (48 (0.8) vs. 43.1 (2.3), $W = 13$, $p < 0.05$, effect size $r = 0.74$), and the mixed group (47.8 (4.8) vs. 41.2 (3.8), $W = 14$, $p < 0.05$, effect size $r = 0.76$), while no pre-post differences were found within the track group (43.7 (3.1) vs. 42.9 (1.4), W 0.5 = , $p = 0.44$, effect size $r = 0.42$). It is worth mentioning the narrower distribution (IQR) of the sand group from pre to post-training intervention. Kruskal–Wallis test indicated statistically significant differences among groups only post-training intervention ($H(2) = 15.18$, $p < 0.05$, effect size $\varepsilon^2 = 0.66$), further suggesting that the whole sample had similar baseline levels of RPP. Post-hoc analysis with Bonferroni adjustment revealed that significant differences ($p < 0.05$) were present between the sand vs. track groups, 48 (0.8) vs. 43.7 (3.1) W/kg, and between the mixed vs. track groups, 47.8

(4.8) vs. 43.7 (3.1) W/kg, with no significant differences between the sand vs. track groups.
Conclusions: Even a relatively brief exposition to sand-based training may elicit profitable adaptations in maximal muscular power of developing female athletes. Integrating an exclusive training routine on sand also seems to "tighten" the power performance distribution across athletes of similar level. This information could be used in future research designs for both performance enhancement and injury prevention purposes.

Technical effects of the combined use of technology and feedback on nordic walking technique of breast cancer survivors and healthy women

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Purpose: Growing literature furnishes evidence concerning the positive effects of Nordic Walking (NW) on health and diseases. NW seems positively affect the health of breast cancer survivors (BCS), therefore, a good technique is fundamental to secure and exalt its positive effects. To reach the best practical competence, both the number of introductory workouts and the efficacy of feedbacks are important. Therefore, the study aimed to observe the effect of a standard NW teaching format and that of additional workouts, containing feedback based on a technological approach, on NW technique of BCS and healthy women (HW).
Methods: 31 BCS (54.34 ± 2.45) and 30 HW (49.67 ± 3.78) not practicing physical exercise have been recruited. Participants were introduced to NW through 8 technical lessons, according to the International Nordic Walking Federation scheme. Two kinesiologists, also being NW instructors, conducted the group lessons. At the end of the 8 lessons (T0), the participants were tested using the Gabel E-Poles G1 (Gabel, Italy), recording biomechanical variables concerning the use of upper limbs, hands and poles, during a 5-min test. After the test, half of the participants had 6 additional workouts including feedback based on their technique during NW practice. The remaining part had 6 workouts without supervision and feedback. After the additional workouts (T1), the test has been repeated.
Results: At T0, BCS showed lower poles alternation regularity ($p = 0.01$) and poles contact symmetry ($p = 0.04$) than HW. RM-ANOVA showed a significant time x group effect when we considered health condition (BCS vs. HW) ($F_{(4, 54)} = 5.259$, $p = 0.001$) and the presence of feedback (yes vs. no) ($F_{(4, 54)} = 18.806$, $p < 0.001$). BCS had best results in poles alternation regularity ($p = 0.01$), contact time symmetry ($p = 0.03$) and poles inclination symmetry ($p = 0.007$) than HW. Participants receiving the additional feedback had best results in poles contact symmetry ($p < 0.001$) and degrees symmetry ($p = 0.01$) than participants not receiving them.
Conclusions: In BCS, 8 workouts of introduction to NW seem to be not enough to guarantee the same technical results as HW. After the 8 workouts of introduction to NW, the presence of additional workouts with feedbacks seems positively affect the symmetry of both poles contact and degrees. The use of technology (i.e. Gabel E-Poles G1) with a longer supervised NW introductory program seems to be a best approach for BCS and HW.

Effects of neuromuscular fatigue on memory consolidation and savings during postural motor adaptation

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Purpose: Muscle fatigue (MF) temporarily disrupts physical performance by influencing several physiological mechanisms. Detrimental effects of MF on motor skills learning have been recently reported. However, little is known about the effects of localized MF on neural processes regulating human postural control and if MF has long-term effects on motor adaptation processes. The purposes of this study were: 1) to develop a novel paradigm for testing motor adaptation in a whole-body, postural task and 2) to evaluate the effects of MF on motor retention by measuring adaptation rates and savings.
Methods: Twenty-three healthy participants were randomly assigned to fatigue (FAT) or control (CON) group and performed 2 sessions (D1, D2; 48–72 h apart). The task consisted in keeping the center of pressure (COP) within a certain range while counteracting a mechanical perturbation to the body. Live feedback of the COP and performance error (COP displacement) were provided through a screen. Eight blocks of 30 trials each were performed (baseline, adaptation × 6, washout), interleaved by sustained isometric exercise of tibialis anterior muscles. Exercise intensity was different between groups (FAT: 65 ± 5% CON: 7.5 ± 5% MVC). In D2 both groups exercised at low intensity.
COP data and surface EMG signals of ventral and dorsal muscles from the dominant side of the body were collected. EMG were used to calculate anticipatory and compensatory postural adjustments. Comparisons were done at several protocol phases: late baseline (LB), early (EA) and late adaptation (LA), early (EW) and late washout (LW).
Results: COP displacement did not differ between groups at D1 (LB: 1.5 ± 0.7 and 1.3 ± 0.9; EA: 25.1 ± 9.2 and 28.9 ± 10.5; LA: 1.5 ± 1.9 and 2.5 ± 1.6; EW: -0.7 ± 2.9 and -1.5 ± 3.0; LW: -0.3 ± 0.9 and 0.1 ± 1.3 cm, for CON and FAT, respectively), whereas adaptation rates and savings were lower in FAT at D2. We found differences in EMG data between groups in both sessions.
Conclusions: Adaptation curves were comparable to other studies in literature, confirming the rationale of this novel paradigm. Despite similar performance at D1, MF negatively affected long-term retention—shown by decreased adaptation rates and savings in FAT at D2. Muscle-specific trends in FAT suggest opposite strategies between groups. We hypothesize the fatigued state at first exposure limits the exploration of alternative task solutions, impairing retention and decreasing adaptation rate in a second exposure to the task.

Gait variability and fatigability during a simulated 10-km running race in trained runners

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Purpose: During running, fatigue inevitably occurs, runners adopt altered gait patterns as they fatigue. No study, though, quantified the gait variability and fatigability over the 10-km running race. Therefore, the aim of this study was to analyze the changes in gait variability and fatigability in distance runners.
Methods: Twelve male runners (36.50 ± 5.40 years) completed a simulated 10-km running race on overground. During this trial, heart rate (HR) was recorded over the distance while rating of perceived exertion (RPE, CR-10) immediately at each 2-km lap was reported. At the same time, kinematic and kinetic measurements as: contact time (CT); flight time (FT), step length (SL), stride time (ST); leg (k_{vert} ($kN{\cdot}m^{-1}$)) and vertical (k_{leg} ($kN{\cdot}m^{-1}$)) stiffness, were recorded. Time domain measures of gait variability [total standard deviation (SDtot), mean standard deviation stride-to-stride intervals over 100 cycles (SD100), standard deviation of the average stride-to-stride intervals over 100 cycles (SDA100)] and phase coordination index (PCI) were calculated every 2-km. To assess differences for each variable every 2-km interval, repeated-measures analysis of variance (ANOVA) was used with repeated contrast. When significant F-value was found, post-hoc analysis (LSD) between conditions was performed while the effect size was also calculated (η^2). The determination coefficient (R^2) was calculated between HR—RPE (as proxy of the physiological effort) and gait variability (SDtot—SD100—SDA100—PCI.) Rejection level was set at $\alpha < 0.05$.
Results: While the average speed on 10-km was 13.89 ± 1.52 $km{\cdot}h^{-1}$ constant **(small variation ~ 1% over the distance) there was an increased HR (89 < 93%$HR_{MAX,}$ P < 0.05) and RPE (6.58 < 8.96 a.u.**P < 0.001) **when distance increased. Conversely, ANOVA showed no differences over five 2-km intervals running for the footstep data** (CT—FT—SL—ST—k_{vert}—k_{leg}), while significant increases in stride-to-stride variability were found for SDtot—SD100—SDA100—**PCI (P < 0.05) over the running distance. Furthermore, we found a moderate and** strong R^2 (0.444—0.660) when compared HR—RPE and SDtot—SD100—SDA100—**PCI**, on five and last four 2-km intervals, respectively.
Conclusions: These results suggest that the gait variability is one mechanical determinant to assess the neuromuscular output when the fatigability increased related to the physiological effort as in running race.

Evaluating proprioceptive acuity: exploring the differences between static and dynamic position reproduction

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Purpose: Proprioception plays a crucial role in sports performance and daily movements. While several methods have been proposed to assess proprioceptive acuity, most of them have focused only on static conditions. This raises concerns about the ecological validity of such protocols, as they fail to evaluate proprioception during the execution of dynamic movements, where timely information about ongoing actions is essential for optimal evaluation. Therefore, this study aimed to investigate proprioceptive acuity in both static and dynamic tasks, specifically focusing on joint position reproduction (JPR) during concentric and eccentric muscle contractions.
Methods: Sixteen participants (F = 8) completed Dynamic and Static JPR tasks. A tactile stimulus on the dominant limb's wrist, delivered through an electrical stimulator, provided position cues. Stimuli were triggered at elbow angles of 45°, 60°, or 90° (15 trials per angle). In Dynamic JPR, participants performed flexion and extension, receiving stimulation during concentric or eccentric phases. They then reproduced the stimulated position after completing the movement. Static JPR involved similar movements with 5 s of stationary posture after the trigger was delivered. Movement timing was controlled by a metronome. Angular error (AE) measured differences between stimulus-delivered elbow angle and participant reproduction. Dynamic tasks underwent kinematic analysis using Sentry (SWHARD Srl, Genova) to assess angular movement. Acceleration at stimulus delivery was analysed for its role in proprioceptive acuity.
Results: Participants showed higher AE in Dynamic vs Static Task. Acuity during eccentric contractions was higher than during concentric contractions. During Dynamic Task, in eccentric condition, the proprioceptive acuity was higher at 45° than 60° and 90°, and at 60° than 90°. In concentric condition, the reproduction was more accurate at 60° than at 45°. Kinematic analysis revealed significant correlations between acceleration at the time of stimulus and AE, both in the concentric and eccentric conditions.
Conclusions: Proprioceptive acuity is influenced by task type (static or dynamic) and muscle contraction mode (concentric or eccentric). Additionally, different movement phases and kinematic characteristics affect joint position sense. These findings emphasize the importance of considering these factors when assessing proprioception to ensure accurate and ecologically valid evaluations.

Changes in landing kinetics following a match-related fatigue protocol in soccer players within 12 months after acl reconstruction

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Purpose: The return to sport (RTS) outcomes following ACL reconstruction (ACLR) are still unacceptable and need to be improved. Evidence suggests that the fatigue cumulated over the course of a soccer-match play may affect both neuromuscular function and control. This study aims to assess the effects of a match-related fatigue protocol on neuromuscular control during single-leg drop landings (SLDLs) in ACLR soccer players returning to sport. Since residual neuromuscular impairments may persist in ACLR individuals, we expect to find significant landing alterations that could be exacerbated after the fatiguing protocol.
Methods: This study is a cross-sectional investigation with a pre-test post-test experimental design. Participants were ACLR soccer players (N = 13) at 6.9 ± 2.3 months after surgery and healthy soccer players (N = 13) who were matched for age, anthropometric

characteristics and limb dominance. A series of SLDLs with rebound were performed by participants before and after 45 min of a Soccer Aerobic Field Test (SAFT[45]), an intermittent exercise protocol designed to mimic the mechanical and physiological demands of a soccer match-play. Ground reaction forces (GRF) were normalized to body mass and examined to obtain peaks, vertical impulses and loading rates to be statistically compared.

Results: At baseline, peaks of vertical GRF and loading rates during SLDLs were lower for ACLR individuals with respect to controls (< 18% and < 35% on average, respectively; $P < 0.01$). In addition, the reconstructed side showed lower vertical stance-phase impulses (< 6%, $P < 0.01$), lower peaks of posterior GRF (< 27% on average, $P < 0.01$) and two-times lower peaks of anterior and medial GRF ($P < 0.01$) with respect to controls. In response to SAFT[45], peaks of anterior and medial GRF increased significantly only for the reconstructed side of ACLR individuals (+ 23% and + 32%, respectively, $P < 0.01$).

Conclusions: We found significant baseline differences in landing kinetics reflecting the adoption of a protective strategy by ACLR soccer players. However, the asymmetric response to fatigue may place ACLR individuals at a higher-risk of reinjury. Testing ACLR soccer players after a match-related fatigue protocol prior to RTS could help in fine-tuning the late-stage rehabilitation phase in order to restore asymmetries, improve the readiness to RTS and reduce the risk of recurrent ACL injuries.

Acknowledgments: Co-funded by the Erasmus + Programme of the European Union, GA2018-2512.

Alterations in magnitude and spatial distribution of erector spinae muscles Activity in cyclists with recent history of low back pain

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Purpose: Overactivation of erector spinae (ES) muscles has been identified as one of the potential major causes of low back pain (LBP) in cyclists[1]. Previous evidence on rowers with LBP reported an altered magnitude and spatial distribution of ES activity[2]. Conversely, less is known about cyclists' lumbar region activation patterns. Accordingly, in this cross-sectional study, we compared the activation and spatial distribution of ES muscles in cyclists with and without a recent history of LBP.

Methods: Based on Oswestry Disability Index (ODI-I), participants were assigned to either an LBP (n = 10; ODI score 18.5 ± 10.1%) or to an asymptomatic group (CG; n = 11). They performed an incremental cycling test characterized by 4 bouts of 3 min at 70, 80, 90, and 100% of their functional threshold power (FTP). Concurrently, the ES activity was recorded bilaterally through High-Density surface EMG and synchronized at source with an electro-goniometer to characterize the pedal strokes. The average normalized root-mean square amplitude (RMS), the entropy, and the y-axis barycenter (y-bar) of the RMS maps were extracted. The measurements were compared between groups and loads with repeated measure 2-way ANOVAs.

Results: A load x group interaction was observed for RMS amplitude ($p = 0.003$), entropy ($p = 0.038$), and y-bar displacement ($p = 0.033$). Post hoc analyses revealed differences in RMS amplitude between 70–100% (+ 19%, $p = 0.010$), 80–100% FTP (+ 21%, $p = 0.004$) in the LBP group, and between LBP and CG at 100% FTP (9.6%, $p = 0.049$). Similarly, entropy differed significantly between 70–100% FTP (-8.4%, $p = 0.002$) and 80–100% FTP (-8.5%, $p = 0.002$) in the LBP only.

Conclusions: As the load increased, LBP cyclists showed greater and less homogeneous ES muscles activation compared to CG. The increase in ES activity may be the result of an augmented neural drive directed to the active muscles. The decrease in entropy suggests a more heterogeneous ES activation at higher %FTP intensities. In contrast, previous studies reported that more homogeneous activation of various muscle regions may be essential in preventing musculoskeletal injuries[3]. Our results suggest that greater magnitude and reduced homogeneity of ES activity during an incremental cycling test may reflect an inefficient recruitment strategy of ES in cyclists with a recent history of LBP.

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Achilles Tendon stiffness and energy cost of walking in subjects with type 2 diabetes

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Purpose: Poorly controlled type 2 diabetes causes a nonenzymatic glycation of soft tissues leading to an increase in tendon stiffness. Stiffening of the tendons (i.e. the Achilles tendon) reduces the degree to which it can be stretched, affecting its potential for storing and releasing elastic strain energy during locomotion. This suggests a possible reduction of the locomotor capacity in these patients, possibly leading to an increase in the energy cost of level walking (CoT). The aim of this study was to investigate the relationship between Achilles tendon stiffness and degree of hyperglycemia, estimated by glycated haemoglobin (HbA1c) values, in well-controlled type 2 diabetic patients and to verify to which extent these factors could affect their CoT.

Methods: 29 well-controlled type 2 diabetic patients (T2D) and 11 healthy controls (CR) were recruited for this study. All subjects were middle-aged (50–70 years) and moderately active. Glycated haemoglobin (HbA1c) was 52 ± 9 and 37 ± 2 mmol/mmolHb in T2D and CR, respectively. All subjects were requested to perform 3 maximal voluntary contractions of the plantar flexors using a Cybex dynamometer (to assess maximal torque values, MVT); during these contractions a ultrasound apparatus was positioned on the Achilles tendon to measure its elongation (TL); based on these data tendon stiffness (TS) was calculated as Δtorque/Δelongation. In addition, all subjects were requested to walk on a treadmill at different speeds (from 2 to 6 km/h) to assess their CoT.

Results: Larger values of MVT (94 ± 33 vs 74 ± 22 Nm, $p = 0.045$) and TS (8 ± 2 vs 6 ± 1 Nm/mm, $p = 0.002$) were observed in diabetic patients compared to controls, whereas values of TL were similar between groups (14 ± 3 and 15 ± 4 mm, p = NS). A statistically significant direct association was observed between HbA1c levels and tendon stiffness ($r = 0.651$, $p < 0.001$, $N = 40$). No differences were observed in CoT between groups at any of the investigated speeds.

Conclusions: Even in compensated T2D patients, an increase in HbA1c levels is associated to an increase in Achilles tendon stiffness. This increased stiffness, however, does not compromise walking

ability, as indicated by the lack of difference in the CoT values between patients and controls.

Serving to win: exploring serve effectiveness in high-level sitting volleyball

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Purpose: In Sitting Volleyball (SV), serving is characterized by the requirement that players must hit the ball while sitting directly on the playing court, without the aid of any devices, and that opponents are allowed to block it. Currently, there is a lack of data on how serve efficiency can influence the outcome of a match in SV. This study aimed to identify the indicators that differentiate successful gameplay in SV by investigating the relationship between several performance indicators associated with serve effectiveness and match outcomes.
Methods: Video material from a total of 24 matches (women = 12) from the 2021 Paralympic Games and the 2022 World Championship was analyzed and a total of 3667 serves were considered in the statistical analysis. A mixed-effects logistic regression model was used to examine the relationship between the match outcome (win/loss) and the following variables: efficacy of the serve (ace, error, positive serve, negative serve, block), type of serve, serving zone and making a point or error in the side-out or counterattack phases. The Wald test was used to test the significance of individual coefficients in the regression models. We used a p-value of 0.05 as the cut-off for determining statistical significance.
Results: In both genders, the results showed a statistically significant model for making a point or an error in the side-out phase as well as in the counterattack phase, and also for the efficacy of the serve and the serving zone (with p-values ranging from 0.002 to < 0.001). Regardless of gender, higher percentages of matches won were associated with a larger number of serving actions resulting in a direct point or a positive serve, with percentages ranging from 58 to 64%. The results also highlighted that an error in the side-out phase by the opposing team and making a point during the counterattack phase occurred in 60% and 62% of matches won by men, respectively, and in 60% and 65% of matches won by women, respectively.
Conclusions: In SV, the serve is a crucial stroke for high-level teams, where greater serving efficacy is associated with winning a game. Consequently, coaches are encouraged to foster mastery of this skill in both their male and female athletes. Given these preliminary results, further exploration of the relationship between variables, considering their possible interactions, would be beneficial. This could contribute to a better understanding of SV performance throughout match analysis.

Calf muscular pump training using an innovative leg-press in patients with chronic venous insufficiency

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Purpose: Chronic venous insufficiency (CVI) is a common vascular disorder that affects the lower extremities, the clinical presentation varies from aesthetic to severe manifestations. Calf muscle pump represents the driving force of the venous drainage, stimulating both fluids reabsorption and an appropriate venous hemodynamics.[1] Aim of this study is to investigate the effect of three different types of resistance produced by an innovative leg-press machine on venous function in CVI patients.
Methods: In this prospective crossover study 30 CVI patients (6 M-24F, mean age 56 ± 14 years) were included. Before starting the exercise protocol, the cohort filled a IPAQ questionnaire. A non-invasive air-plethysmography evaluation of venous function was performed, during different types of resistance (Isoweight, Viscous, Elastic) delivered by a novel concept leg-press machine[2] (Biostrength®—Technogym SPA Italy). The followings parameters were assessed: total venous volume (VV) venous filling index (VFI), ejection fraction rate after 1 calf contraction (EF%) and residual volume fraction after 10 calf muscle activity (RV%). Each test was interspersed by 30 min rest and the different resistances were applied in a random way. The Borg cr10 scale was administrated to evaluate the perceived exertion at each set.
Results: According to the IPAQ scores, the patients were categorized as having inactive lifestyle (640 ± 569 MET-minutes per week). The 3 resistances activated significant different response in term of both EF% and RV%. The EF% were: Isoweight $46 \pm 10\%$, Viscous $53 \pm 11\%$, Elastic $38 \pm 8\%$ ($p < 0.0001$), while the RV% were Isoweight $36 \pm 6\%$, Viscous $31 \pm 6\%$, Elastic $40 \pm 4\%$ ($p < 0.0001$) The CR-10 Borg scale was significantly higher during the viscous resistance exercise, which was reported to be harder compared to isowight and elastic ones which were graded as moderate (5.4 ± 1.0 vs 3.0 ± 0.8, $p < 0.0001$) and easy (5.4 ± 1.0 vs 2.1 ± 0.1, $p < 0.0001$), respectively.
Conclusion: The most venous blood propulsive force can be elicited by the calf training utilizing viscous resistance, while elastic one resulted to be the less effective in this context. Viscous resistance modality strongest exertion request might be associated with the higher muscular recruitment during the exercise performance. These findings could be of particular importance for enhancing the use of adapted physical activity in the therapeutic management of widely diffuse pathological conditions such as CVI.
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Taekwondo practice reduces stand-to-sit duration of the timed up and go test in older adults

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Purpose: Older adults show limitations in functional mobility that may lead to a high risk of falls resulting in hospitalizations and deaths. For this reason, investigations on the effectiveness of novel adapted sport activities to improve their functional mobility are needed. Although Taekwondo (TKD) practice has already been

shown to enhance functional mobility of older adults, a thorough analysis of the kinematic variables underpinning these changes is still lacking. This study aims at investigating the effect of TKD on Timed up and go (TUG) kinematic variables in older adults.
Methods: Before (T0) and after (T1) two-month TKD course, peak angular velocity about the anteroposterior (AP), mediolateral (ML) and craniocaudal (CC) axes as well as the durations of the Sit-to-Stand (SiSt), Intermediate Rotation (IR), Final Rotation (FR) Stand-to-Sit (StSi) and total duration of the TUG test were recorded in 7 males and 6 females (age: 67.5 ± 7.4 years; height: 1.62 ± 0.11 m; mass: 74.1 ± 10.4 kg) using a triaxial inertial measurement unit (G-Walk, BTS; Sampling frequency: 100 Hz) placed on their lower back.
Results: A significant reduction in the StSi duration was observed at T1 (1.0 ± 0.2 s) compared to T0 (1.3 ± 0.3 s; p = 0.003). No differences were observed between T0 and T1 in the total TUG duration, peak angular velocity about the CC, AP, and ML axes during the SiST IR and FR, and StSi phases.
Conclusions: A two-month TKD course was not sufficient to improve functional mobility in older adults, however, it elicited a reduction in StSi duration. The StSi duration of the TUG has been previously recognized as a critical phase to detect individuals with high risk of falls. Therefore, improvements in this phase shall be regarded as fundamental from a public health standpoint.
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Effects of 12 sessions of remote supervised training in paediatric patients affected by haematolymphoid and soft tissue tumors

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Purpose: Children diagnosed with cancer often exhibit diminished physical capacity, both due to the pathology and the side effects of the treatment. Limited knowledge exists regarding the effects of training intervention on strength and aerobic capacity in pediatric patients with cancer. However, evidence suggests that exercising is a safe and effective strategy for enhancing functional mobility during daily life activity. Our study aimed to maintain physical functionality in pediatric patients suffering from haematolymphoid and soft tissue tumors.
Methods: To date, we have recruited 52 patients with different types of cancer (age 13.5 ± 3.83 years). Patients who joined the project were asked to perform remote supervised training once or twice a week from the time of the diagnosis throughout all phases of treatment, including times in the hospital and periods in which they were at home. Patients were tested before and after 12 sessions of training with 30″Sit to Stand Test (30STS), 30″Sit Up, 30″Push up Test to assess strength, 60″Flamingo Balance to evaluate balance, and Sit and Reach to evaluate mobility.
Results: 17 patients had to suspend the activity due to medical reasons, 25 patients ended the activity and 10 patients are still enrolled in the study. Overall, all outcomes improved after 12 training sessions, in particular we observed a significant improvement in 30STS (p = 0.004). Moreover, when patients were grouped by their age (Y = < 13y, M = 13-15y, A = > 15y), patients aged from 13–15 had significant improvement in the performances of 30STS, 60″Flamingo Balance and Sit and Reach. Finally, when the sample was divided according to the type of cancer (blood, lymphoid, or soft tissue), we observed that patients with soft tissue tumors had greater improvement in the 30STS compared to other groups.
Conclusions: Preliminary data showed that online training session is a feasible exercise modality in patience with pediatric cancer. Moreover, physical efficiency was fully maintained and sometimes even improved. As such, 9 patient resumed their sport and physical activities during the study intervention and were considered fully healed. We can suggest that upon medical approval, physical exercise is a safe strategy and can help to maintain functionality during therapies even with a remote intervention.

Implementation of eras pre-habilitation program by exercise prescription in patients undergoing lung resection

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Purpose: Enhanced Recovery After Surgery (ERAS) programs have revolutionized perioperative care by implementing evidence-based interventions to accelerate patient recovery and improve outcomes. Pre-habilitation, a crucial component of ERAS, involves preoperative optimization through exercise, nutritional support, and psychological preparation. However, limited research has focused specifically on exercise prescription in the pre-habilitation phase of lung surgery patients within the ERAS context. This study aims to address this gap by investigating the effects of multimodal exercise interventions in optimizing patient outcomes.
Methods: A prospective, single-center study was conducted involving patients scheduled for lung surgery within an ERAS program at the Sport Medicine Unit, Policlinics of Foggia. Twenty-five eligible patients aged 38–82 years, undergoing lung surgery, were recruited. Participants were assigned to either the exercise intervention group (n = 12) or the control group (n = 13), based on randomization. The exercise group received a structured exercise program consisting of three-weeks (three-sessions/week) aerobic, resistance training and flexibility exercises, under the guidance of exercise specialists. Patients underwent a comprehensive pre-operative assessments to evaluate their physical fitness, functional capacity, and musculo-skeletal health. The program was individualized based on the patient's baseline fitness level and surgical requirements. The control group received standard preoperative care without the structured exercise program. Outcome measures included physical fitness parameters (cardiorespiratory fitness, muscle strength, flexibility), respiratory function (spirometry), length of hospital stay, postoperative complications, quality of life, and patient-reported outcomes. Baseline measurements were collected before the intervention, and

follow-up assessments was conducted at specific time points (preoperatively, postoperatively, and during follow-up visits).
Results: The exercise intervention group demonstrated significant improvements in physical fitness parameters (6MWT, VO_2 Peck), respiratory function (FVC, FEV1, FEV1%VCin), reduced postoperative complications, and enhanced recovery compared to the control group. Positive effects on length of hospital stay, quality of life, and patient-reported outcomes were also demonstrated.
Conclusions: The results of this study provide valuable insights into the benefits of structured exercise interventions in optimizing patient short-term outcomes, enhancing recovery, and informing evidence-based exercise protocols for pre-habilitation in ERAS programs. These findings have the potential to improve the standard of care for lung surgery patients and promote the integration of exercise as a key component of ERAS protocols.

Effects of twelve-weeks of supervised combined training on left atrial function of patients with recent myocardial infarction. role of the training frequency

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Purpose: Left atrial plays an important role in mantaining stroke volume during exercise, particularly in patients with left ventricular dysfunction. The effects of exercise training on atrial function in patients with heart failure with recent myocardial infarction (MI) are poorly understood. We assessed the effects of a 12-weeks coombined exercise training (CT) program on left atrial function in patients with recent MI.
Methods: The study included 45 stable patients with a previous MI (occurring between 3 and 12 months before the enlistment), who were randomly assigned to three groups: fifteen patients were assigned to a supervised CT with low frequency (two session/week) (CTLF); fifteen patients to supervised CT with an high frequency (three session/week) (CTHF); a third group to follow contemporary exercise preventive guidelines at home (control). Before and after training, all patients performed a symptoms-limited exercise test on a treadmill and an echocardiography. The training included aerobic continuous exercise at 60–70% of peak heart rate and resistace exercise performed at 60% of 1 repetition maximum and involving several muscle groups.
Results: At the end of the protocol, exercise duration at ergometric test presented a significant greater increase in the CTLF and CTHF groups compared to control (Intergroups p 0.002). Peak atrial longitudinal strain (PALS) and conduit phase presented a significant increase in the CTHF group and were unchanged in the CTLF and control groups (intergroups p 0.008). Peak atrial contraction strain (PACS) presented a significant greater increase in the CTHF compared to control. Left ventricular global longitudinal strain, increased significantly in both CTHF asnd CTLF compared to control (intergroups p 0.004). No side effects leading to discontinuation of training were observed.
Conclusions: We demonstrated that a combined high frequency combined training effectively improved atrial functiion in post-MI patients. This result can help with programming exercise training in these patients.

Designing, implementing and testing a fitness monitoring system to promote health and wellbeing in South Tyrol: insights in the first project

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Purpose: Physical fitness (PF) is a marker of health, associated with quality of life (Ortega et al., 2008). The systematic collection of PF measures, the provision of appropriate feedback to users and the adoption of strategies to counteract the secular decline in PF are essential to actions aimed at improving individuals' wellbeing and physical and mental health. Moreover, PF surveillance is fundamental to successful sustained public health intervention and primary prevention of diseases on an institutional level (Aerts et al., 2021; WHO, 2022). The purpose of this contribution is to present and discuss the structure of the FirST study project.
Methods: Despite the good monitoring systems for public health established in South Tyrol, PF surveillance is not yet considered within the adopted measures, except some occasional data collections in schools. The FirST project aims to fill this gap, by designing, developing and evaluating a PF monitoring system for South Tyrol population above 14 years old, including those with special needs. The system will be developed considering the most recent scientific evidence and the experiences of countries where such services already exist (e.g. Finland, Portugal and Slovenia), without losing sight of Region's peculiarities. A particular attention will be paid to the adoption of sustainable, reliable, not expensive tests (www.fitback europe.eu; Ortega et al., 2022), and to the implementation of innovative digital technologies to favour data collection and analysis and the provision of feedback to users. Participants' psychological response during testing will also be studied through self-report ques tionnaires and through some selected psychophysiological parameters.
Results: It is expected that the project will enrich the literature on PF monitoring and surveillance by addressing adolescent, adult and elderly population. It will also contribute to the international applied field, since PF monitoring and surveillance systems for some of these population groups are still scarce or not present.
Conclusions: PF monitoring and surveillance are indicated among the top priorities in the field of HEPA studies. PF and physical activity (PA) have a reciprocal influence, with PA practice leading to improved PF, which, in turns, lead to the maintenance of adequate PA levels. So, investing in PF field can directly contribute to the prevention of diseases and reduce the burden and costs on healthcare systems and the general economy.

Previous sport-specific experience influences the rating of perceived exertion but not the perceived enjoyment, and physiological and physical demands of active young adults during recreational 3x3 basketball matches

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Purpose: The aim of the study was to assess the effect of previous basketball experience on the perceived exertion, enjoyment, physiological, and physical demands during recreational 3 × 3 basketball matches.
Methods: Twenty-four apparently healthy male active young adults were recruited for this study and were equally allocated in two experimental groups: 1) possessing previous basketball experience (9.6 ± 4.5 years) (EXP); 2) without or with minimal previous basketball experience (0.7 ± 0.9 years) (NO-EXP). During the first experimental week, participants completed the 30–15 Intermittent Fitness Test (30-15_{IFT}) to assess their maximal heart rate (HRmax) and fitness level considered as the velocity of the last completed stage (V_{IFT}). Successively, each group played separately a 3 × 3 basketball match following the official FIBA rules. During each match, the physiological demand was assessed via percentage of HR_{max} (%HR_{max}), while physical demands were determined via microsensors as PlayerLoad™ per minute (PL/min), accelerations per minute (ACC/min), decelerations per minute (DEC/min), jumps per minute (JUMP/min) and changes of direction per minute (COD/min). At the end of each match, the rating of perceived exertion (RPE) and players' enjoyment were also recorded.
Results: No between-group differences were found for HR_{max} (p = 0.099) and V_{IFT} (p = 0.061) at the end of the 30-15_{IFT} although EXP group showed moderately better performance compared to NO-EXP group [effect sizes (ESs) = 0.403 and 0.451 for HRmax and V_{IFT}, respectively]. Moreover, no differences were found in match %HR_{max} [p = 0.238; ES = – 0.490, Moderate], and enjoyment (p = 0.059, ES = 0.430, Moderate), while NO-EXP participants showed higher RPE values (p = 0.005; ES = 0.680, Large) compared to EXP participants. Finally, no differences (p > 0.05) were found for all the investigated physical demand measures.
Conclusions: Participants possessing previous sport-specific experience resulted in similar physiological and physical demands, and enjoyment, but lower perceived exertion compared to participants without previous sport-specific experience during a 3 × 3 basketball match. The lower RPE values might be explained by the previous sport-specific experience and by the moderately different initial fitness level, highlighting the necessity for health and sport practitioners to consider these aspects when designing training sessions including recreational 3 × 3 basketball matches.

The association between digital media and health in children

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Purpose: The impact of an excessive digital media exposure on physical and mental health in children has been widely investigated from the scientific community, even more during and after the COVID-19 pandemic, due to the prolonged lockdown periods and the consequence of the higher exposure to digital media for e-learning activities. Therefore, the aim of this review was to systematically summarize the evidence on the impact of digital media on physical and mental health in children, also with the inclusion of studies investigating the effect of COVID-19 pandemic.
Methods: Scientific databases were referred for studies selection. Screening process followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) Statement and flow diagram. The assessment of quality of included studies followed the Joanna Briggs Institute (JBI) Checklists.
Results: Forty studies were included in the review and the investigated outcomes were grouped into five themes: 1) physical activity and body composition, 2) motor skills and posture, 3) sleep, 4) behaviour, and 5) COVID-19 and vision function. Included studies were mainly cross-sectional (n = 28), whilst fewer were randomized controlled trials (n = 4) and cohort studies (n = 9). The quality of studies has been mainly rated as moderate. A frequent and prolonged period of exposure to digital media induced a reduction on the amount of physical activity in children, parallel to an adverse body composition profile. Behaviour and sleep habits changed in children due to an overexposed to digital media, resulting in emerging feelings of anxiety, poor adaptive skills and control abilities, later bedtimes, sleep quality reduction. A higher number of digital devices, coupled with a longer screen time, was associated with poor academic performance and learning development. Finally, COVID-19 pandemic further caused poor vision and ocular condition (i.e., myopia).
Conclusions: Excessive exposure to digital media has been proved to impair different domains of physical and mental health in children. Considering the available recommendations and guidelines for digital media use, parents and adults involved on children's care should be mainly aware of the exposure risks with a concurrent positive influence on digital media behaviour across life stages.

Impact of problematic instagram use on self-esteem and their association with physical activity levels in a sample of university students

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Purpose: Among young adults, Instagram (IG) is a very popular social network, with more than 1.6 billion users worldwide, enabling different options for communication. However, inappropriate or excessive use may cause negative health effects as well as low self-esteem (Rodríguez et al., 2020; Xanidis et al., 2015). This study aimed to explore the relationships between IG use and self-esteem, investigating the possible protective role of physical activity (PA) in a sample of university students.
Methods: A cross-sectional study was adopted (University of Urbino Ethic Committee n. 47, 29/07/2021). An online questionnaire (Google Form) was emailed to all the students at the University of Urbino, comprising demographic questions, and the Italian versions of the IPAQ-short, the Rosemberg Self-esteem scale, and the Social Media Use Questionnaire (that investigates the problems of social withdrawal and compulsion). A MANOVA was used to investigate sex differences in the IG-related variables; associations among variables were preliminarily explored with Spearman Correlation.
Results: A total of 1242 students (74.5% females, mean age = 22.7 ± 5.5 yrs) responded to the questionnaire, 94.8% of them used IG. Sex differences highlighted higher values for females than males in IG using time (75 ± 49 min/day versus 65 ± 43 min/day, $p = 0.001$), withdrawal (1.0 ± 0.8 versus 0.8 ± 0.7, $p < 0.001$), and compulsion (1.9 ± 0.9 versus 1.6 ± 0.9, $p < 0.001$). Significant associations were found between time and problematic IG use (withdrawal and compulsion respectively *rho* = 0.212; 0.263; $p < 0.001$); these were associated with lower self-esteem (*rho* = – 0.237; -0.338; $p < 0.001$). Higher PA levels were correlated with lower withdrawal and compulsion (*rho* = – 0.103; -0.134; $p < 0.001$) and greater self-esteem (*rho* = 0.135, $p < 0.001$). On the contrary,

sitting hours showed a negative association with self-esteem (*rho* = –0.106, p = 0.002).
Conclusions: This study highlighted how university female students are more exposed to the potential harms of social networks. Moreover, spending more time on IG may be linked to problematic use and a decline in self-esteem. PA might play a protective role in this relationship. Further models could explore the relationships between variables and prediction. To lessen the negative impacts of incorrect social media use on students' self-esteem, programs on health and active living promotion should be targeted at them.
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Bioelectrical impedance vector analysis and cardiovascular performance in liver-transplanted recipients

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Purpose: The lifestyle, which combines regular physical activity and adherence to a healthy diet, treats many chronic diseases. Cardiovascular disease is one of the leading causes of mortality after liver transplantation. The study aims to verify the effectiveness of promoting a healthy lifestyle by comparing implementing the Mediterranean diet with an unsupervised physical activity program in a sample of males undergoing liver transplantation.
Methods: Thirty-three male liver transplant recipients aged 61.4 Â ± 8.0 years to 1.2 Â ± 0.7 years post-transplant were enrolled. Bioelectrical vector impedance analysis (BIVA) and cardiopulmonary exercise testing (CPET) were performed. Pearsonâ€™s correlation test (Spearmanâ€™s test for not normally distributed values) was applied to examine the relationships between BIVA and CPET.
Results: The results report a VO2 peak = 22.5 Â ± 5.5 ml/kg/min with heart rate max = 153.2 ± 16.6 bpm. On average, the positioning of the subjects is in the middle of the R/Xc graph. Furthermore, the BIVA values of resistance correlate with the submaximal performance of Ve/VCO2 slope ($R = 0.509$; $p < 0.05$) and phase angle with the maximal effort of VO2 peak ($R = 0.557$; $p < 0.05$).
Conclusions: The group of liver transplant patients showed moderate physical activity levels. Therefore, the results lead us to hypothesize that an approach based on a lifestyle intervention could further reduce the cardiovascular risk factor associated with chronic disease.

The erasmus + sport eumove project: educational strategies to improve healthy lifestyles

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Purpose: European Union (EU) has financed the Erasmus + Sport EUMOVE project to design an innovative digital tool for promoting healthy lifestyles in school. The goal is to design and implement a comprehensive set of strategies to promote healthy lifestyles.
Methods: The project is based on two theoretical frameworks: The Behaviour Change Wheel and the Creating Active Schools Framework. The direct beneficiaries of the project are school leaders, teachers, and parents, and indirect beneficiaries are primary and secondary students. The EUMOVE project is a 3-year project delivered by a collaboration between academic and non-governmental institutions.
Results: The EUMOVE project started in 2020 and now the following resources are available and free in the EMOVE website: 1)Physically active lessons: we created a series of videos https: //eumoveproject.eu/physically-active-lessons-toolkit/ to help teachers in structuring physically active classes in which combining physical activity (PA) with academic content. 2)Real Time Active Breaks platform: the avatar Eumovy is in charge to perorm active breaks helping teachers and students https: //platform.eumoveproject.eu/webpages/login/login.html. 3)Learning units about healthy lifestyles: 54 learning units were created to promote healthy nutrition, PA and sleep hygiene. The learning units started in the school setting and then expanded in the extra-school context with the involvement of families in homework and challenges https: //eumoveproject.eu/academic-level/. 4)Active School Commuting Toolkit: series of strategies to promote active commuting to/from school https: //eumoveproject.eu/wp-content/uploads/2021/03/English-Active-Commuting-1.pd. 5)Par ent Toolkit: a static document with health information related to PA, nutrition and sleep, https: //eumoveproject.eu/wp-content/uploads/2021/03/English-Parent-Toolkit-2.pdf. 6)School leaders toolkit: a set of strategies was created in order to create more physically active school environment (recess, classroom, playground) to facilitate healthy lifestyle English-School-Environment-1.pdf. 7)EUMOVE APP: we created an APP for teachers and parents to be connected at EU level with all the created materials https://eumoveproject.eu/app-eumove/.
Conclusions: The EUMOVE project offers evidence-based and innovative resources to be applied by the educational community in the real-world setting to promote healthy lifestyles among students in European countries.

Recovery-Based autoregulation of training volume does not provide additional benefits to a mixed session periodized resistance training program

Purpose: The aim of the present investigation was to study how autoregulation impacted training volume, performance and muscle size on a 10-week mixed session periodized (MSP) resistance training program in resistance trained men.
Methods: Twenty-four resistance trained men were randomly assigned to an autoregulated MSP (AMSP group; n = 13; age = 26.2 ± 4.9y; body mass = 82.0 ± 8.7 kg; height = 176.8 ± 6.0 cm) or to a MSP group (n = 10; age = 24.0 ± 2.6; body mass = 81.3 ± 10.5 kg; height = 174.0 ± 5.4 cm). Participants in both groups trained 5 days a week for 10 weeks and performed the same exercises. The difference between the groups consisted in the use of a perceived recovery-based autoregulation of the training volume in AMSP. Maximal strength (bench press and squat 1RM), power (bench press throw and countermovement jump), and muscle architecture measurements (muscle thickness of biceps brachii, trapezius,

vastus lateralis and vastus medialis) were collected prior to and post the training period. In addition, training volume and session load was calculated for each training session.
Results: A higher total training volume, without differences in the average session load ($p > 0.05$) was registered in AMSP compared to MSP ($p < 0.001$). No significant differences between the groups were detected for muscle thickness and lean body mass ($p > 0.05$). No significant differences between the groups were also detected for any strength and power measurements.
Conclusions: Results of this study indicate that a perceived recovery based AMSP was not more effective than a MSP for increasing muscle size and performance in resistance trained men. Furthermore, the autoregulation criterion adopted in the present investigation, induced an increase in training volume that did not produce additional benefits.

The rate of force development as a determinant of maximal theoretical velocity in the force–velocity relationship

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Purpose: Rate of Force development (RFD) calculated at 50 and 100 ms represents the capacity to quickly produce force starting from a relaxed state during isometric contractions. The theoretical maximal unloaded velocity obtained from force–velocity relationship (V0) represents the capacity to produce force at high velocity during dynamic contractions. While these two capacities are intuitively close, their association has not been studied so far. For this reason, we investigated the role of RFD and maximal voluntary force (MVF) on the theoretical maximal velocity (V0) and force (F0) of the knee extensors.
Methods: Single-leg knee extensors were tested under isometric and dynamic conditions in 31 young male adults. Participants were asked to perform two 5-s maximal isometric contractions to calculate MVF and 10 isometric burst-like contractions to calculate RFD at 50, 100, and 150 ms. Then, a set of incremental-load knee extension maximal efforts were performed on a modified knee-extension non-isokinetic ergometer. Force and velocity were continuously measured to calculate individual force–velocity relationships adopting linear model.
Results: Stepwise linear regression showed that isometric RFD at 50 ms was the main determinant of V0 ($R^2 = 0.223$, $P = 0.007$) while MVF was the main determinant of F0 ($R^2 = 0.304$, $P = 0.001$). Correlation analysis showed that RFD at 50 ms ($R = 0.473$, $P = 0.007$) and RFD at 100 ms ($R = 0.428$, $P = 0.016$) correlated with V0, while RFD 150 ms correlate with F0 ($R = 0.381$, $P = 0.034$). The slope of the force–velocity relationship did not correlate with any RFD or MVF indexes.
Conclusions: We showed that the V0 (and not F0) is partially explained by muscle contraction quickness, the so-called "explosive" force capacity. So, the capacity to produce force at high velocity partly depends on the capacity to rise quickly the force in the early phase of the contraction, suggesting that some underlying determinants of RFD would also affect V0.

Can the acute effect of wb-ems combined with resistance training exercise improve strength and flexibility performance?

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Purpose: Muscular strength development depends by both morphological and neural factors, such as muscle cross-sectional area, muscle-tendinous stiffness, neuromuscular inhibition reduction, motor unit recruitment and synchronization. Whole-Body Electromyostimulation (WB-EMS) is a different training strategy to develop muscular strength with different motor outcomes. WB-EMS induce a global-body electrical myostimulation, synchronously activating up to 8–10 different muscle groups, while the subject performs functional movements during the stimulation. The aim of this study was to assess the acute effects of a single session of WB-EMS superimposed to a classic resistance training, compared to traditional resistance training on isometric strength and flexibility.
Methods: Fifteen female subjects (aged 22.00 ± 2.33) were randomly divided in two groups, experimental group (EG) (n = 8, age = 22.37 ± 2.20) and control group (CG) (n = 7; age = 21.57 ± 2.57). The experimental group performed 4 sets with 12 repetitions of full squat, hip thrust and Romanian deadlift with superimposed WB-EMS (Miha Bodytec equipment—GmbH, Augsburg, Germany). WB-EMS was conducted with intermittent stimulation 4 s WB-EMS / 4 s rest, at 85 Hz, 350 μs. The control group performed the same exercises with no superimposed WB-EMS. The assessment included isometric strength evaluation though leg extension 90°, leg curl 90° and Romanian deadlift 90°, flexibility thought sit and reach test, isometric resistance though wall sit 90°.
Results: The RM-ANOVA showed significant difference between groups in leg extension mean strength, where the experimental group achieved better results than control group ($p = 0.032$). Significant differences by time were found in deadlift mean and peak strength after the experimental training ($p = 0.001$). In addition, a significant time*group interaction was found in flexibility ($p = 0.002$), leg extension ($p = 0.044$) and leg curl ($p = 0.001$) peak strength, where the experimental group showed a less enhancement in performance, while the control group experienced a decline.
Conclusions: The results of this pilot study indicated that WB-EMS can be a training strategy for developing muscular strength, improving intra and inter-muscular coordination, motor unit recruitment and their synchronization.

Effects of fitlight training on cognitive-motor processes in Élite Judo athletes

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Purpose: Large research has employed sensorized light systems as a form of cognitive-motor training (CMT) to enhance executive functions (EFs), such as Fitlight™. The objectives of this study were: 1) to determine whether a 5-week Fitlight program improved EFs in young adults élite judo athletes when compared to the non-intervention group, 2) to verify if CMT had an effect on physical fitness in the experimental group.
Methods: Twenty-seven subjects (14 males and 13 females) (age = 19.5 ± 2.0 years) were randomly assigned to a Fitlight-trained group (FG, n = 14; 8 males and 6 females) and to a control group (CG, n = 13; 6 males and 7 females). Weight, height, and body mass index were assessed for anthropometric characteristics. For physical fitness, counter movement jump (CMJ), handgrip test (HG), dynamic and isometric chin up test (DC and IC), were assessed before (T0) and after (T1) training, and analyzed by a 2 × 2 ANOVA (group x time). For cognitive functioning, flanker and digit span (DS) were assessed at T0, T1, and T2 (2 months after T1), and analyzed by a 2 × 3 ANOVA (group x time). Also, be a winner in a judo competition after the training period was assessed by Chi^2 test.
Results: A significant difference was found for the accuracy of flanker in the FG with respect to the CG at T1 (98.30% vs 92.05%, $p = 0.028$). Also, the CG was less accurate at T1 than the FG at T2 (97.73%, $p = 0.035$). A significant difference was found for the span of backward DS in the FG between T0 and T2 (3.57 vs 5.21, $p < 0.001$). A significant difference was found for relative DC in the FG from T0 (11.5 rep) than at T1 (14.29 rep) ($p = 0.027$). A significant difference was found for CMJ in the FG from T0 (29.21 cm) than at T1 (31.49 cm) ($p = 0.05$). No significant differences were found for forward DS, reaction time and rate of correct score of backward DS, reaction time of flanker, IC and HG ($p > 0.05$). In the FG 64.3% vs 38.5% won ($p < 0.01$).
Conclusions: A 5-week judo-specific CMT using Fitlight™ improved élite judo athletes' cognitive ability, specifically cognitive flexibility and working memory, as well as strength endurance, explosive strength and performance in judo competitions. Élite judo competitors appear to be able to furtherly improve some EFs tasks and physical fitness components with a CMT which lasted only 5 weeks. Coaches might take this information into account when drafting seasonal training schedules.
Acknowledgments: Special thanks to Banzai Cortina in Rome.

Changes in hand grip strength and finger grip strength after the barbell deadlift at different load intensities in powerlifters and weightlifters

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Purpose: The barbell deadlift (BD) is one of the three competition exercises in powerlifting, and it is also performed extensively by weightlifters during training. Previous studies have demonstrated that several factors could influence the BD performance and they could affect for a successful attempt. The aim of this study was to analyze how changes in load intensities during the BD affect hand grip strength and finger grip strength.
Methods: For this study, 15 powerlifters and weightlifters were recruited. To be included participants had: (1) to be competitive athletes and to engage at least 3 years in powerlifting / weightlifting; (2) at least a frequency of 3 workouts / week; (3) to practice BD regularly during training. The study included the following 3 steps: (1) Estimation of BD 1RM; (2) Baseline measurement of hand grip strength and finger grip strength; (3) Measurement of hand grip strength and finger grip strength after BD at different load intensities (i.e., 50%, 70%, 90%). For the latter step, each participant performed 10 repetitions with load intensity of 50%, 6 repetitions with load intensity of 70%, and the maximum possible number of repetitions with load intensity of 90%.
Results: Repeated measures ANOVA showed a significant difference ($p < 0.001$) between trials for right hand handgrip test performance with a significant difference between baseline and trials at 50% ($p < 0.05$), 70% ($p < 0.001$), and 90% ($p < 0.001$); between trial at 50% and 70% ($p < 0.01$), 90% ($p < 0.001$). Repeated measures ANOVA showed a significant difference ($p < 0.001$) between trials for left hand handgrip test performance with a significant difference between baseline and trials at 50% ($p < 0.05$), 70% ($p < 0.001$), and 90% ($p < 0.001$); between trial at 50% and 90%; between trial at 70% and 90% ($p < 0.01$). Repeated measures ANOVA showed a significant difference ($p < 0.001$) between trials for right pinch grip test performance with a significant difference between baseline and trials at 50% ($p < 0.01$), 70% ($p < 0.05$), and 90% ($p < 0.001$); between trial at 50% and 90% ($p < 0.05$); between trial at 70% and 90% ($p < 0.01$). Repeated measures ANOVA showed a significant difference ($p < 0.001$) between trials for left hand pinch grip test performance with a significant difference between baseline and trial at 90% ($p < 0.001$).
Conclusions: Our study revealed a change in hand grip strength and finger grip strength after the BD at different load intensities with decreasing performances as load intensity increases. These findings suggest that hand grip strength and finger grip strength could be considered factors for a successful BD.

Attentional focus effects on lower limb muscular strength expression in athletes: the superiority of the core component of action in the maximal isometric SQUAT task

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Purpose: Research has repeatedly suggested that an *external* focus of attention (FOA) is far superior to an *internal* one in motor learning and performance[1]; however, an attentional focus directed at the *core*

component of a given action is also associated with functional performance[2]. This study aimed to compare the effect of these three FOA on participants' performance during a maximal muscular strength task, which was not explored to date.

Methods: We recruited 18 highly trained[3] basketball players winners of the U17 and U19 national Italian competitions, with highly advanced resistance training status[4], and experienced with the maximal isometric squat (MIS) exercise. Task comprised three trials of MIS at the athlete's individual 90-degree position, with the goal of lifting the bar (280 kg) from the rack as quickly as possible. After 4 familiarization-training sessions, athletes performed the task adopting three types of FOA, each on a different week: *Idiosyncratic Core Component* (ICC = individualized focus based on the key element of the action that drives the task execution), *Relevant External Focus* (REF = "focus on moving up the bar"), *Relevant Internal Focus* (RIF = "focus on the feet sensations") in a counterbalanced order, without time constraints during the execution. Outcome measures collected were kinetic force–time variables, such as peak force relative to body weight (PFb) and average rate of force development[5] (avgRFD = Δforce/Δtime), processed with a customized MATLAB script. Moreover, after each trial, the participants were asked to fill out a manipulation check questionnaire to investigate their adherence to the given FOA instructions.

Results: Repeated measures ANOVA showed significant FOA effects on avgRFD across conditions ($p < 0.05$; $\eta p^2 = 0.25$; $F = 5.25$; $dof = 2.16$; $power = 0.80$). Pairwise comparison showed that $avgRFD_{ICC}$ was significantly higher than $avgRFD_{REF}$ ($p < 0.01$; $d = 2.47$; 95% CI = 0.08–0.45) and $avgRFD_{RIF}$ ($p < 0.05$; $d = 2.64$; 95% CI = 0.03–0.49). There were no differences in PFb measure across conditions ($p > 0.05$).

Conclusions: Athletes who focused on their ICC of action attained significantly higher avgRFD performance compared to REF and RIF in the MIS task. These results suggest that promoting forms of individual attentional focus strategies related to the core component of action may increase lower limb muscular strength expression in highly trained athletes.

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Self-Perception of teaching styles of physical education teachers: preliminary results in apulia region

Purpose: The enhancement of physical and sports literacy in school setting are prerogatives and development aim for the physical education (PE) teachers. Therefore, as part of the teaching of motor activities, the proposal of motor tasks through different organizational modes (individual tasks, in pairs, in small groups, circuits, relay, paths, team games, etc.) is functional to the achievement of the educational objectives set in the didactic learning units. In addition, the definition and acquisition of motor skills, declined in terms of skills and knowledge, allows not only to learn gradually more complex motor skills, but also to develop the skills that allow the child to perform variable movements, skills that can also be transferred and applied in different disciplinary areas and, more generally, in relationship life. The present study aims to assess PE teachers' perception about the use of teaching styles during curricular lessons.

Methods: The sample involved a total of 83 PE teachers (M = 41, F = 42, main age = 43, 74 ± 10, 76) divided according to years of service (0–4 = 36%, 5–10 = 34%, and over 10 = 30%) and academic training (ISEF = 44% and master's degree = 56%). Teachers complete a digitalized version of a self-produced questionnaire to assess how many times they use each teaching styles during the last month. In this study we reported only how often PE teachers have used each teaching style.

Results: Data analysis showed that with reference to the Reproductive Teaching Styles, Command and Practice styles are the most used by PE teachers (54% and 69%, respectively), while Reciprocal and Self-Check are the least (9% and 15%, respectively). Instead, regarding the Production Styles, Divergent Discovery (46%) and Guided Discovery (36%) are often used by teachers, but, at the same times, teachers rarely proposed motor task with Guided Discovery (36%) and Self-Teaching (42%) styles.

Conclusions: The preliminary results of the analysis of PE teachers' perception of teaching styles reveals the prevalence of the use of some styles over others, and this presuppose not only a different (but similar) teacher's behavior, but also limits children's way of learning a certain motor task. Future research and analysis will investigate the perception of different teaching styles according to seniority, school grade and academic training to design training courses for teachers adapted to children's needs.

Syllabuses analysis of teaching methods of physical and sport activities in education and training courses in Italy

Purpose. To become a (generalist) teachers in Italian primary school a degree in Education and Training (ET) is needed, allowing to teach all disciplines. The Italian primary teacher training model has many strengths, but it presents some critical issues, especially when specialized disciplines, such as physical education PE, must be taught: although at least 9 credits of training activities on physical and sports education teaching methods (MEDF) must be carried out, these credits seem not to be sufficient to adequately train generalist teachers for PE.

This study is aimed at analyzing the syllabuses of MEDF courses in ET degrees in Italy, to summarize contents and aims, comparing them to the expected learning outcomes stated by decree 10 September 2010, n. 249 that established the new order (also) for primary teacher training, to the aim of primary school PE by National guidelines and by provisions laid down by Law 230/2021for health and physical well-being.

Methods. A documentary/comparative approach has been adopted. The syllabuses of all (35) MEDF classes and laboratories in ET courses has been analyzed, to outline the consistency of the contents and the related specific learning aims comparing them to the normative statement on primary teacher training and the aim of primary school PE.

Results ET courses in Italy have a quantitative homogeneous distribution with 9 CFU of MEDF classes and laboratories according to the decree n. 249, but on the qualitative side the comparative study of MEDF syllabuses highlighted an heterogeneous organization of contents and learning outcomes and too "light" training on PE teaching methods, especially in practical activities. Furthermore, contents and objectives often do not meet the objectives established by national guidelines for PE in primary schools and the promotion of physical activity for children' health and wellbeing.

Conclusions In order to coherently write MEDF syllabuses in ET courses for classes and laboratories could be useful make a consensus conference on MEDF classes in ET to produce recommendations, including evidence-based ones, and core contents and learning outcomes for teaching physical education in primary school, respecting autonomy and freedom of education.

Does the spontaneous play facilitate the acquisition of fundamental motor skills in pre-school age children?

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Purpose: To assess whether the practice of spontaneous play may affect children's competence level in the fundamental motor skills (FMS).
Methods: A total of 288 children aged 3–5 years were involved in the study and divided into 3 groups in relation to the attended grade in kindergarten: young children (Young group, 3 years, n = 66), middle aged children (Middle group, 4 years, n = 99), older children (Old group, 5 years n = 128). The Test Gross Motor Development 3^Edition (TGMD-3, Ulrich, 2019) was used to assess children's motor performance level (GMI). Spontaneous outdoor play (SP) was estimated by means of the Children's Outdoor Play assessment questionnaire completed by one parent/main caregiver (Veitch et al., 2009; Pesce et al. 2016).
Results: The Young group revealed minor GMI compared to the Middle group (3 years 101 ± 1.45; 4 years 107 ± 1.25; $p = 0.003$) as well as to Old group (5 years 106 ± 0.973; $p = 0.002$). However, the comparison between Middle group and Old group on GMI did not show significant differences ($p = 0.785$). In addition, no significant differences were found for the SP amongst the three age groups ($p = 0.122$). However, SP correlated with the GMI level only for the Young group, ($r = 0.882$; $p < 0.001$), while Middle and Old groups showed no correlation between SP and motor performance level (Middle. $r = 0.175$; $p = 0.209$; Old $r = 0.078$; $p = 0.657$).
Conclusions: Our results show that changes of competence level in FMS pre-school age children do not follow a constant increase, indeed a non-linear increment was observed across the different age groups. Furthermore, while the amount of spontaneous play does not change with age, our results indicate that spontaneous play affects FMS skill level only in early preschool age children. The findings suggest that physical education interventions should focus on deliberate motor activity to support children's motor skills development.

How learn to ride a bicycle: a simple method

Purpose: The main objective of this work was to develop a simple, fast and safe way to learn to ride a bicycle. The formulated hypothesis, at the basis of the experimental project, is that the subjects first acquire the necessary balance to start riding on the scooter and then immediately transfer these skills to the bicycle.
Methods: The work was carried out on a group of 80 children, 32 males and 48 females, aged 5.46 ± 0.75 years, 1.14 ± 0.05 m tall and weighing 21.27 ± 2.80 kg, attending a kindergarten in Rome, Italy.
The control group, on the other hand, was made up of 24 children who took part in only one of the exercises foreseen by the experimental protocol, but, like all the other subjects, was evaluated before and after four weeks on the bicycle.

The exercises were performed exclusively on the kick scooter in intervals modality: 15 s of work and 15 s of passive recovery for 30 min each, twice a week, for a total of four weeks of work (30 min × 2 = 1 h × 4 weeks = 4 h total and 2 h of exercise on the vehicle a two wheel).

The bicycle was never used during the exercises, but only in tests before and after the experimental protocol.

Results: The hypothesis formulated at the beginning of the experimentation was confirmed. All the children who participated in virtually all of the drills learned to ride a bicycle.
Those who exercised could maintain balance while sitting on the bicycle and with their feet planted on the pedals except for the control group. 72 children out of 80 (90%) after the initial push of the researcher, were able to pedal immediately.

After only a few attempts, 80% of the children managed to start alone and from a stationary position. Only 20% required additional time to acquire this skill.
Conclusions: The results obtained confirm that it is possible to acquire the balancing abilities to ride a bike without using this vehicle for the initial exercises, but another: the kick scooter.
When a subject is able to balance on the kick scooter for about 4 s, he will be able to do it on the bicycle as well.

Forest school increases spontaneous physical activity level in primary school children

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Purpose: In recent decades, a new school model called the Forest School has emerged in northern Europe, based on the concept of Outdoor Education (Priest, 1986). This model is founded on the belief that the natural environment can promote well-being, growth, and development, encouraging exploration and physical activity for children. As physical inactivity has been increasing among children and adolescents, this study aimed to explore spontaneous physical activity (PA), perceived well-being and positive and negative affects of children attending a forest school (FS) and a "traditional" school (TS) in the Trentino Region.
Methods: Twenty-two 4th-grade children (9–10 years) were recruited from a classroom in a TS ($n = 12$; 5 girls) and one in a FS ($n = 10$; 5 girls). Moderate to Vigorous Physical Activity (MVPA) was assessed during school time in two one-week periods in January and May 2023, using accelerometers (ActiGraph wGT3X-BT). At the end of each week, two questionnaires were administered to evaluate perceived well-being (Multidimensional Student's Life Satisfaction Scale, MSLSS scales School; Zapulla et al., 2014) and pereceived positive and negative affects at school (adapted PACES, Carraro et al., 2008).
Results: Analysis revealed a significant effect of school on MVPA ($p = 0.009$); children in the FS showed higher level of PA during school time compared to those in the TS. In the FS, all children met the WHO guidelines for MVPA in both periods, whereas in the TS, 11 out of 12 children met the guidelines in January, and 8 out of 12 in May. A time effect was found on PACES-Cons ($p = 0.004$), indicating that in May, children reported significantly higher negative emotions related to staying at school compared to January. This might have been due to the unfavorable weather conditions that both groups encountered in May or to the accumulated tiredness at the end of the school year. Significant effects for school ($p = 0.049$) and school x time ($p = 0.028$) were found on PACES-Pros, revealing higher positive affects in the TS, which increased in May. No significant effects were observed on MSLSS scores.
Conclusions: The FS appears to promote higher levels of PA in children. However, children in the TS reported more positive affects compared to those in the FS, this may be due to habituation in this last group. Future studies should address these apparently contrasting

results to shed light on the determinants of lifelong physically active behaviours.

Football academies as educational agencies: an investigation on the educational and inclusive role of internal stakeholders

Purpose: This study aims to examine the role of sports, particularly football, to promote social inclusion and personal development among children and youth, with particular attention to individuals with Special Educational Needs (SEN) and foreigners. The identified problem is the lack of awareness regarding the educational role of football academies (FA) and their capacity to promote social and cultural inclusion. The question is whether internal stakeholders (coaches, trainers and directors) fully understand their role not only from a sports perspective but also from an educational and social standpoint. The purpose is to assess the perception of internal stakeholders regarding the effectiveness of educational agencies in promoting an inclusive and intercultural approach and in helping young individuals develop motor, cognitive, and social skills.
Methods: The research adopts a quantitative approach through the administration of a 17-item questionnaire, which includes closed-ended questions and the use of the Likert scale. The participants include 47 internal stakeholders of FA in a limited territory of Campania region, including graduates in Exercise and sport sciences, holders of licenses from the Italian Football Federation (FIGC) and executives. The Chi-square test was used to analyze the relationships between categorical variables and establish the significance of the responses.
Results: The results revealed that internal stakeholders acknowledge the educational role of sports and coaches, but the awareness of the educational action is influenced by the different philosophies and visions of the operators. However, no significant correlation was found between the educational contribution provided by coaches and knowledge about sensitive phases of children's growth and development. Additionally, training on educational and inclusive aspects to handle situations with children with SEN was found to be insufficient. Nevertheless, FAs demonstrated a positive willingness to welcome children with SEN and from diverse cultures, recognizing the universal language of sports in promoting inclusion.
Conclusions: The study highlights the need for further training of FA operators to address the challenges of inclusion and socio-educational upbringing. FAs' task should be the holistic development of young individuals, not only from a technical and tactical perspective but also socially and personally, promoting inclusion and integration. Coaches and operators must be aware of their educational role and receive training to address the educational challenges of young athletes, enabling everyone to express themselves to the fullest.
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Differences in physical function and radiology examination in elderly population and people living with HIV (PWH) with sarcopenia

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Purpose: Sarcopenia is a progressive, generalized skeletal muscle disorder characterized by reduction of muscle mass and strength with aging, which is also associated with several chronic disorders, including HIV infection. We investigated the relationships between sarcopenia-associated functional and muscle mass measures in a subgroup of elderly and people living with HIV (PLWH), before being enrolled in The Grow Your Muscle (GYM) Study, which aims to assess the effects of physical exercise on sarcopenia, and compared these measures between the two populations.
Methods: The GYM study is a monocentric, 48-week, randomized, parallel-group, superiority trial which enrolled sedentary subjects of $>$ 60-year-old for elderly or $>$ 50-year-old in the PLWH with sarcopenia. We performed a cross-sectional analysis of functional and radiology measures at BL. These included measures of muscle strength (handgrip, chair-stand-test, thigh extensors), balance (Mini-BESTest), physical function (6MWT); body composition (fat mass, fat free mass at arms, limbs and total body, and ASMMI) by dual-energy X-ray absorptiometry (DEXA); mid-thigh cross-sectional area (CSA) and intramuscular adipose tissue (IMAT) by magnetic resonance. Correlations between variables were assessed by the Spearman correlation test, wherease differences between groups by Mann–Whitney test.
Results: Thirty-six elderly [age: 74 (68–76) years], and 37 PLWH [age: 61 (58–67) years] ($p < 0.0001$) were enrolled in the study. Significant correlation were observed in both groups between handgrip and arm lean mass ($R = 0.4$, $p = 0.011$ in elderly and $R = 0.5$, $p = 0.007$ in PLWH) and ASMMI ($R = 0.4$, $p = 0.002$ in elderly and $R = 0.6$, $p = 0.006$in PLWH); between 6MWT and CSA ($R = 0.4$, $p = 0.043$ in elderly and $R = 0.4$, $p = 0.043$); and between right thigh extensors and leg lean mass ($R = 0.6$, $p = 0.0002$ in elderly and $R = 0.6$, $p = 0.0007$), ASMMI ($R = 0.6$, $p = 0.001$ in elderly and $R = 0.6$, $p = 0.003$ PLWH) and CSA ($R = 0.7$, $p < 0.0001$ in elderly and $R = 0.7$, $p = 002$ in PLWH). Compared to the elderly, PLWH showed better performances with thigh extensor [313 (211–343) vs 232 (171–258) N, $p = 0.0015$]; handgrip [34 (28–39) vs 28 (23–37) kg, $p = 0.0018$]; and higher muscle mass value as by ASMMI [6.7 (5.8–7.3) vs 5.8 (5.1–6.8) kg/m^2, $p = 0.027$]; total lean [75 (70–80) vs 62 (53–63)%, $p = 0.0002$]; mid-thight CSA [10684 (8790–13389) vs 8493 (6725–11, 329) %, $p = 0.0015$]; and lower total fat [26 (20–30) vs 37 (26–37) %, $p = 0.0015$].
Conclusions: Correlations between functional test performances and muscle mass at different levels in the context of sarcopenia, showed that PLWH had higher muscle strength, function and mass than the elderly.

Preliminary results of the grow your muscle (GYM) study on muscle strength, body composition and blood lipids in people with sarcopenia

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Purpose: Sarcopenia is a geriatric condition associated with an increased risk of fall and, fractures, and metabolic diseases. The aim of this study was to investigate the effects of a home-based, app-monitored body-weight resistance training program in improving muscle health in elderly and people living with HIV (PLWH) with sarcopenia. We here present measures of muscle strength, body composition and laboratory analysis at baseline (BL) and after 12 weeks (W12).
Methods: This is a monocentric, 48-week, randomized, parallel-group, superiority trial. Inclusion criteria are being sedentary; > 60-year-old in the elderly or > 50-year-old in the PLWH group and sarcopenia, as defined by low appendicular skeletal muscle mass index (ASMMI) by bioimpedentiometry (BIA) and/or low muscle strength by handgrip. Participants are randomized 1: 1, separately in each group (elderly and PLWH), to: 1) Exercise group (EG), where participants perform a home-based, app-monitored resistance-training program; 2) Control group (CG), without exercise prescription. At BL, W12 and end of study (W48) participants are tested for muscle strength (handgrip, chair-stand-test, right thigh extensors), balance (Mini-BESTest), physical function (6MWT); body composition (fat mass, fat free mass and ASMMI), and blood lipids. Changes between BL and W12 are assessed by Wilcoxon matched pairs signed rank test and percent change differences between groups by Mann–Whitney test.
Results: Ninety-two participants (55 elderly and 35 PLWH) have been screened so far and 72 (78%) have been enrolled in the study: 35 in EG (17 elderly and 18 PLWH) and 37 in CG (19 elderly and 18 PLWH). At W12, 13 participants in EG (8/13 male, 3/13 PLWH) and 22 in CG (13/22 male, 8/22 PLWH) completed the first 12 weeks of study and 9 dropped-out (7 EG and 2 CG). Regarding elderly population a significant increase of the number of repetitions during the chair-stand ($p = 0.039$) in the EG was found, with this value that was significantly higher in EG respect to CG ($p = 0.028$). Regarding PLWH a higher ASMMI was found at W12 in EG respect to CG ($p = 0.003$) in PLWH. No other significant statistical differences were observed in the other parameters for muscle strength, body composition and blood lipids in both elderly and PLWH.
Conclusions: These preliminary results in a small size sample indicate that the training protocol was effective to increase the performance at the chair-stand test in the elderly population.

A multidisciplinary pilot study in people with hiv who switched from triple to dual therapy: influence on physical capacities, lifestyle and oxidative stress

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Purpose: HIV is a major public health problem, affecting approximately 40 million people worldwide (WHO, 2023). Although the advent of antiretroviral treatment has significantly extended the life expectancy of people living with HIV, it has also increased the risk of comorbidities, such as liver or cardiovascular diseases (Cahill & Valadez, 2013). This study aims to assess whether the switch from triple to dual therapy in a cohort of people with HIV could affect: i) physical capacities, physical activity and sedentary behavior; ii) oxidative stress and vitamin D.
Methods: 26 people with HIV were assessed just before (in baseline, treated with triple therapy) and six months after switching to dual therapy. Physical capacities were evaluated using finger tapping for manual dexterity, the YMCA step for cardiorespiratory fitness, handgrip and sit to stand for strength, one leg stance for balance and sit and reach for flexibility. The Global Physical Activity questionnaire was used to quantify physical activity and sedentary behaviour. Oxidative stress and vitamin D were evaluated through liquid chromatography.
Results: participants were men (mean age 42 years, SD = 8, range 31–56). Handgrip strength and sit to stand were statistically different when comparing triple versus dual therapy, increasing, by 8.5% and 8.2%, respectively. Lifestyle factors such as physical activity and sedentary behaviour did not change. Measures of aspartate transaminase and vitamin D, decreased and increased, respectively, before and after the therapy switch.
Conclusions: these results highlight the potential benefits of switching from triple to dual therapy in terms of physical capacities and parameters related to oxidative stress. Further studies in larger cohorts of people with HIV are recommended to consolidate the present findings.
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Vestibular system and posture. effects of proprioceptive exercise training in a group of subjects with benign paroxysmal positional vertigo

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Purpose: Benign paroxysmal positional vertigo (BPPV) is the most frequent and common vestibular disorder among the adult population, which manifests itself with a sudden and brief sensation of spinning

during particular movements of the head, such as getting out of bed and/or picking up an object from the floor. Approximately 20–30% of the world's population suffer from vertiginous events during their lifetime, which lead to a reduction in static and dynamic postural control and states of anxiety, with repercussions on the general state of health and quality of life. (Iwasaki & Yamasoba, 2015). The aim of this study was to evaluate the effects of a training program on balance and to enhance people's wellbeing and quality of life.

Methods: The Cyber Sabots stabilometry^{TM} was used to evaluate the postural stability. Ten subjects (7F, 3 M) aged between 50 and 70 (63, 3 ± 11,21) were recruited at the Centro di Medicina in Treviso. Subjects were assessed through electronic stabilometry in dinamic mode, open eyes (OE) and closed eyes (CE). Re-education program was proposed for the vestibular system, with exercises that stimulate visual, proprioceptive information for recovery of static and dynamic balance. The experimental group trained for 40 min, twice a week for 10 weeks. Functional tests and dynamic stabilometry (OE, CE) were used for the assessment at T0-T1-T2. Variables Xmoyen, Ymoyen, Surface, VarVit, IVV, Romberg and Wz were submitted to statistical analysis.

Results: ANOVA test and post-hoc BONFERRONI test showed significant differences in T2: Surface-OE ($p = 0.002$); WZ-OE ($p = 0.048$). In the Fourier transform (FFT)-CE ($p = 0.015$).

Conclusion: Data suggest that associating proprioceptive gymnastics training with therapeutic maneuvers in subjects with BPPV seems to bring about improvements in postural control and an improvement on a psychological level. The analysis shows a reduction in surface oscillations and in energy consumption (Yetiser & Salturk, 2022).

Comparison between two different exercise training protocols on functional fitness in older adults

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Purpose: The decline in the functional fitness is one of the most significant factors limiting the social and daily activities and decreasing the quality of life in the elderly. Numerous studies showed that physical activity is associated to an improvement in the physical performance of older adults (1). Therefore, the aim of this study was to compare the effects of a strength combined balance protocol (SBP) and a strength combined aerobic protocol (SAP) on functional fitness variables in older adults.

Methods: Seventy-eight subjects (n = 60 women) were randomly recruited for participating in the "Promotion of Physical Activity and Prevention of Domestic Accidents" (PAP & DAP) project and assigned to the Balance Group (BG; n = 33; 72.6 ± 5.88 years; 66.5 ± 9.23 kg; 161.4 ± 8.22 cm; 25.5 ± 2.60 kg/m^2) and the Aerobic Group (AG; n = 45; 72.5 ± 6.39 years; 66.5 ± 10.86 kg; 161.8 ± 7.42 cm; 25.5 ± 3.62 kg/m^2), that respectively performed SBP and SAP twice a week (4 h) for 6 weeks. The functional fitness was assessed with the Senior Fitness Test (SFT) battery including the following tests: chair stand (leg and endurance strength), arm curl (arm strength), sit and reach (back and hamstring flexibility), back scratch (shoulder flexibility), timed up and go (dynamic balance and walking ability) and two-minute step (aerobic endurance). The Shapiro–Wilk test was used to check the normality of the data. For paired samples, Student's T test for parametric data and Wilcoxon Test for non-parametric data were used to assess the differences between pre- and post-intervention within the same group. For independent samples, Student's T test for parametric data and U-Mann Whitney for non-parametric data were used to evaluate the differences between two groups pre- and post-intervention. The alpha level was set a priori at 0.05.

Results: Both groups showed statistically significant improvements in all SFT tests, except in the chair sit and reach test in the BG. No statistically difference was found between the two groups.

Conclusions: Six weeks of SBP and SAP are adequate for inducing significative increases in the functional fitness of older adults regardless of the type of multimodal protocol used.

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Leisure-Physical activity, actigraphic daytime activity and sleep during a weekly stay in Italian spa

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Purpose: The spa setting could increase physical activity (PA), daytime activity and improve sleep quality in pathological patients [1,2]. Thus, the current study aims to shed light on leisure-time PA, daytime activity and sleep in healthy subjects during a one-week stay in Italian spa.

Methods: 137 participants (males = 36.5%; 64.3 ± 10.4yrs) spending one week at *GB-Hotels* (Abano Terme, Italy) and undergoing thermal treatments filled in the *Godin-Shepard Leisure-Time Physical Activity Questionnaire* (GSL-TPAQ) and the *Mini Sleep Questionnaire* (MSQ) at the beginning and the end of the spa stay. The Actigraph Motionwatch 8 (Camntech) monitored the daytime activity, whereas the daily PA was recorded through a diary. ANCOVA analyses were adjusted for age, BMI, and sex. FORST funded the current study.

Results: The percentage of active subjects raised from 51 to 66%, with a significant increase in the PA during the spa stay (GSL-TPAQ: before: 27.6 ± 22.7 LSI; during: 40.3 ± 30.1 LSI; $p < 0.001$). The percentage of participants with *no sleep problems* incremented from 31 to 45% during the spa stay, with a significant improvement in the sleep quality (MSQ: before: 30.3 ± 10.3a.u.; during: 25.3 ± 9.5 a.u.; $p < 0.001$). MSQ delta values were higher in *active* (-5.83 ± 0.93) and *sufficiently active* (-5.93 ± 1.20) than *inactive* participants (-1.81 ± 1.31), even though without statistical significance. Participants were active for 44% of the daily monitored time, with 27% *moderate*, 15% *low*, and 1% *vigorous* actigraphic daytime activity. The most reported physical activities were: walking, swimming, gym use, and gymnastics in thermal-water pools, with 500.3 ± 402.7 min of PA weekly.

Conclusions: A week of spa stay seemed effective in incrementing the PA and sleep quality. Participants reported reaching the recommended 300 min of physical activity in a week. Leisure-time PA could be favoured by the resorts' facilities, free time, and better predisposition of the participants to being active during the Spa stay. Sleep could improve thanks to the relaxing atmosphere, the effect of

the hot water on body temperature and mud applications on cortisol's circadian rhythm regulation.

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A comparison of strokes distribution among wheelchair paralympic table tennis classes

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Purpose: Table tennis is the third largest paralympic sport for the number of players. However, strokes distribution among classes has not been considered from previous investigations. Therefore, the purpose of this study was to conduct a notational analysis of strokes distribution in relation to the wheelchair classes during international competitions.

Methods: Five matches for each wheelchair class (C1-to-C5) were evaluated from 50 elite male right-handed players. Both players for each match were analyzed for the following performance indicators: strokes type, shots outcome, and area of ball bouncing (A1-to-A6). Each shot was classified as neutral, error or winner for both forehand (FH) or backhand (BH) executions in service, drive, topspin, lob, push, block, top countertop, flip, smash, and long pimples shots.

Results: Considering error outcome, C1 demonstrated a higher error rate for BH drive compared with C2 ($p = 0.006$), C3 ($p < 0.001$), C4 ($p = 0.003$), and C5 ($p < 0.001$), and for BH lob compared with C3 ($p < 0.001$), C4 ($p < 0.001$) and C5 ($p < 001$). Differently, C1 showed a lower error rate for BH topspin compared with C4 ($p = 0.036$) and C5 ($p < 0.001$), and for BH block compared with C3 ($p = 0.038$) and C5 ($p = 0.22$). A higher error rate emerged in C1 compared with C5 ($p = 0.005$) for FH drive, whilst a lower error rate was found in C1 compared with C2 ($p = 0.040$) and C4 ($p = 0.027$) for FH push. Regarding winner outcome, C1 and C2 demonstrated a higher winning rate for BH lob ($p \leq 0.01$) compared with C3-to-C5. Moreover, C5 demonstrated a higher winning rate for FH topspin compared with C1 ($p < 0.001$), C2 ($p = 0.002$) and C3 ($p = 0.019$). The analysis of stroke distribution for the area of ball bouncing demonstrated that A2 (lateral and near-to-the-net zone) was mainly reached ($p < 0.001$) by C1 compared with C3, C4, and C5. Moreover, C1 and C2 mostly reached ($p < 0.05$) A4 (lateral and near-to-the-net zone) compared with C4 and C5. A6 (central and far-from-the-net zone) was largely reached ($p < 0.05$) by C3, C4, and C5 compared with C1 and C2.

Conclusions: Several inter-class differences were found, specifically between the first and the fifth class. The current notational analysis provided a meaningful performance modelling of indicators for coaches and athletes that can be used to design training programs for each class.

Corrective adjustment procedures to mitigate the relative age effect in track and field

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Purpose: The Relative Age Effect (RAE) reflects potential (di)-advantages in talent identification and selection experienced by youth athletes during the early stages of their careers. Research underlined that the RAE's magnitude is moderate to high at national and international levels in track and field. This study investigates the effectiveness of corrective adjustment procedures (CAPs) in eliminating or mitigating the RAE in the Italian context.

Methods: Data on the 60-m sprint, high jump, triple jump, and pole vault of Italian youth national competitions were examined between 2005 and 2019. The study included male and female track and field athletes aged 11.01 to 19.99 years. Longitudinal quadratic trendline equations were calculated considering athletes' exact age and respective performance. Based on the longitudinal quadratic trendline, CAPs were applied. Thus, RAE distributions (Quartile 1–4) for "All sample", "Top 25%" and "Top 10%" of athletes were examined based on raw and corrected performance.

Results: All the quadratic models significantly fit the relationship between chronological age and performance. The variance explained by fitted models ranged between 0.89 to 0.84 for males and 0.80 to 0.74 for females. Analyzing the raw performance data, the RAE was evident, with sizes ranging from larger to small (range = 0.33–0.13) and medium-trivial effect sizes (range = 0.28–0.06) for males and females. Furthermore, the RAE was found to be modulated by the level of competition. Differently, following CAPS application, results generally identified a removal or reduction of RAEs.

Conclusions: Results suggested that CAPs method positively impacted mitigating/removing the RAE in the context of track and field. CAPs development and application in the context of track and field have the potential to help improve youth athlete participation experiences, particularly for later-born athletes. Potentially, CAPS may improve performance evaluation, identification of technically skilled performers, and sporting experiences, helping coaches with the evaluation and long-term talent identification of athletes.

Sex differences and performance equality in long distance cross-country skiing

Purpose: To evaluate sex differences in cross-country skiing (XCS) athletes with the same absolute or relative performance capacity in a long-distance race.

Methods: 8 female and 10 male participants in a 75 km XCS race (Marcialonga 2023) were tested for upper and lower-limb maximal isometric strength and monopodalic balance. The sub-maximal skiing capacity was evaluated during 4 to 5 5-min bouts while double poling on a flat snowy track with a portable metabolic chart. The actual skiing speed was measured using a GPS, and feedback was automatically provided to the skier every 3 s. This allowed them to keep the targeted speed, which was incremented by 1.5 km/h in each bout until the blood lactate exceeded 4 mMol/L. Cardio-metabolic parameters @2 and 4 mMol/L were extracted and gross efficiency calculated at 19 km/h. Maximal values were measured during a 4 min maximal skiing bout ending on a hilly terrain. Total training volume

until the race was requested. Female and male athletes were matched based on absolute (race time) and relative (respect to the winner) XCS performance. Sex differences were evaluated using a *Student T-test* for unpaired data.

Results: When matched for relative performance, a 20% lower race time was observed for females with no differences between sexes for total training volume, monopodalic balance, absolute and relative heart rate values @2 and 4 mMol/L (all $p < 0.05$). However, skiing speed, maximal strength, oxygen consumption and ventilation @2 and 4 mMol/L, as well as at maximal rates, were all higher for males. Considering absolute performance matching, no significant differences between sexes were found in monopodalic balance, cardiometabolic parameters and skiing speed @2 and 4 mMol/L and at maximal rates. Maximal strength was higher in males but females demonstrated superior skiing efficiency at submaximal absolute velocities.

Conclusions: Sex difference in long-distance XCS is even higher than the average gap existing in other sport (around 10%), because of the great reliance on upper-body muscles. Oxygen delivery and muscle strength were the main differences between sexes. On the other hand, at equal absolute performance, men and women showed similar performance capacity at relative and maximal level, with woman having to training more than twice as much as men. Better skiing efficiency in women maybe compensates for the superior strength capacity observed in men of equal absolute performance capacity.

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Effect of menstrual cycle phases on perceived exertion and well-being in elite women soccer players

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Purpose: Hormonal variation and symptoms linked to different menstrual cycle (MC) phases may influence perceived performance in professional women soccer players. However, results from previous studies analysing hormonal fluctuation on parameters related to internal and external load are controversial. Therefore, the aim of this study was to investigate the effect of different menstrual phases on perceived exertion (RPE) and well-being in professional women soccer players during official matches in the Italian first division.

Methods: Twenty-five female soccer players (Age: 23, 59 ± 4, 11; Height 1, 67 ± 0, 05 m; Weight: 62, 44 ± 4, 56 kg) were pooled according to four different MC phases: Menstrual Phase (days 1–7), Follicular Phase (days 8–12), Ovulatory Phase (days 13–15) and Luteal Phase (days 16–28). Recovery status, quality of sleep, stress, fatigue, and muscle soreness were recorded in the morning by using the Hooper Scale, whereas MC phase was self-reported by the players. RPE was recorded at the end of each match and data were normalized by duration of the game. Linear mixed model followed by the least significant difference was performed to analyse differences between the four MC phases for all the parameters collected.

Results: RPE reported the highest value in the luteal phase ($p < 0.05$). The highest stress value was found in the ovulation phase ($p < 0.05$), whereas the lowest fatigue value in the follicular phase ($p < 0.05$).

Conclusions: We may speculate that RPE variation was related to the high levels of progesterone and estradiol of the luteal phase. Moreover, the variation of fatigue and stress in follicular and ovulatory phases could depend on hormonal fluctuation and MC symptoms. This result may account for an important role of female sex steroid hormones on RPE and well-being in women soccer players.

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Handle with care: 3 km race mean speed in sub-elite middle distance runners with different profiles as estimator of maximal aerobic speed

Purpose: In running, the measurement of 3 km race speed (s3K) has been widely utilized for estimating maximal aerobic speed (MAS) (Haugen et al. 2022). However, such popular methodology doesn't account for the heterogeneity of middle-distance runners who use aerobic and anaerobic contributors in different ways over distance (Ferri et al. 2012). The purpose of this study was to compare the ecological performance (s3K) with the MAS, as well as runners competing over different distances.

Methods: 18 sub-elite middle distance male runners (22.7 ± 5.19 years, $V'O_2max$: 70.9 ± 5.55 mlO_2/min/kg) were enrolled. In the laboratory session, a ramp test was performed on a motorized treadmill; metabolic data were measured (CPET, Cosmed) to calculate MAS and the ramp peak velocity (V_{peak}). For the ecological test, all athletes ran 3 km race in an official competition with pacers. In addition, to compare different profile characteristics, two subgroups have been obtained: Group 1 competing in 800-1500 m (N = 8) and Group 2 in 3000-5000 m (N = 10). Linear correlations between parameters have been characterized by Pearson's coefficient (all runners analysis) and by Spearman's one (subgroup analysis).

Results: The average s3K, MAS and V_{peak} were 20.2 ± 0.70, 19.2 ± 0.71 and 20.6 ± 0.73 km/h, respectively. Such values were significantly different for all comparisons. s3K increased with MAS (N = 18; r = 0.634, p = 0.005). Regarding profiles, s3K was significantly higher if compared to MAS in both Group 1 (p = 0.0017) and Group 2 (p = 0.00078). Group 1 showed no correlation between s3K and MAS (r = 0.593, p = 0.59), while Group 2 exhibited a strong positive correlation (r = 0.712, p = 0.033). Furthermore, s3K increased with V_{peak} (r = 0.776, p = 0.000). As concerns profiles, Group 1 showed s3K was strongly correlated to V_{peak} (r = 0.771, p = 0.018), as well as Group 2 (r = 0.826, p = 0.008).

Conclusions: The entire sample of middle-distance runners highlight strong correlations among the ecological s3K and the measured laboratory speeds (MAS, V_{peak}); such correlations would be reduced by considering the different profile characteristics. Overall, prescription of workouts at MAS obtained by the 3 km race mean speed could lead to inaccuracies.

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When low is too low? Effects of the intensity of low-intensity training sessions in an 8-week training block in well-trained distance runners

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Purpose: To investigate the effects of three combinations of low-intensity training sessions in an 8-week training block in well-trained distance runners.
Methods: Twenty-one well-trained male runners were divided into three groups. Each group completed the same 8-week training interventions with a pyramidal training intensity distribution, differentiated only by the intensity of the low-intensity training sessions: 80–90% of first lactate threshold (LT_1) (LOW-LIT); 90–100% of LT_1 (HIGH-LIT); and a combination of 80–90% of LT_1 and 90–100% of LT_1 (MIX-LIT). The intensity of the low-intensity sessions were isolated manipulations of intensity of these specific sessions, while training load was kept constant. Participants were tested pre- and post-intervention for body mass, velocity at LT_1 and LT_2, 5-km running time trial, and 120-min constant load trial at LT_1 followed by a 5-km running time trial. In addition, perception of effort was monitored after each training sessions.
Results: There were significant group x time interactions for heart rate and blood lactate during the 120-min constant load trial at LT_1, Δ 5-km running time trial performance, and perception of effort during low- and high-intensity training sessions (all $P < 0.05$). Specifically, participants in the HIGH-LIT and MIX-LIT showed a lower drift in heart rate and blood lactate during the 120-min constant load trial at LT_1 and a lower decrease in 5-km running time trial performance after the 120-min constant load trial at LT_1, while LOW-LIT and MIX-LIT showed a lower perception of effort during low- and high-intensity training sessions. No significant group x time interactions were observed for the other physiological, performance and perceptual parameters.
Conclusions: Each intervention effectively improved endurance surrogates and performance in well-trained endurance runners. However, a combination of low-intensity training sessions at higher and lower intensity seems more beneficial to improve durability and keep lower the perception of effort during the training sessions.

Whole body vibration improves bone and muscle quality by modulating the expression of irisin and NOX4 in a murine model of aging

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Purpose: The aging process alters musculoskeletal health, causing a progressive impairment of bone microarchitecture and a significant increase in muscle atrophy. These structural alterations are associated with increased oxidative stress and altered expression of bone and muscle growth regulators. In this context, appropriately designed whole body vibration (WBV) protocols are known to significantly improve bone and muscle quality in 4-month-old young mice through increased expression of irisin, a myokine with osteoinductive power produced by skeletal muscle in response to exercise. In contrast, little is known about the effects of WBV on musculoskeletal tissue in old rodents, suggesting that further studies are needed to determine its efficacy in counteracting age-related loss of bone and muscle mass. Based on this evidence, the aim of this study was to investigate musculoskeletal adaptations to WBV in a mouse model of aging in terms of structural and metabolic changes.
Methods: Twenty-four-month-old mice were sacrificed after a three-week training with a WBV protocol characterized by three series of mechanical vibration of 2, 30 min, interspersed with a recovery period of 2, 30 min. Bone tissue samples were taken from the spine and muscle tissue from the quadriceps for histological and immunohistochemical analysis. A group of mice of equal age was maintained under sedentary conditions and sacrificed at the same time as the intervention group mice.
Results: Mice subjected to WBV were characterized by significantly better bone and muscle parameters than the corresponding sedentary mice. Particularly, vibratory training promoted an increase in bone volume and trabecular thickness, as well as a reduction in trabecular separation and an increase in muscle fibre diameter. Moreover, the expression of irisin was higher in the mice exposed to WBV, while the expression of NADPH Oxidase 4 (NOX4), which identifies oxidative stress, was reduced in the trained group compared to the control group.
Conclusions: An appropriate WBV protocol could be a viable alternative strategy to counter bone and muscle mass loss in the elderly by reducing oxidative stress and positively regulating myokines with osteoinductive power.

Time course of brain-derived neurotrophic factor release following acute exercise: a comparative study in young and middle-aged adults

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Purpose: Brain-Derived Neurotrophic Factor (BDNF) is a crucial neurotrophin involved in memory, learning and neural plasticity. Its levels can be significantly influenced by several exogenous stimuli such as physical exercise (PE)[1]. For this reason, the effect of PE on BDNF release has been previously studied in physiological and

pathological conditions[2,3]. This study aimed to evaluate the BDNF time course in two age groups of healthy males after an incremental exercise, as this comparison has not yet been made.

Methods: Twenty young adults (YA: 24.7 ± 3.6 yrs; percentage of fat mass (%FM): 11.1 ± 5.4%; peak oxygen uptake ($\dot{V}O_{2peak}$): 49.7 ± 9.9 ml/kg/min) and 12 middle-aged adults (MA: 54.6 ± 5.7 yrs; %FM: 16.7 ± 6.5%; $\dot{V}O_{2peak}$: 44.8 ± 5.1 ml/kg/min) were enrolled. Participants underwent a cycling ramp $\dot{V}O_{2max}$ test till exhaustion, while constantly measuring gas exchange using a metabolimeter. Peripheral blood samples were collected at baseline (T0), 15 min (T1), and 24 h (T2) after the exercise test. Serum BDNF (sBDNF) levels were measured using an ELISA kit. Wilcoxon signed rank and Mann Whitney U test were used to analyse the data. Results were considered significant when $p < 0.05$.

Results: sBDNF levels did not show significant changes from T0 to T1 for both YA and MA groups. Instead, a significant sBDNF increase was observed between T0 (YA T0: 13.3 ± 1.69 ng/ml and MA T0: 12.7 ± 0.9 ng/ml) and T2 for both groups (YA T2: 15.5 ± 3.5 ng/ml, $p < 0.001$; MA T2: 14.4 ± 3 ng/ml; $p < 0.05$). No statistical differences in sBDNF levels were found between groups in all time points, neither for absolute values nor for percentage changes.

Conclusions: Our study represents a pioneering investigation that explored the impact of age on sBDNF release following acute strenuous exercise within a substantial cohort of healthy males. We detected a significant increase of sBDNF at 24 h post-exercise both in YA and MA with no differences between the two groups. These findings confirm the importance of acute exercise to stimulate BDNF release also in MA people and emphasize the pivotal role of PE in promoting neurogenesis and plasticity across the entire lifespan.

Acknowledgments: We would like to thank YA (students of the Exercise and Sport Science degree course) and MA for their voluntary participation in the study.

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Physical activity impact on promoter-specific methylation of genes involved in the redox-status and disease progression: a preliminary study on breast cancer patients undergoing treatments

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Purpose: Breast cancer (BC) is estimated as the most diagnosed tumor among all cancer types and the first cancer-related death among women. Evidence indicates that oxidative stress, high levels of reactive oxygen species, is implicated in the pathogenesis of BC. In particular, high levels of ROS can induce damage to lipids, proteins, and DNA, which in turn leads to genetic mutations and genomic instability, thus contributing to carcinogenesis. Physical activity (PA) has emerged as an integrative therapy to improve cancer survival outcomes and patients' Quality of Life (QoL). Probably due to the PA capacity to counteract the negative effects of BC treatments on redox homeostasis; however, the exact biological mechanisms are not completely understood, as well as the effect of PA on DNA methylation during BC treatment. Here, we studied the effects of PA on DNA methylation in BC patients undergoing cancer-related treatment.

Methods: twenty newly diagnosed BC patients (40–60 years), were recruited after the surgery and before the beginning of treatments and were divided into a control group (CG, n = 10) undergoing usual care, and an exercise group (EG, n = 10), which additionally participated in a 16-weeks online PA program. Body composition, functional capacity (i.e. 6 min walking test), and QoL were evaluated before and after the protocol; as well as the promoter methylation of breast-cancer-related genes (BRCA1, RASSF1A and L3MBTL1) and antioxidant enzymes (SOD1/SOD2/catalase) using qMSP; the respective mRNA levels; and mRNA levels of methylation regulators (DNMT3A/DNMT3B/TET1) using RT-Qpcr.

Results: our preliminary data show that in CG, SOD1 methylation increased, which was accompanied by a decrease in SOD1 mRNA. In EG, both SOD2 and L3MBTL1 were significantly demethylated following exercise, accompanied by a significant increase in SOD2 and L3MBTL1 mRNA. Regarding methylation regulators, we found that mRNA levels of TET1 were significantly decreased within CG, with levels higher at EG POST, and DNMT3B mRNA significantly decreased within EG.

Conclusions: Our results show that PA can modify aberrant DNA methylation seen in BC, possibly impacting several signalling pathways/biological activities involved in tumour growth, metastasis, and inflammation, as well as moderating distress symptoms known to negatively affect BC patients. These findings underline the pivotal role of PA as coadjuvant therapy, alongside usual care in BC patients undergoing treatments.

Genetic influence on muscle injuries in top-level football players: a pilot study

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Purpose: Recently, genetic predisposition to injury has become a popular area of research and the association between a few Single Nucleotide Polymorphisms (SNPs) and the susceptibility to develop muscle injuries in football has been shown (1,2). This pilot study aimed to investigate the combined influence of common gene polymorphisms previously associated with muscle injuries in Italian football players.

Methods: Total of 64 Italian top-level football players (age 23.1 ± 5.5 years; height 179.3 ± 7.3 cm; weight 73.0 ± 7.9 kg) were genotyped for 4 gene polymorphisms (*ACE I/D rs 4341, ACTN-*

3 R/X rs 1, 815, 739, COL5A1 C/T rs 12, 722, MCT1 A/T rs1049434). Genomic DNA was extracted using a buccal swab, and genotyping was performed using a PCR method. Structural-mechanical injuries and functional muscle disorders were collected over 10 years (2009–2019).

Results: Logistic regression analyses showed a significant association of all four polymorphisms with muscle injury incidence ($P < 0.01$), while the *ACTN-3* and the *COL5A1* polymorphisms were significantly associated with the severity of injury ($P = 0.042$ and $P = 0.012$, respectively). Moreover, the mean total genotype score (TGS) was significantly higher in injured than in non-injured (control) football players (Injured: 57.5 ± 15.5 vs non-injured: 36.6 ± 13.7, t = 6.33, $P < 0.001$) and it was a strong predictor of muscle injury (OR = 2.93, 95%CI: 0.06 ± 0.18, $P > 0.001$).

Conclusions: These data suggest that the carriage of a high number of "protective" gene variants could influence the individual susceptibility to develop muscle injuries in football. Further studies are needed to confirm these findings in other professional football player cohorts.

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The difficult journey from bed to the gym: skeletal muscle anabolic response to activity and inactivity in patient with type 2 diabetes

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Purpose: Type 2 diabetes (T2DM) is considered a global pandemic and one of the major challenges to human health. T2DM is associated with an altered muscle protein metabolism and vascular dysfunctions, which may reduce the anabolic response especially in older adults. Short term period of inactivity, such as during a few days of hospitalization, impairs protein turnover and skeletal muscle anabolic response, leading to muscle atrophy and impairment. On the other hand, resistance exercise (RET) is known to restore muscle mass and quality in healthy older adults. The aim of this study was to explore the effect of short-term bed rest and 3 months of RET on muscle anabolism in a group of diabetic older adults.

Methods: 26 older adults with T2DM (age 59.0 ± 4.6 years; BMI 31.2 ± 4.1 kg/m^2; HbA1c 6.7 ± 0.9%) were recruited and randomized to 5 days of Bed Rest (N = 12) or 12 weeks of RET (N = 14). Muscle strength, muscle mass and muscle biopsies from vastus lateralis were obtained before and after the two interventions. Muscle protein synthesis (MPS) was assessed during a stable isotope infusion experiment wherein subjects ingested an essential amino acid (EAA) mixture to test their anabolic response.

Results: a significant treatment x time interaction was found in all variables considered ($p < 0.05$). Bed rest decreased leg lean mass by ~ 3% (approximately -0.44 kg; $p < 0.01$) and isometric quadriceps strength by ~ 17% ($p < 0.01$). Basal MPS decreased by ~ 24%, while the response to EAA decreased from 62% (pre-bed rest) to 20% (post-bed rest). On the contrary, 12 weeks of RET improved both basal MPS and the acute response to EAA, but not significantly, which can be translated to a slight increase in leg lean mass ~ 0.24 kg ($p < 0.05$) and strength ~ 5% ($p > 0.05$).

Conclusions: The results of this study suggest that bed rest in diabetic older adults significantly attenuate the EAA-induced increase in MPS, probably due to blunted activation of mTORC1 and amino acid transporters. More importantly, our data imply that 12 weeks of RET are not able to restore the decline in protein metabolism, muscle mass and strength occurring with only 5 days of complete inactivity.

Beta-Endorphin release in healthy males after acute physical exercise and its association with circulating BDNF

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Purpose: Growing evidence indicates that physical exercise (PE) is crucial for brain health, particularly for hippocampal neurogenesis [1]. Brain-derived neurotrophic factor (BDNF) appears to play a key role in this process. However, recent studies propose Beta-endorphin (BE) as an intriguing candidate for mediating exercise-induced increases in neurogenesis [2]. Until now, no study has analysed age-related differences in BE secretion and its association with BDNF after acute PE in humans. This study aimed to examine the exercise-induced changes in BE release in 34 healthy males divided into 2 age groups and to investigate potential correlations between BE and BDNF.

Methods: Twenty-two young adults (YA: age, 24.6 ± 3.5 yrs; BMI, 23.2 ± 2.3 kg/m^2; peak oxygen uptake ($\dot{V}O_{2peak}$), 49 ± 9.8 ml/kg/min) and 12 middle-aged adults (MA: age, 54.6 ± 5.7 yrs; BMI, 23.4 ± 2.2 kg/m^2; $\dot{V}O_{2peak}$, 44.8 ± 5.1 ml/kg/min) were enrolled. Participants completed a maximal graded cycling test and $\dot{V}O_2$ was measured breath-by-breath. Venuous blood samples were taken before the exercise (T0), 15 min (T1), and 24 h (T2) post-exercise. BE and BDNF levels in serum were detected by ELISA kit. Data were analyzed with Mann–Whitney test, Wilcoxon signed-rank test, and Spearman's correlation.

Results: We observed a significant increase in BE levels from T0 (YA: 176 ± 21.2 pg/ml; MA: 152.1 ± 21 pg/ml) to T1 (YA: 211.7 ± 30.8 pg/ml, $p < 0.001$; MA: 187.2 ± 33.5 pg/ml, $p < 0.01$), followed by a significant decrease from T1 to T2 (YA: 180.2 ± 23.7 pg/ml, $p < 0.001$; MA: 155.7 ± 23 pg/ml, $p < 0.01$). YA have shown higher BE levels than MA both at T0 ($p < 0.01$) and T2 ($p < 0.05$), however no significant differences between groups were observed at T1. (BDNF levels of YA and MA are reported in another abstract from our research group). The correlation analysis revealed a significant negative association between basal BE and BDNF levels at T2 only in YA group (*rho* = – 0.467, $p < 0.05$).

Conclusions: Despite the influence of chronological ageing on circulating BE levels, our results reveal that acute PE can promote an

immediate increase in BE levels in both YA and MA, with similar percentage changes. Moreover, these preliminary data suggest that PE might induce compensatory mechanisms for the production of molecular players involved in neurogenesis, showing higher levels of BDNF at 24 h post-exercise in YA with low basal levels of BE.

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Self-Evaluated performance of elite kickboxers in light of the multi-states theory

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Purpose: The multi-states (MuSt) theory was used in this study to examine the interplay between self-confidence, emotional arousal control, worry, concentration disruption, challenge and threat appraisals, psychobiosocial experiences, and self-evaluated performance in medalist kickboxers involved in the WAKO World Kickboxing Championship 2021.

Methods: The participants were 103 gold, silver, or bronze medalists (58 women and 45 men), aged 18–39 (M = 25.16 ± 4.54 years), who were contacted via email and social media and asked to fill an online survey three months after the event.

Results: According to the MuSt theory predictions, self-confidence and emotional arousal control were positively associated with challenge appraisal, functional psychobiosocial experiences, and self-evaluated performance. Worry and concentration disruption were positively associated with threat appraisal, and negatively related to functional psychobiosocial experiences. Concentration disruption was also negatively related to self-evaluated performance. Path analysis showed that self-confidence had a positive indirect effect on self-evaluated performance through challenge appraisal and psychobiosocial experiences. Worry and concentration disruption had negative indirect effects on self-evaluated performance through threat appraisal and psychobiosocial experiences. Emotional arousal control also had a positive indirect effect on self-evaluated performance via psychobiosocial experiences.

Conclusions: Findings suggest that athletes should be encouraged to use self-regulation strategies throughout their performance process. These strategies, such as self-talk, imagery, cognitive restructuring, mindfulness, and action-focused strategies, have been shown to be effective in helping athletes increase self-confidence, view competition as a challenge, experience functional emotions, regulate their actions, and manage competitive pressure.

Acknowledgments: We are grateful to Marco Roggio, Pierfranco Sanna, Massimo Casula and Michele Surian for reviewing the survey and sharing their technical and tactical knowledge on combat sports.

The relation among physical activity, intuitive exercise, and quality of life in women with endometriosis: an exploratory study

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Purpose: Endometriosis is a chronic condition that negatively impacts Quality of Life (QoL). Given the side effects of treatments for endometriosis, international guidelines have suggested focusing on physical activity and exercise as part of the therapeutic approach for this disorder (National Institute for Health and Care Excellence, 2017). The purpose of the study is to investigate differences in physical activity and intuitive exercise (i.e., listening to physical cues instead of forcing oneself to follow rigid exercise routines) in women with endometriosis compared to women without chronic conditions. Furthermore, we aimed at investigating the relation among physical activity, intuitive exercise, and QoL in women with endometriosis.

Methods: Thirty-six women with endometriosis (months from diagnosis: M = 87.33, SD = 85.02) and 36 women without chronic conditions took part in the study and completed self-report questionnaires assessing physical activity (International Physical Activity Questionnaire-Short Form, IPAQ-SF) and intuitive exercise (Intuitive Exercise Scale, IEXS). Participants with endometriosis also completed two self-report questionnaires assessing QoL (Short Form-12, SF-12 and Endometriosis Health Profile-30, EPH-30).

Results: Women with endometriosis scored lower on IPAQ-SF (i.e., total MET/week) than women without chronic conditions ($t_{(70)} = 2.73$; $p = 0.01$; women with endometriosis: M = 1870.08, SD = 1941.70; women without chronic conditions: M = 2991.23, SD = 1522.08). With respect to IEXS, no differences among groups emerged (all $ps > 0.05$). In women with endometriosis, the SF-12 mental health score positively correlated with the IPAQ-SF (i.e., total MET/week) ($r = 0.35$; $p = 0.04$), while the SF-12 physical health score positively correlated with the emotional exercise scale of the IEXS ($r = 0.19$; $p = 0.01$). Lastly, the EPH-30 pain dimension (i.e., better QoL in terms of pain) positively correlated with the mindful exercise scale of the IEXS ($r = 0.28$; $p < 0.001$).

Conclusions: Results of our study suggest that women with endometriosis engage in lower levels of physical activity than women without chronic conditions, probably due to the symptoms that characterize this condition. Furthermore, our results suggest that the practice of physical activity has beneficial effects on psychological wellbeing of women with endometriosis. Moreover, listening to physical cues to determine when to exercise may positively impact physical dimensions of QoL in women with endometriosis.

Psychological characteristics of martial arts practitioners: an Italian cross-sectional study

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Purpose: Psychological characteristics (e.g., personality, temper) represent a category of elements that influence a person's thoughts and behaviours. They are influenced by hereditary factors, personal experiences and environmental factors.
Based on the current studies in the literature, martial arts practice (e.g., Judo, Karate, Boxe) is often associated with psychological benefits other than physical, but evidence exploring the psychological characteristics of practitioners is still unclear.

In line with this, this study explores the psychological characteristics of adults that practice martial arts to understand if there is a pattern.
Methods: An anonymous web-survey is currently being disseminated on the Italian territory among adults practicing martial arts using Microsoft Forms. The web-survey, constructed by validated questionnaires, is structured into 4 sections: I) Demographic, II) Personality Traits, III) Anxiety and Depression, IV) Stress. The demographic section investigates socio-demographic and martial arts-related data. The second one explores personality traits (i.e., openness, conscientiousness, extroversion, agreeableness, neuroticism) using the Big-Five Inventory 44 questions. The third section investigates anxiety and depression using the Hospital Anxiety and Depression Scale. The last section explores stress using the Perceived Stress Scale.
Results: Preliminary results collected from 88 participants (75% men) who practiced martial arts for 20, 5 ± 17, 3 years, show that the mean age of the total sample was 37, 5 ± 15, 1 years old and the most practiced martial art was Judo (29, 5%), followed by Jujitsu (18, 2%) and Karate (11, 4%). Considering personality traits, the results of each domain were as follows: extroversion 27, 7 ± 5, 57, agreeableness 34, 75 ± 4, 96, conscientiousness 35, 11 ± 5, 24, neuroticism 21, 06 ± 5, 14, openness 38, 35 ± 6, 2. Anxiety and depression resulted in normal ranges, scoring respectively 6, 74 ± 3, 26 and 4, 14 ± 2, 9. The mean stress level resulted in 19, 3 ± 3, 20 which is considered moderate.
Conclusions: Martial arts practitioners seemed to have a tendency toward openness, conscientiousness and agreeableness, probably due to the need to train with a partner. Moreover, participants scored normal levels of anxiety and depression perhaps linked to the constant practice that requires discipline and consistency. Future studies may explore if martial arts are able of increasing these parameters traits in populations with low levels of the abovementioned traits. Finally, the practitioners had moderate stress levels. It might be supposed that is probably related to the practice experience or to the time since the beginning of their practice. These hypotheses will be further investigated.

Ethics for sport: promoting a positive development in sport through a managerial approach

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Purpose: Ethics in sport has been recognized as a fundamental pillar of the Olympic movement as stated by the Olympic Charter (2021). Indeed, one of the fundamental principles of the Olympism, defined as a "philosophy of life, exalting and combining in a balanced whole the qualities of body, will and mind", is to blend sport with culture and education. In this sense, Olympism seeks to create a way of life based on the joy of effort, the educational value of good example, social responsibility, and respect for universal fundamental ethical principles. The purpose of this oral presentation is to present the 'Ethics for Sport' modular training project, some recommendations and tools that can be implemented in youth sport and physical education (PE) contexts to promote an ethical sport education.
Methods: The modular training project named 'Ethics for Sport' examined the very nature of sport, sports coaching, and sports leadership using the academic disciplines of ethics applied to sport (Hardman & Jones, 2011). This initiative bring a depth of sport-specific experience and understanding to bear on these topics for coaches, PE teachers, and sport managers in particular. It defined a methodological guide aimed at raising awareness on promoting an ethical sport education and developing specific didactic, organizational, and managerial ethical skills.
Results: Didactic recommendations to create a mastery (task-involving) motivational climate in youth sport and PE, interactive, and inclusive didactic, and managerial methodologies, and safeguarding coaching and leadership ethical principles in sport are some of the key elements of the modular training project. In addition, some evaluation and assessment tools (i.e., sport chart, logbooks, cooperative games, and videos) are also presented.
Conclusions: The main aim of the 'Ethics for Sport' project was to develop teaching and managerial ethical methodologies, skills, and tools focused at preventing violence in youth sport and PE. Future research is needed to implement the modular training model and to test it, evaluating its efficacy, expanding its aims, and adapting it to specific contexts and countries.
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Exploring mental health perception and physical activity engagement in people with intellectual disabilities: a gender and age analysis

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Purpose: To examine the influence of gender and age on the perception of mental health symptoms among individuals with intellectual disabilities, as well as the impact of sport participation on their mental wellbeing.
Methods: The study involved 99 individuals (65 males, 34 females) with intellectual disabilities, recruited from sport federations and recreational associations. Perceived levels of anxiety and depression were assessed using the Zung Anxiety and Depression Scale (SAS/SDS). The participants' sport activities, including intensity, frequency, and types, were evaluated using the International Physical Activity Questionnaire (IPAQ) and reported as MET/hour/week. Statistical analysis was conducted to explore associations between mental health perception, sport participation, and wellbeing.
Results: Analysis of the IPAQ data revealed that the 78% of the study population was engaged in sufficiently/very good levels of physical activity. According to SAS/SDS, 16% of the individuals scored above the cut-off for anxiety, and the 26% scored above the cut-off for depression. A gender comparison showed that males engaged in more intense physical activity ($P = 0.023$) and reported lower levels of anxiety and depression ($P = 0.002$) than females. When dividing the sample by age (≤ 30 and > 30), there were no gender differences in mental health feelings for the younger group. However, among those over 30 years old, females exhibited higher levels of anxiety and depression than males, despite no differences in the amount of physical activity achieved. Significant relationships were found between the amount of physical activity and anxiety and

depression scores in the overall population (R = 0.35, P = 0.0003), as well as in males (R = 0.26, P = 0.04) and females (R = 0.52, P = 0.002) separately.

Conclusion: This study found an inverse relationship between physical activity and mental health perception in people with intellectual impairments, with higher levels of physical activity related with lower levels of anxiety and depression. Furthermore, gender and age differences in mental health perception outcomes have been observed. Further research with a larger sample size is recommended to gain a better understanding of the impact of physical activity and to determine an optimal minimum exercise dose for preventing and managing anxiety and depressive symptoms in individuals with intellectual disabilities.

Satisfaction of basic psychological needs and self-regulatory modes predict resilient recovery in long distance runners

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Purpose: Exploring if endurance runner's resilience (adopting Richardson's model that articulates it through Resilient recovery, Homeostatic recovery and Dysfunctional recovery) was related to the gratification of the Basic Psychological Needs, as illustrated in the Self-determination Theory, furthermore identifying in this relationship the mediational role of Regulatory Modes of the Self.

Methods: The Resilience Process Questionnaire (RPQ), the Self-Regulatory-Modes Scale (SRM) and the Basic Psychological Need Satisfaction and Frustration Scale (BPN) were administered to a sample of 330 long-distance runners, members of Fidal (Italian Athletics Federation).

Results: A simple mediation analysis indicated that Relatedness was indirectly associated to Resilient Recovery through its relationship with Locomotion. Relatedness had a positive effect on the Locomotion (a = 0.320, p = 0.000), and higher reported Locomotion was subsequent related to more Resilient Recovery (b = 0.566, p = 0.000). Higher levels of Relatedness corresponded to higher Resilient Recovery even after taking into account Relatedness' indirect effect through Locomotion (c' = 0.308, p = 0.038). Competence was indirectly related to Homeostatic Recovery through its relationship with Locomotion. Competence had a positive effect on the Locomotion (a = 0.443, p = 0.000), and higher reported locomotion was subsequent related to more Homeostatic Recovery (b = 0.296, p = 0.000). Higher levels of Competence corresponded to higher Homeostatic Recovery even after taking into account Competence's indirect effect through Locomotion (c' = 0.289, p = 0.000). Autonomy was indirectly related to Dysfunctional Recovery through its relationship with Assessment. Autonomy had a negative effect on the Assessment (a = – 0.405, p = 0.000), and higher reported Assessment was subsequent related to more Dysfunctional Recovery (b = 0.263, p = 0.004). Higher levels of Autonomy corresponded to lower Dysfunctional Recovery even after taking into account Autonomy's indirect effect through Assessment (c' = – 0.224, p = 0.000).

Conclusions: The study showed that BPNs and SRMs are predictors of the resilience level of running athletes. SRM in particular plays a mediating role between BPNs and Resilience. The adoption of Richardson's (2002) multidimensional model of Resilience allowed to differentiate three mediating structures for the three recovery factors of the model (Resilient Recovery, Homeostatic Recovery, Dysfunctional Recovery). In the first case, Locomotion mediates the effect of Relationality Gratification on Resilient Recovery; in the second case, Locomotion mediates the effect of Competence Need on Homeostatic Recovery; finally, Assessment mediates the effect of Autonomy Frustration on Dysfunctional Recovery.

Assessing upper limb dexterity abilities using imu sensors: towards automated evaluation and consistency in motor performance

Purpose: Wearable sensors have emerged as essential instruments within the sports industry, serving as vital resources for evaluating motor gesture characteristics and diagnosing movement-related ailments in healthcare environments. In recent years, inertial devices have become increasingly recognized as dependable for evaluating an individual's motor abilities. Utilizing these devices eliminates the potential errors that may arise from human operators, thereby providing an automated assessment methodology characterized by accuracy and reproducibility. This study presents a novel methodology for evaluating upper limb dexterity abilities using IMU sensors for data processing. This study aimed to examine the achievement of consistency in performance through the different moments of muscle activation due to the repetition of tests. The sample included 20 college students, aged 23 to 30, using a standard upper limb tapping test.

Methods: A modified version of the standard test was used in this study, in which participants were instructed to perform the test 20 times. Each repetition had a duration of 30 s. This approach facilitated a more comprehensive analysis of the test results under a wider range of conditions. In the present study, IMU sensors were used as a valuable tool to discern limb movement and generate objective measurements during the examination. The IMU was placed on the index finger of the participant's dominant hand. Raw data from the sensor were acquired by automated software running on a tablet device wirelessly connected to the sensor. In addition, a preexisting and validated algorithm was employed to evaluate the collected data and provide insights into the test outcome during post-processing.

Results: Participants performed constancy between the eighth and eleventh trials out of 20. We hypothesized that this phenomenon might be attributable to each subject's efficiency in reaching the ideal temperature for activating the viscoelastic system, enabling them to achieve and maintain constancy in performance. The viscoelastic system is a mechanical feature of biological tissues, such as muscles and tendons, that allows them to absorb and release energy during movement. This system can help provide stability and resistance to stress during physical activity.

Conclusions: The study proposed a novel processing stage approach to asses coordinative abilities, which could provide comprehensive data to characterize motor function. Further research on these devices could improve understanding of the transmission of proprioceptive information within the central motor system. In addition, these devices could also be used to evaluate motor disorders in neurodegenerative diseases or to assess the effectiveness of motor therapies.

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Barriers and facilitators to the use of exoskeleton technology in people with spinal cord injury: a systematic review

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Purpose: Exoskeleton technology holds great potential for transforming the lives of individuals with spinal cord injuries by enhancing their strength and mobility. These wearable devices can assist with movements such as walking, standing, and lifting, and can be customized to meet individual needs. However, the current utilization of wearable exoskeletons outside of rehabilitation contexts is limited. To enhance interventions and promote the widespread adoption of exoskeletons, it is crucial to consider the acceptance of these devices for both rehabilitation and functional purposes. This systematic review aims to identify the barriers or facilitators of exoskeleton use among individuals with spinal cord injuries, thereby providing strategies to improve interventions and increase the adoption of these devices.
Methods: A comprehensive search was conducted in multiple databases, including EMBASE, Web of Science, Scopus, Cochrane, PubMed, and Grey literature. Qualitative and quantitative studies reporting barriers and facilitators of exoskeleton use from the perspectives of patients, healthcare professionals, and caregivers were included. Two reviewers independently screened, extracted data, and assessed study quality using the Mixed Methods Appraisal Tool and undertook a thematic content analysis for papers examining the barriers and facilitators, categorized through the socio-ecological model.
Results: Fifteen articles met the inclusion criteria, involving a total of 480 spinal cord injuries patients and 197 healthcare professionals. The study revealed various factors that impact the utilization of exoskeletons. Factors such as age, engagement in an active lifestyle, and motivation were identified as facilitators, while fear of falling and unfulfilled expectations were recognized as barriers. Physical aspects, such as fatigue, neuropathic discomfort, and specific health conditions, were found to be barriers.
Conclusions: This systematic review provides a comprehensive overview of the barriers and facilitators to the use of exoskeleton technology. There are therefore still challenges to be faced, efforts must be made to improve its design, functionality, and accessibility. By addressing these barriers, exoskeletons can significantly improve the quality of life of people with SCI.

Sport tourism event management. The running road race to boost tourism: the naples city half marathon

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Purpose: The purpose of this research is to analyze the impact of sports events on the territory and in particular the effects on tourism, image and the level of national and international knowledge of the territory where the event is organized and their event management. References on the topic report that this events, attracting a lot of stakeholders, they can become catalysts to improve the image of the host city and charge its economic, socio-cultural and political development. Hosting sporting events can promote tourism beyond the event itself and that smaller events can have a greater positive effect on residents' psychic income, as more community residents are likely to be involved in the event in some way.

The research focused on the analysis of marathons and half marathons in Italy and in particular the Naples City Half Marathon which represents the most attended running sporting event. Through it we want to verify what is theorised in the literature.
Methods: We have analyzed how the events have evolved over time in the four successive editions (years 2019–2023). Through an interview with the organizers and based on the data on the various editions they provided, we estimated the economic and touristic impact. The economic impact calculation method was used to assess the economic impact, v.o.s 2018.
Results: Analysis of the number of registered runners shows a steady growth of foreign runners (from 11% 2019 to 31% in 2023) and also those from outside Campania Region (from 54% in 2019 to 80% in 2023) showing an increase in the attractiveness of this event over the years. Number of nationalities present increased from 53 to 70 (2020). About 70% of the runners are in the age group of 36 to 55 years old which has a higher propensity to spend and about 20% between 18 and 35 years old. Approximately constant 75% male runners. The economic impact analysis of the 2023 edition was carried out assuming an average expenditure per person of €90 for Italian runners and accompanying persons (n.10169) and €340 for foreign runners (n.4011) resulting in a total direct economic impact (direct expenditure) of €2.28MM. The indirect economic impact (multiplier effect) was estimated at about €1.1MM.
Conclusions: The promotion of touristic image of the territory and positive economic impact attributable to the event is demonstrated by the steady increase in the number of foreign runners and from outside the Campania Region confirming the effective event management implemented by the organizers.

Competencies and skills for career advancement in sports organizations: the New Miracle Project outcomes

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Purpose: The European project New Miracle aims to offer a tailored, competence-based, training programme to facilitate the career progression of young women sports managers and to foster gender equality in their career advancements (European Commission, 2022; International Olympic Committee, 2023).
Methods: Based on two literature reviews (Guidotti et al., 2023a, 2023b), a comprehensive, updated, and evidence-based, sport management competency framework has been developed, encompassing 71 items representing foundational knowledge, competencies, and skills relevant to entry, middle and senior managerial positions within

the sport industry. To validate the framework, 24 European women sport managers participated in two focus groups through a clustering and a sorting stage, also in relation to the three main managerial levels (i.e., Entry, Middle, Senior). Then, to guide the implementation of their training programme, 36 participants rated their perceived relevance, level of possess, and need for training of the identified skills (Guidotti et al., 2023c).

Results: The clustering and the sorting stages of the framework showed a good validity and internal consistency. Whilst several items resulted transversal among different managerial levels, specific needs emerged for the Entry, Middle, and Senior managers. Then, participants reported a perceived a lack of possess of several items, especially belonging to the technical and knowledge spheres.

Conclusions: The New Miracle project provided sustainable long- and short-term outcomes, with the competency framework to be considered a valuable tool for the implementation and adjustment of sport management educational curricula in different settings.

Acknowledgments: The authors thank the Lithuanian, Italian, Latvian, and Slovakian Olympic Committees, partners of the Erasmus + New Miracle project (622, 391-EPP-1–2020-1-LT-SPO-SCP).

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The evolution of membership constraint in Italy: implications, contradictions, and prospects for amateur sports system and inclusion of minor foreigners

Purpose: In Italy, the sporting institution of membership constraint to a single sports club has long been a subject of problems and proposals. This study aims to analyze its evolution, implications, and recent contradictions, with particular focus on its application to amateur athletes and potential obstacles in enrolling minor foreigners. It also seeks to explore the potential contradiction between the pursuit of social and educational value in sports activities and the necessity of applying the membership constraint as a possible source of income for sports associations and as a cornerstone of talent development.

Methods: The research methodology is based on the analysis of Italian regulations regarding membership constraint, the study of European laws seeking to harmonize sports regulations among member countries, and the evaluation of legal, social, and economic implications of abolishing the membership constraint.

Results: It emerged that the membership constraint, without a specific time limit, has led to political and legal disputes. Although the recent reform abolished the membership constraint even for amateur athletes, exemptions were introduced to accommodate protests from sports clubs regarding youth academies and potential financial losses resulting from the transfer of athletes' membership rights, and therefore, it was recently reintroduced.

Conclusions: The study highlights the complexity and contradictions within the Italian sports system regarding membership constraints. The introduced exceptions have created uncertainty and raised doubts about its compatibility with the principle of freedom of association, particularly concerning minor foreigners and the promotion of social and educational value of sports. To promote sustainable and inclusive sports development in Italy, it is necessary to find an appropriate balance between ensuring financial resources for sports associations and preserving accessibility, especially for minor foreigners, while actively pursuing inclusion in sports as an educational and social tool. Investigating the impact of legislative uncertainty and measuring and evaluating the educational and social role of sports clubs in achieving these objectives in the presence of the sporting constraint could be further explored.

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Acute passive stretching-induced decrease in joint and arterial stiffness: does a correlation exist?

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Purpose: An acute bout of passive stretching could decrease both joint passive stiffness and arterial stiffness of the stretched muscle, via neural and/or mechanical mechanisms caused by alternating phases of tissue elongation and relaxation. However, whether these responses to passive stretching may be correlated is still unknown. The present study aims to verify whether the decrease in joint passive stiffness is correlated with the reduction in arterial stiffness induced by passive stretching and to assess possible responsible mechanisms.

Methods: The joint passive stiffness of the plantar flexor muscles (slope of the passive tension/ankle angle curve) and the popliteal artery stiffness (via tonometry approach and subsequent pulse-wave velocity calculation) were determined in 30 healthy men (age: 24 ± 2 years, stature: 1.78 ± 0.07 m, body mass: 77 ± 6 kg) before and after an acute bout of passive stretching of the plantar flexor muscles [5 ξ (45-s stretch and 15-s rest)]. Popliteal artery blood flow and central hemodynamic variables were calculated during stretching administration.

Results: After passive stretching, joint and popliteal artery stiffness decreased by 17% ($P < 0.001$) and 7% ($P < 0.001$) respectively. Popliteal artery blood flow increased during the last two elongations ($P = 0.005$). No changes in central hemodynamics occurred. No correlation between the stretch-induced decrease in joint and arterial stiffness was found ($R = 0.28$, $P > 0.05$).

Conclusions: The lack of correlation suggests that passive lengthening triggers different mechanisms responsible for mechanical properties alterations in joint and arterial stiffness.

Acknowledgments: The authors would like to thank all the participants for their kind commitment. The study was supported by thePSR2021_CE_EMILIANO.

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Fiber-Type composition and sensitivity of mitochondrial respiration to submaximal [ADP]: two sides of the same coin

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Purpose: We recently demonstrated that a 10-day exposure to inactivity/microgravity (bed rest, BR) determined impairments of peak oxygen uptake and microvascular/endothelial functions, whereas maximal ADP-stimulated mitochondrial respiration ($JO_{2\text{-}max}$) ex vivo was unaffected. Aim of the study was to evaluate mitochondrial sensitivity to submaximal [ADP] by a new approach aimed at identifying different mitochondrial populations.
Methods: Isolated permeabilized *vastus lateralis* fibers were analyzed by high-resolution respirometry in 9 young males before and after a 10-day BR. We applied to JO_2 *vs.* [ADP] a traditional Michaelis–Menten kinetics equation, and calculated the apparent K_m and maximal respiration (V_{max}), and two "sequential" hyperbolic equations, yielding two K_m and V_{max} values. Isoform expression of myosin heavy chains (MyHC) 1,2A and 2X was determined.
Results: The two hyperbolic equations improved the fitting and identified two distinct phases of JO_2 *vs.* [ADP]: a first phase with low V_{max} (28 ± 10 pmol/s/mg) and apparent K_m (62 ± 54 μM), and a second phase with high V_{max}(61 ± 16 pmol/s/mg) and K_m (1784 ± 833 μM). [ADP] at 50% JO_{2max} showed a trend to decrease after BR, suggesting a greater sensitivity of mitochondrial respiration to submaximal [ADP]. Correlation and receiver operating characteristics analyses suggest that the two mitochondrial populations, responsible for the two phases of JO_2 vs. [ADP], were related to the % of MyHC isoforms.
Conclusions: The new approach identified two distinct phases of JO2 vs. [ADP], associated with the % of MyHC isoforms, and presumably related to two different mitochondrial populations.
Acknowledgments: Funding: Italian Space Agency (ASI, MARS-PRE Project, Grant No. DC-VUM-2017–006); Ministero dell'Istruzione dell'Università e della Ricerca, PRIN Projects 2017CBF8NJ, 20178S4EK9, 2020EM9A8X; WP6, Project ALT FRAILTY, Active Ageing UNIUD.

Effect of pedaling cadences on the agreement between critical power and respiratory compensation point

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Purpose: Although critical power (CP) and respiratory compensation point (RCP) have been demonstrated to occur, in terms of oxygen uptake (VO_2), at the same metabolic intensity[1], their equivalence has been questioned[2]. The main aim of this study was to investigate whether and how different pedal cadences (60 vs 100 rpm) affect the agreement between CP and RCP, in terms of both VO_2 and power output (PO).
Methods: Fourteen (7 females) healthy adults (23 ± 2 yrs) performed, on a cycle ergometer at both 60 and 100 rpm: *i)* a "step-ramp-step" exercise protocol[3] to identify the VO_2 and PO corresponding to RCP; *ii)* 4–5 constant power output trials for CP identification; and *iii)* a 30-min bout of constant-load exercise at CP to determine the corresponding VO_2. The agreements between the PO and VO_2 associated with CP and RCP within (i.e., CP vs. RCP at 60 and 100 rpm) and between (i.e., 60 vs. 100 rpm at CP and RCP) cadence-specific conditions were evaluated using Bland–Altman (BA) analyses, Lin's concordance correlation coefficient (CCC), and root mean squared error (RMSE).
Results: BA's VO_2 biases, expressed in $mL \cdot min^{-1}$, between CP and RCP (mean [95% limits of agreement]) were -1.6 [-304.2; 301.1] (CCC = 0.977; RMSE = 154.4 $mL \cdot min^{-1}$) at 60 rpm, and 120.9 [-269.3; 511.0] (CCC = 0.950; RMSE = 232.9 $mL \cdot min^{-1}$) at 100 rpm, while between 60 and 100 rpm BA's biases were -138.1 [-445.0; 168.7] (CCC = 0.961; RMSE = 208.8 $mL \cdot min^{-1}$) at CP and -15.7 [-192.7; 161.2] (CCC = 0.992; RMSE = 91.6 $mL \cdot min^{-1}$) at RCP.
BA's PO biases, expressed in W, between CP and RCP were 7.0 [-14, 7; 28.7] (CCC = 0.974; RMSE = 13.1 W) at 60 rpm, and 9.4 [-14.2; 33.0] (CCC = 0.969; RMSE = 15.3 W) at 100 rpm, while between 60 and 100 rpm BA's biases were 11.7 [-6.9; 30.3] (CCC = 0.968; RMSE = 15.1 W) at CP and 14.1 [-4.1; 32.4] (CCC = 0.960; RMSE = 16.9 W) at RCP.
Conclusions: The results confirm that: *i)* Either expressed in terms of VO_2 or PO, CP and RCP are in close agreement within the same cadence; *ii)* CP and RCP, when expressed in terms of PO, represent cadence-specific parameters. These results suggest that, when estimating CP and RCP, considering the difference existing between cadences in terms of PO is of paramount importance.
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Cardiorespiratory responses to sinusoidal exercise below and across critical power: energy balance and fatigue

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Purpose: Sinusoidal exercise was partially investigated, without considering its energetics and the effects of fatigue. This study aimed to compare the cardiorespiratory and metabolic responses, assess the contribution of aerobic and anaerobic lactic metabolism to the energy balance, and determine the fatigue effects, in sinusoidal protocols, across and below critical power (CP).
Methods: Eight participants (males, 26.6 ± 6.2 yrs.; 75.6 ± 8.7 kg; maximum oxygen uptake 52.8 ± 7.9 ml•min^{-1}•kg^{-1}; CP 218 ± 13 W) underwent exhausting sinusoidal cycloergometric exercises, with sine midpoint (MP) at CP (CP_{ex}) and 50 W below CP ($CP\text{-}50_{ex}$). Sine amplitude (AMP) and period were 50 W and 4 min, respectively. MP, AMP and time-delay (t_D) between mechanical and metabolic signals of expiratory ventilation (V'E), oxygen uptake ($V'O_2$) and heart rate (f_H) were assessed sine-by-sine. Blood lactate ([La^-]) and rate of perceived exertion (RPE) were determined at each sine.
Results: V'E, $V'O_2$, and f_H MP were higher in CP_{ex} than $CP\text{-}50_{ex}$. $V'O_2$ AMP was 304 ± 11 and 488 ± 36 ml•min^{-1} in CP_{ex} and $CP\text{-}50_{ex}$, respectively. Asymmetries between rising and declining sine phases were observed in CP_{ex}, with unchanged t_Ds. $V'O_2$ MP and RPE increased progressively during CP_{ex}. [La^-] increased by 2.1 mM in CP_{ex} but remained stable during $CP\text{-}50_{ex}$. Anaerobic contribution was larger in CP_{ex} than $CP\text{-}50_{ex}$.
Conclusions: This study represents the first analysis of the energetic aspects of sinusoidal exercise across and below CP. The reduced aerobic component during CP_{ex} than $CP\text{-}50_{ex}$ associated with lactate accumulation explained lower $V'O_2$ AMP in CP_{ex}. The asymmetries in CP_{ex} suggest progressive decline of muscle phosphocreatine concentration, leading to fatigueas indicated by RPE.
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Body composition and ultrasound measurements as valuable tools to maximize the recruitment of participants with relevant number of identifiable motor units during submaximal strength test

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Purpose: High-density surface EMG (HDsEMG) provides valuable information about motor units (MUs) properties and their adaptability non-invasively. However, great intersubject variability in identification of MUs exists due to anatomical constraints of the muscle, individual volume conductor properties and the contraction intensity[1]. A recent study[2] showed that greater muscle-electrode distance (MED) negatively influences EMG signal decomposition outcome, at low force levels only. Here we investigated the influence of body composition and anatomical features on the extraction of MUs number in vastus lateralis (VL) during voluntary contractions.
Methods: Thirty-eight healthy male subjects (age 23.8 ± 3 yr) took part in this study. Participants performed submaximal isometric knee extensions at 15, 35, 50, and 70% of maximal voluntary contraction. Concurrently, HDs-EMG was used to record right leg (RL) VL muscle activity. EMG signals were decomposed, and the MUs number was extracted. Body composition was assessed with BIA and DXA scan. Ultrasonography (US) was used to determine MED. Correlations and regressions analyses between average MUs number and all body composition features were assessed.
Results: A total of 1082 MUs were identified from VL (average 28 MUs/subject). Negative correlations were found between MUs number and Fat Mass (FM) estimated by BIA (15%: $p < 0.001$, $r = -0.58$; 35%: $p = 0.002$, $r = -0.48$) and DXA (15%: $p = 0.021$, $r = -0.37$; 35%: $p = 0.017$, $r = -0.38$), RL FM measured by DXA (15%: $p = 0.001$, $r = 0.51$; 35%: $p < 0.001$, $r = 0.60$; 50%: $p = 0.047$, $r = -0.33$), and MED (15%: $p < 0.001$, $r = -0.69$; 35%: $p < 0.001$, $r = -0.68$; 50%: $p < 0.001$, $r = 0.59$). At 70% MVC, MUs number negatively correlated with MED ($p = 0.002$, $r = -0.48$) only. None of the main anthropometrical features (i.e., BMI) correlated with MUs number. Multiple regression between MUs number, MED and FM_{BIA} explained 58% ($p < 0.001$) and 50% ($p < 0.001$) of the variance in the MUs number at 15% and 30% MVC, respectively.
Conclusions: Our results revealed the possibility to partly predict the quality of HDsEMG decomposition, i.e., number of identified MUs/subject. In particular, the current analysis confirmed that having higher levels of body and localized fat mass, assessed with BIA or DXA, decreases the number of detectable MUs. Overall, we showed that the single most predictive parameter for MUs number is the MED, therefore its quantification through US may be recommended prior to HDsEMG recording.
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No effects of different doses of L-citrulline supplementation on exercise tolerance and related physiological responses in healthy adults

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Purpose: Dietary supplementation with L-citrulline (*Cit*), a non-protein amino acid co-produced with nitric oxide, might increase plasma L-arginine (*Arg*) concentration, reduce blood pressure, and improve exercise tolerance in humans. However, since exercise-performance studies have administered doses of *Cit* > 6 g, it is presently unknown whether a greater dose of *Cit* might further affect physiological responses to exercise and performance in healthy adults. Thepurpose of this study, therefore, was to test the hypothesis that, compared with placebo (*Pla*), different doses of *Cit* supplementation would increase plasma *Arg* concentration and availability, reduce blood pressure, and enhance exercise performance in a dose-dependent manner.
Methods: Nine healthy, moderately trained men participated in this randomized, double-blind, crossover study. On three separate occasions, they completed a ramp incremental exercise test to volitional exhaustion on an electromagnetically braked cycle ergometer to

determine peak oxygen uptake (V̇O2peak), peak power output (Wpeak), and time to exhaustion (TTE). All tests were performed 90 min after the oral ingestion of pure *Cit* (6 g or 12 g) or *Pla,* with a 7 d washout period in-between. While plasma *Arg* concentration and availability and systolic (SBP) and diastolic (DBP) blood pressures were assessed baseline, pulmonary ventilation and gas exchange, and muscle oxygenation and hemodynamics were collected throughout the ramp exercise test.

Results: Plasma *Arg* concentration ($P < 0.01$), but not plasma *Arg* availability ($P > 0.05$), increased in a dose-dependent manner following ingestion of *Cit*. However, changes in both plasma *Arg* concentration and plasma *Arg* availability following *Cit* supplementation were significantly correlated with changes in SBP ($r = -0.54$ and $r = -0.53$, respectively; $P < 0.01$) but not DBP ($P > 0.05$). TTE (*Pla:* 856 ± 17, *Cit6:* 847 ± 16, *Cit12:* 856 ± 21 s), Wpeak (*Pla:* 313 ± 10, *Cit6:* 312 ± 10, *Cit12:* 316 ± 14W), V̇O2peak (*Pla:* 49.6 ± 2.6, *Cit6:* 49.2 ± 4.1, and *Cit12:* 50.1 ± 3.2 mLO2/kg/min, and all related physiological responses did not differ between the experimental groups ($P > 0.05$).

Conclusion: These results indicate that whereas plasma *Arg* concentration and availability and resting BP are altered dose-dependently with *Cit*, there is no additional improvement in exercise tolerance and related physiological responses after ingesting different doses of *Cit* compared with *Pla*.

Feasibility, educational problems and results of the "Mago" project: a distance-adapted physical activity for children and adolescents with obesity

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Purpose: This study's main goal is to evaluate the feasibility and didactic-educational problems of an adapted physical activity (PA), carried out remotely, for children and adolescents with obesity in nutritional and pediatric follow-up. The secondary goal is to verify the effectiveness of the program on anthropometric, biochemical, cardiopulmonary, and fitness parameters.

Methods: The PA proposed are the following: Synchronous online lessons (1 h 3 times/week); asynchronous activity carried out independently (1 h twice a week); independent PA at least once a week; "Active breaks" to break up prolonged sedentary behaviours. Before and after the program, the following information was recorded: adverse events, clinical and anthropometric parameters (weight, BMI, waist circumference, body composition—BIA, blood pressure), metabolic parameters (glycemia, insulinemia, glycated hemoglobin, OGTT, lipid profile), parameters of cardiopulmonary exercise test (VO2max), six-minute walking test, upper and lower limb strength. PA was measured with the PAQ-C questionnaire. The overall satisfaction was logged at the end.

Results: 20 adolescents were recruited (11 males: 14.20 ± 1.72 years, zBMI 37.18 ± 5.43; 9 females 13.9 ± 1.47, zBMI 34.74 ± 6.40), and 18 completed the project. No adverse events occurred during the lessons. The participation in the synchronous lessons was 68.8% while 50.2% participated in the asynchronous ones. The study showed an improvement in the percentage of lean body mass (p = 0.005) with unchanged BMI; a reduction in blood glucose during the OGTT at the 90' and 150' times (p = 0.047, p = 0.016); a reduction of basal insulin and of insulin at 150' during OGTT (p = 0.020, p = 0.011). In addition, there was a significant improvement in cardiovascular fitness: VO2max (mL/kg/min) (p = 0.007) and insulin sensitivity (Matsuda Index), although not reaching statistical significance. The fitness tests showed a significant improvement in lower limb strength ($p < 0.01$) and in the 6MWT ($p < 0.01$) with limited variation in PA. 65% of the subjects declared that they would participate again in MAGO project.

Conclusions: Participation in the MAGO program was feasible and effective albeit a relatively limited participation in the activities. Even in the absence of a control group, the program appears effective to improve cardiovascular fitness, glucose metabolism, body composition, strength, and endurance in children and adolescents with obesity, irrespective of changes in BMI.

Sardegna palestra a cielo aperto: a multisport outdoor program for individuals with Parkinson's disease

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Purpose: the aim of this pilot study was to investigate the anthropometric, body composition, functional and psychological effects of 10-week multisport outdoor (*i.e.,* hiking, surf, kayak, and sailing) program in individuals with mildly disabled Parkinson's disease (PD).

Methods: the study design was set as a crossover intervention trial, and, at the time to this abstract, we can present the data emerging from the first group of enrolled persons (Group 1). Ten subjects (9 men, 1 woman) were selected from the Neurology Unit (ASL Sassari) to participate in a multisport outdoor program. The intervention consisted of 8 hiking sessions (2/week), and 12 sessions of different water-sports activities (i.e., surf, kayak, and sailing; 2 sessions/week). Main outcomes (anthropometric profile, body composition, balance, muscular strength, flexibility, cardiorespiratory fitness, quality of life) were assessed at baseline, at the end of the hiking sessions (T1), and at the completion of the water-sports intervention (T2).

Results: Bonferroni-adjusted pairwise comparisons revealed significant weight reduction (baseline-T2: -2, 9%; p = 0, 024; d = 0, 971) and decreased Five-Time-Sit-to-Stand time (baseline-T1: -17, 2%; p = 0, 005; d = 1, 0). Regarding cardiorespiratory fitness, data showed a significant increase in 2-Minute (baseline-T2: + 10, 1%; p = 0, 031; d = 0, 62), and in 6-min walking tests (baseline-T2: + 9, 5%; p = 0, 015; d = 0, 75 and T1-T2: + 5, 3%; p = 0, 026; d = 0, 75). A non-significant trend of change was observed for fat mass (FM, baseline-T2: -10, 75%; p = 0, 07; d = 0, 69), fat free mass percentage (FFM%, baseline-T2: + 1, 98%; p = 0, 084; d = 0, 726), FM percentage (FM%, baseline-T2: -7, 18%; p = 0, 08; d = 0, 73), and total body water percentage (TBW%, baseline-T2: + 2, 45%; p = 0, 07; d = 0, 72).

Conclusions: a 10-week multisport outdoor program consisting of hiking, surf, kayak, and sailing proved safe and feasible and showed potential for improving anthropometrics, body composition and global functioning in mildly disabled individuals with PD. These preliminary findings will have to find confirmation over the larger sample planned at study conception, also having the present within-subjects findings compared with the planned waiting-list control group.

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Effect of a multidisciplinary approach on phase angle of breast cancer survivors being treated with chemotherapy

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Purpose: Phase angle (PhA) has been suggested to be a prognostic, health, functional, and nutritional indicator in various diseases. In patients with different types of cancer, a low PhA is associated with an impaired nutritional and functional status, decreased quality of life, and increased morbidity and mortality. Available data reported that PhA decreased by 5–15% after completing chemotherapy, and those effects might persist in the long term. The aim of the study was to investigate the effects of a multidisciplinary approach on PhA of breast cancer survivors (BCS) being treated with chemotherapy.
Methods: 48 BCS (48.58 ± 8.60 years) treated with neoadiuvant or adiuvant chemotherapy have been enrolled in the study and have been treated with nutritional and psychological support, acupuncture, online myofascial and relaxing exercises, and have been supported with guidelines concerning spontaneous physical activity and physical exercise practice in natural environment, for the whole duration of the chemotherapy. Chemotherapy mainly included 4 cycles of doxorubicin and 12 cycles of taxol. Nutritional support has been adjusted, with a daily frequency. Psychological support has been furnished with a monthly frequency. Traditional acupuncture has been administered with a fortnightly frequency. Twice a week, both hands-feet myofascial and relaxing online exercises, have been administered, while spontaneous physical activity and and walking in natural environment have been solicited through educational leaflets and videos.
Results: The BIVA software (Piccoli, 2002) was used to perform statistical analyzes based on the T2 Hotelling test for paired samples, investigating the linear distance between the vectors on the RXc graph, calculated as Mahalanobis distance (D). Statistical analysis showed a significant migration of PhA mainly characterized by its increase, together with the decrease of extracellular water ($T2 = 18.3$; $F = 8.7$; $P < 0.001$; $D = 0.87$). Paired sample t-test confirmed the significant increase of PhA ($p < 0.001$) and body cellular mass ($p = 0.001$), and the restribution of bodily water with the increase of its intracellular ($p < 0.001$) and the decrease of its extracellular part ($p < 0.001$).
Conclusions: The described multidisciplinary approach seems able to counteract the collateral negative effects of chemotherapy on whole-body cells membrane integrity and functions, linked with the well-known-linked negative side effects of chemotherapy.

Reactive agility and pitching performance improvement in visually impaired competitive italian baseball players: an innovative training and evaluation proposal

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Purpose: Visual input significantly affects kinesthesis skills and, hence, visually impaired individuals show less developed sensorimotor control, especially in an unfamiliar outdoor environment. Regular blind baseball practice can counteract such a deficit but, given the complex kinetic chain model required, a targeted workout proposal is needed to improve the main athletic gesture performance. On these premises, we investigated, for the first time, the running and pitching performance of a competitive Italian blind baseball team.
Methods: Baseball player evaluations were conducted during the regular competitive season through quantitative tools and parameters such as Libra Easytech sensorized proprioceptive board, goniometric active range of motion, chronometric speed, and pitching linear length. Moreover, the perceived physical exertion was assessed by the Borg CR10 scale. Consequently, an adapted athletic training protocol was designed and tested on the field during the in-season phase, with the aim to strengthen sport specific-gesture coordination and efficacy as well as to prevent injuries in a real game-frame.
Results: Quantitative assessments showed an improvement in ankle stability index, bilateral upper limb and hip mobility, reactive agility, running braking phase control during second base approaching, and auditory target-related pitching accuracy along with a decrease in perceived physical exertion.
Conclusions: This protocol might represent an effective and easily reproducible training and evaluation approach to tailor management of visually impaired baseball players, and safely improve their athletic performance under the supervision of an adapted exercise specialist.

Cardiorespiratory fitness, energy intake and cardiovascular risk in a sample of paralympic athletes with locomotor impairment

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Purpose: To evaluate the possible relationship between oxygen uptake peak (VO_{2peak}), energy and macronutrient intakes (E&MI) and cardiovascular and inflammatory risks (CVR and InR) in a population of Paralympic athletes (PA) with a locomotor impairment (PA-LI).
Methods: A retrospective chart review of the health and fitness evaluations preceding London 2012 Paralympic Games[1] was performed in 46 male PA-LI. They were divided in 2 groups depending on their health conditions: 29 PA with spinal cord injury (PA-SCI, mean age: 37 ± 8.9 years old), and 17 PA with other health conditions, e.g., lower limb amputation and poliomyelitis (PA-OHC, mean age: 35 ± 9.1 years old). They underwent anthropometry assessment (standard and skinfold measurements); laboratory blood tests, including C reactive protein (CRP) and uric acid to estimate InR; nutritional 24-h recall to assess energy and macronutrient intakes (E&MI); arm cranking ergometer incremental maximal exercise tests to measure VO_{2peak}. CVR was estimated through 3 indices: fatty liver index[2] (FLI), lipid accumulation product[3] (LAP) and visceral adiposity index[4] (VAI). FLI was calculated from body mass index (BMI), waist circumference (WC), gamma-GT and triglycerides (TG); LAP from WC and TG; VAI from BMI, WC, TG and high-density lipoprotein cholesterol. Mann–Whitney test and Spearman correlations were performed to compare the groups and to evaluate the relationship between variables, respectively.
Results: In spite of no differences in E&MI, body composition and CVR indices, PA-SCI vs PA-OHC showed lower VO_{2peak} (30 ± 10.6 *vs* 37 ± 7.9 ml/kg/min, $p < 0.01$) and higher CRP (1.37, IQR: 0.53–1.79 *vs* 0.33, IQR: 0.26–0.96 mg/l, $p < 0.01$). VO_{2peak}/kg correlated negatively with uric acid levels (r: -0.563, $p < 0.0001$), CRP levels (r: -0.425, $p < 0.01$), FLI (r: -0.564, $p < 0.0001$), LAP (r: -0.513, $p = 0.0001$) and VAI (r: -0.558, $p < 0.001$).
Conclusions: In PA-LI VO_{2peak} is inversely related to markers and indices of InR and CVR, suggesting a protective role of the cardiorespiratory fitness on health. Physical exercise[5] and sport[6] are highly recommended to improve VO_{2peak}.
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Does long-term physical activity effectively reduce the consumption of antihypertensive drugs? A randomized controlled trial

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Purpose: Although physical activity (PA) has been shown to enhance hypertension control, the impact of exercise on the potential decrease of the use of antihypertensive medications remains inadequately researched. The aim was to assess the impact of a two-year PA on the medication requirements of individuals with hypertension.
Methods: This is a observer-blinded, randomized, parallel-group clinical trial. From 180 recruited subjects, 76 completed the 24-month intervention, divided into an experimental group (n = 36) that underwent an aerobic and strength training combined, and a control group (n = 36) that underwent a stretching and postural training, three times per week. Participants' exercise sessions were recorded using Polar heart monitors and 6–20 Perceived Exertion Scale- RPE, For sufficient adherence, participants had to complete at least 50% of the planned 256 training sessions and 5 scheduled medical visits. The antihypertensive drug load for each participant was determined by adding the ratios of the prescribed daily dose (PDD) to the defined daily dose (DDD) for all antihypertensive medications taken by the participant (WHO, 2009). The outcome measures were evaluated at 0, 6, 12, 18, and 24 months for all participants.
Results: The adherence of the 76 participants was between 75 and 80%. RM-ANOVA revealed a significant lower antihypertensive drug load in the EG compared to the CG at 18 ($p < 0.017$) and 24 months ($p < 0.003$).
Conclusions: This study provided evidence that long-term physical exercise, incorporating both aerobic and resistance training, effectively reduced the dependence on medication in hypertensive patients. The trend of decrease regarding the EG drugs load intake and the trend of CG drugs load increase, although not significant over time, results in a significant difference between the groups at 18 months and even more at 24 months. This trend certifies the protective value of PA against the aging process and its related health risk factors. In conclusion, there are three essential conditions that must be considered when designing a physical protocol with the goal of reducing blood pressure and, consequently, medication intake: a long-term commitment to regular PA, good adherence to the exercise protocol, appropriate volume, intensity and modality of exercise. However, our research findings cannot be directly compared to similar studies because, to our knowledge, we uniquely considered drug load as the outcome measure.

Breaking the sedentary: investigating the effects of active breaks on physical Activity and psychosocial well-being in primary school children

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Purpose: Sedentary behavior is a growing concern and has been linked to various health problems (Janssen et al., 2010). Moderate to vigorous Physical Activity (PA) Active Breaks (ABs), performed during sedentary periods, may be helpful in promoting physical activity and well-being in developmental ages. However, despite promising results, ABs are not widely used in schools (Biddle et al. 2016; Roset et al., 2020). Therefore, this study investigated the effect of an ABs intervention on PA levels and psychosocial aspects in primary school children.
Methods: A non-randomized controlled design was employed. The sample consisted of 67 primary school children (35 F and 32 M—avg. age 8.79 ± 0.94 y.). Throughout a three-month duration, children were engaged in 10-min ABs sessions twice a day during the curricular school activities. PA levels were measured using the Physical Activity Questionnaire for Children (PAQ-C), and an ad-hoc questionnaire was created to measure well-being and time-on-task

behavior before and after ABs intervention. The questionnaire contained three subscales: well-being, concentration, and learning.
Results: Results showed an increment in the PA levels ($F = 19.80$, $p < 0.001$) and a higher scores on the Classroom Behavior Questionnaire in the well-being subscale ($F = 4.18$, $p = 0.04$). Concentration subscale did not reveal differences between the pre- and post-intervention ($F = 1.67$, $p > 0.05$) while learning subscale revealed lower score in the post- compared to the pre-intervention ($F = 18.81$, $p < 0.001$).
Conclusions: Even though this study follows a non-randomized controlled design, in accordance with existent literature (e.g., Janssen et al., 2010), its results offer compelling evidence for the effectiveness of ABs in promoting PA and psychosocial well-being among primary school children. This evidence is important for the classroom climate and the quality of the teaching–learning processes. However, the learning and concentration subscales did not produce the expected results, and they could be influenced by other variables. Therefore, our further investigations are orienteed to gain a comprehensive understanding of this phenomenon.
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Effects of active breaks on cardiovascular efficiency, attentive skills, and scholastic wellbeing: a middle school intervention study

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Purpose: The increasing need to face the problem of sedentarism, and the role that physical activity could have in improving academic achievement and school wellbeing induced teachers and researchers to find new intervention methodologies in school context. Active breaks (ABs) include brief periods of physical activity as a part of the curriculum. The practice of physical activity, in addition to the health benefits, has a positive effect on the concentration and attentive skills of students, stimulating blood circulation and oxygenation of the brain, with improvement of cognitive functions and learning ability (Lopez-Garcia et al., 2019). Moreover, it reduces stress and anxiety in students, improving their emotional well-being and the quality of school life (Niemann et al., 2021).
This study aimed to investigate the AB chronic responses on cardiovascular efficiency, attentive skills and scholastic wellbeing in a middle school.
Methods: A total of 120 adolescents (aged 11.61 ± 0.64), divided into nine classes, participated in this 12 week- intervention study. Each class was randomly assigned to two experimental groups on the basis of the type of the -protocol performed during the ABs: fitness (FIT), creativity (CREAT). At baseline and at the end of interventions, all participants underwent the following test assessment: 5X10 shuttle test, to assess the level of cardiovascular efficiency, D2-R attention to assess attention and concentration, through speed and accuracy, QBS-R 8–13 assessing students' wellbeing.
Results: The RM- ANOVA showed no significant differences between groups in shuttle test, while a significant improvement over time was found in both groups ($p < 0.05$). Same results were obtained in D2_RE and in D2_RS, assessing the execution speed and wrong answers respectively, where both groups showed a significant improvement over time ($p = 0.001$) with no differences between groups. No difference between groups and over time were found in D2_ER% and in D2_PC scores, assessing accuracy and concentration respectively. Similarly non-significant variation was found in QBS total score.
A significant difference between groups was found in the QBS subscale "Emotional attitude at school ". The CREAT group showed a significant improvement compared to the FIT group ($p = 0.043$).
Conclusions: This study showed a positive impact of both the AB interventions, in terms of cardiovascular efficiency and attention improvements. The CREAT intervention had a greater positive influence on students' emotional reactions when facing academic demands, specifically regarding experiences of anxiety and shame. This outcome is likely attributed to the cooperative nature, emulation, and intergroup challenges fostered by the collective implementation of creative protocols, where students engaged in strategies to solve the motor task.

Planned school physical activities are only the first step for improving non-active children's physical performance

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Purpose: This study is part of a Ministerial project (PRIN-2017; "Is active lifestyle enough for health and wellbeing?", ACTLIFE; University of Verona, Torino, Roma La Sapienza, Napoli Parthenope, Parma, Padova), and aimed to evaluate the effects of different school physical activity interventions (PAI) on physical performance in non-active (nA) Italian children.
Methods: Before (PRE) and after (POST) different 6-month physical activity interventions (PAI; structured, S; semi-structured, *Daily Mile*, D; control, C), 229 children (5 schools, 17 classes; Turin province; aged 9–11 yrs) were anthropometrically measured (stature, body mass, abdominal circumference), and performed physical tests for measuring sprint (20 m-sprint), endurance (shuttle-run), balance (single-leg-stance), dominant upper-limb strength (handgrip), lower-limbs muscle power (standing-long-jump), and flexibility (sit-and-reach) skills. To distinguish active (A) and nA children, participants filled the Italian version of the PAQ-C-it at PRE. ANOVA with repeated measurements (Tukey's post-hoc) was applied for the aim of study.
Results: Effects were found for stature (PRE-POST: $p < 0.001$, 3.45 cm), body mass (PRE-POST: $p < 0.001$,2.5 kg), and abdominal circumference (PRE-POST: $p < 0.001$, 1.6 cm). For the physical tests, effects emerged for sprint (PRE-POST: $p < 0.001$; 0.102 s), shuttle-run (PRE-POST, $p < 0.001$, 148 m; A-nA: $p = 0.015$, 110 m), single-leg-stance (PRE-POST: $p < 0.001$,24.6 s. PAI: $p < 0.001$, C vs S: $p < 0.001$,24.6 s; D vs S: $p = 0.002$, 14.8 s. PRE-

POST x PAI x A-nA: p = 0.047; PRE-POST in C and nA, p = 0.006, 34.2 s; PRE-POST in S and nA, p = 0.006, 26.0 s; PRE-POST in D and A, p < 0.001, 34.6 s), long-jump (PRE-POST p = 0.019; only for S: 9.8 cm, p < 0.001, and for D: 5.6 cm, p = 0.008), and sit-and-reach (PAI: p = 0.024, S vs C: p = 0.022, 4.41 cm; PRE-POST x PAI: p = 0.005; S vs C POST: 3.11 cm, p = 0.026) test. Handgrip reported effects for each single variable (p range = 0.001-0.019) and for PRE-POST x PAI (p = 0.006), PRE-POST x A-nA (p = 0.001), and PRE-POST x PAI x A-nA (p = 0.002). PRE-POST post-hoc effects emerged only for S (p = 0.022; 1.3 kg) and D (p < 0.001; 3.5 kg).

Conclusions: No particular PAI effect emerged for the nA subgroup. Results reported general improvements which could probably be more associable to the 6-months anthropometric growth or other not-measured factors. Therefore, it seems that substantial nA children's physical performance improvements should be promoted by means of a better planned PAI not only at school, but also during extra-curriculum time.

Infrared thermography analysis of the back during prolonged sitting. A proposal of active breaks

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Purpose: The scientific community's interest on the employment of infrared systems in clinical practice is increasing due to their ease of use, non-invasiveness, and safety. Meanwhile, the prevalence of musculoskeletal problems among office workers due to prolonged sitting is increasing. The aim of this study is to analyze a population of office workers with the infraredthermography, to identify the response of the musculoskeletal system in maintaining a seated posture for a long period of time. Further, we evaluated the body's thermal response to an active break to decrease back overload.

Methods: A sample of 40 female and 30 males, was investigated with infrared thermography. We asked to maintain a seated position for 90 min. Participants were divided into two groups: Active Break (AB) Group and No Active break (NAB) group. The NAB group was asked to sit for 90 min without the possibility of standing. The AB group performed stretching and mobility exercise every 30 min during the trial. Measurements were collected at baseline (T0), after 30 min (T1), after 60 min (T2), and after 90 min (T3). Theparticipants in NAB group left the sitting position only to collect thermographic measurements; participants in AB group left the sitting position to collect thermographic measurements and immediately afterwards performed the exercise protocol. Three regions of interest (ROI) were identified: cervical, dorsal and lumbar.

Results: The multi-factor ANOVA revealed significant differences between the two groups for the measurements time points (p = 0.024), gender (p < 0.001) and specifically active breaks x time points (p < 0.001). Further, the comparison of the ROIs between AB and NAB groups provided significant differences (p = 0.026).No significance was found at T1 for cervical, dorsal, and lumbar ROI. - The Tukey post-hoc test between AB and NAB was significant for cervical and dorsal ROI in T2 and T3 but not for lumbar ROI. In particular, for cervical ROI, T2 (p < 0.001), T3 (P < 0.02); for the dorsal ROI, T2 (p < 0.005), T3 (p < 0.005).

Conclusions: The results indicate a significant reduction in back temperature in the exercise group (AB) compared with the non-exercise group (NAB) after 60 min of sitting (T2) and 90 min of sitting (T3). These finding show that our proposal of active break, which included mobilization and stretching exercises, can reduce the surface temperature of the back, and this may be an indicator of less overload and muscle fatigue given by prolonged sitting.

Effects of different teaching approaches on proxy measures of physical fitness of Italian kindergarten children

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Purpose: Physical activity in children is important for motor development and psycho-physical health, laying the foundations for a healthy and active lifestyle as adults. It is important that kindergarten teachers promote physical education activities to facilitate the creation and improvement in a variety of health-enhancing physical activities and sports as adults and throughout life. In this study we investigate the teaching methods, to understand which is the most suitable for this purpose.

Methods: A quasi-experimental study, with convenience cluster sampling and a non-equivalent control group, pre- and post-test design was used. Eleven intact classes of 7 kindergartens in northeast Italy with the same economic background (n. 182 children, mean age 5.43 y old) were recruited and randomly assigned to 1 of 3 groups. Each Group carried out 10 meetings of 1 h, using different teaching methods: group 1: 4 classes, 73 children (mean age 5.41 ± 0.41, female = 37) participated in structured activity + free play at a playground; Group 2: 4 classes, 49 children (mean age 5.48 ± 0.39, female = 31) practiced only free play at the playground; Group 3: 3 classes, 60 children (mean age: 5.43 ± 0.40, female = 26) participated in structured activity + free play in their kindergarten environment. A fidelity check was used and standardized tests of physical fitness were administered before and after the study: medicine ball throw, standing broad jump, and running 20 m sprint. A mixed between-within subjects' analysis of variance was conducted to assess the impact of the three different interventions, across two time periods.

Results: The teaching method for Group 1 (structured activity + free play) was the most effective, producing significant (to medium and large) improvement in the %PFC of the children, comparing with the other groups.

Conclusions: Structured activity combined with free play at a playground has proven to be the best method to promote improvements in performance levels of the composite physical fitness score of the participants, even with a limited dose of PA of only hour/week. The improvement was seen in both 5- and 6-year-old children, with a greater effect in 6-year-olds. The results suggest that further research should be done on the topic and may be useful to kindergarten teachers.

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Incidence of lower back pain among adolescent climbers

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Purpose: Climbing is considered a fast-growing sport. As such, it is practiced at both recreational and competitive levels. Various musculoskeletal injuries in climbers can be provoked by frequent training sessions and competitions. The goal of this study was to investigate the incidence of low back pain (LBP) and to explore the influence of different risk factors (e.g. amount of weekly training, number of seasonal competitions, workout duration) on LBP in adolescent climbers.
Methods: A total of 180 competitive male and female climbers aged 13–19 years participated in the study. Data collection was done using the Nordic Musculoskeletal Questionnaire (NMSQ) and the Graded Chronic Pain Scale (GCPS). Pain Intensity and Disability Scores were calculated using a specific scoring system, determined as 5 grades of severity. Grade 0 (pain-free); Grade I (low disability-low intensity); Grade II (low disability-high intensity); Grade III (high disability-moderately limiting); Grade IV (high disability-severely limiting).The Pearson's Chi Square was used to assess the percentage differences between gender and age categories, while Pearson's correlational analysis was done to determine the relations between GCPS scores and risk factors.
Results: A percentage of 74.4% of the whole sample of athletes reported lower back complaints during the last twelve months, and only 15.5% within the past seven days. The large portion of complaints were classified as low intensity-low disability (Grade I, 62.8%). Athletes competing for U20 reported a small but significantly higher percentage ($p < 0.05$) of almost all NMQ measures in comparison to U16 climbers. No significant correlation was observed between GCPS scores and risk factors.
Conclusions: According to the results obtained from the collected data, incidence of LBP in both male and female climbers is rather low. LBP seems not to be as severe as pain that might be reported in some other body parts (shoulders, hands and fingers), due to nature of this sport. Furthermore, athletes did not differ in LBP prevalence according to gender or age groups. In addition, youth climbers demonstrated lower incidence of LBP compared to athletes competing in other sports, e.g. alpine skiers (Carraro et al., 2020). There is a need for the future studies to prospectively monitor the impact of climbing on LBP in young climbers.
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A pilot study in people with multiple sclerosis: frailty in relation to physical functioning, fatigue and quality of life

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Purpose: Multiple sclerosis (MS) is a chronic disease that causes inflammation and demyelination in the central nervous system. It is known to be the leading cause of disability in young adults in developed countries (Reich et al., 2018). MS can have a significant impact on Quality of Life (QoL), physical functioning and well-being (Mikula et al., 2015). Over the last two decades, the concept of frailty has gradually emerged but the research on frailty in MS is still limited. This study aims to assess: i) the relationship between frailty and physical functioning; ii) the influence of frailty on fatigue and QoL in a sample of people with MS.
Methods: This pilot study included people with MS. Frailty, fatigue and QoL were evaluated using the Tilburg Frailty Indicator (TFI; physical domain), the Modified Fatigue Impact Scale (MFIS) and the WHOQoL-bref, respectively. Physical functioning was assessed using the handgrip strength test, the Timed 25-Foot Walk, the Five times Sit to Stand test and a bipodalic balance test (open eyes). Physical parameters were measured using the Baiobit (BTS, Milan, Italy) inertial sensor system.
Results: 18 subjects (88.9% female, aged 27–72 years, EDSS range 1–5.5 points) participated. Physical frailty correlated with CoP sway area ($r = 0.53$, $p = 0.02$) and walking speed ($r = -0.47$, $p = 0.05$). More physically frail individuals (physical TFI domain ≥ 4 points) perceived greater fatigue ($p = 0.04$) and reduced QoL ($p = 0.04$) than less physically frail individuals (physical TFI domain < 4 points).
Conclusions: From a practical point of view, the early identification of physically frail people in the MS population could be an effective approach to reduce the negative consequences of frailty.
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Physical fitness and quality of life in women with breast cancer: effects of a 12-week combined exercise program

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Purpose: Exercise is inversely associated with mortality and recurrence risk in breast cancer and may be an effective strategy to ameliorate treatment-related side effects. This study aims to explore the impact of 12 weeks of an exercise intervention in breast cancer.
Methods: Adults patients with breast cancer (stage I-IV) visiting the Oncology Unit of the University of Verona Hospital Trust were encouraged to participate in the study. The exercise prescription consisted of aerobic and resistance training two times a week, individually tailored according to the patient's baseline evaluations and medical history. Each exercise session was composed of a warm-up, cycle ergometer, or treadmill for the aerobic part, five strength exercises performed with bands, and stretching activities for cool-down. Adherence and adverse events were recorded during the program. Baseline and post-intervention assessments included: i) the Six minutes walking test (6MWT) to evaluate functional capacity, ii) the handgrip strength test to assess muscle strength iii) the back scratch

and chair sit and reach tests to measure flexibility, iv) anthropometric measures, were obtained through the body mass index (BMI) and the waist-hip ratio, and v) the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire was used to assess quality of life (QoL). Descriptive statistics and paired t-tests were used to analyze the results.

Results: A total of 35 patients participated in the study. 97% of patients were undergoing anticancer treatment during the exercise program, and 83% had previously had surgery. Patients' compliance with the program was 88%, and no adverse events were registered. A significant increase in functional capacity (535.01 vs. 558.86 m; $p < 0.001$) and lower body flexibility (-4.77 vs. -1.69 cm; $p < 0.001$) were detected. No significant differences were observed for anthropometric measures and muscle strength. Concerning QoL, significant enhancements were gained in physical functioning (86.66 vs. 93.33 pts; $p = 0.011$), role functioning (83.33 vs. 100 pts; $p = 0.040$), social functioning (66.66 vs. 83.33 pts; $p = 0.035$) and fatigue (33.33 vs. 22.22 pts; $p = 0.005$), while no changes for the other domains were found.

Conclusions: A 12-week exercise program combining aerobic and resistance training was feasible and beneficial for physical fitness and may ameliorate cancer-related fatigue in women with breast cancer.

Effect of a 12-week aerobic exercise training program on 24h glycemic control in postmenopausal breast cancer survivor women enrolled in the movis cohort

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Purpose: Sedentary lifestyle and unbalanced nutrition could develop insulin resistance in breast cancer survivors (BCS)[1]. In contrast, aerobic exercise could improve glycemic control. The interaction between aerobic exercise and glucose homeostasis still needs to be investigated in BCS[2]. This study aims to evaluate the effect of a 12-week aerobic exercise training program on 24 h glycemic control in BCS.

Methods: Sixteen BCS women (ClinicalTrials.gov NCT04818359) without diabetes were randomized into a control (CG, n = 8) and intervention (IG, n = 8) group. Both groups received lifestyle guidelines on physical activity and Mediterranean diet. The IG also followed a 12-week supervised aerobic exercise training program with incremental intensity (40–70% of heart rate reserve) and duration (20–60 min) for 3 days/week. The 24 h glycemic variability index (i.e., % time > 140 mg/dL obtained by using a flash glucose monitoring device) and caloric intake (retrieved from a food diary) were evaluated for 14 days at the beginning and at the end of the study. Cardiorespiratory fitness ($\dot{V}O_{2max}$), anthropometric and body composition parameters (e.g., BMI and % body fat), and metabolic markers (HOMA-IR and fasting glucose and insulin) were evaluated before and after intervention. The difference between groups over time was evaluated using a two-way mixed ANOVA for the 24 h glycemic variability index and a two-way RM-MANOVA for the other secondary variables.

Results: After the intervention, the 24 h glycemic variability index revealed that the time spent in a hyperglycemic state (glucose > 140 mg/dL) increased significantly ($p = 0.015$) in CG (5.0 ± 4.5 to 11.6 ± 12.0) compared to IG (10.9 ± 12.7 to 11.0 ± 10.4). The caloric intake increased in both CG (+ 19%; $p = 0.068$) and IG (+ 28.1%, $p = 0.028$). Fasted insulin level decreased in both CG (− 34.9%; $p = 0.006$) and IG (− 18.5%; $p = 0.051$), and HOMA-IR decreased by − 34.2% in CG ($p = 0.012$) and by − 17.6% ($p = 0.060$) in IG. The $\dot{V}O_{2max}$ increased significantly in IG (+ 16.4%; $p = 0.017$) and non-significantly in CG (+ 2.2%; $p = 0.638$). Anthropometric, body composition parameters and fasting glucose did not change in both groups.

Conclusions: The IG showed a higher control of the glycemic variability and less time spent in hyperglycemia than the CG after the intervention. However, insulin and HOMA-IR of IG were only slightly modified, highlighting the importance of the combined effect of exercise and caloric intake, which increased in IG and might have mitigated the exercise effect.

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SOFA, scalpel, or walking shoes? The 5-year fate of the patient with peripheral artery disease receiving walking advice, revascularization or home-based exercise

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Purpose: This study evaluated the clinical outcomes in patients with restricted mobility for claudication exposed to different treatments: revascularization (Rev) or structured home-based exercise program (SHB-Ex) or usual care (walking advice and clinical follow up, UC).

Methods: The records of 1590 consecutive PAD patients were assessed between 2006 and 2015 at University Hospital of Ferrara. Exclusion criteria were: PAD at Leriche-Fontaine stages III or IV; end-stage neoplastic disease, severe heart failure. After optimization of medical therapy, patients were non-randomly assigned to: Rev (endovascular, surgical or hybrid; n = 137); UC (walking recommendations according to the guidelines; n = 366) or SHB-Ex (the original Test in-Train out program prescribed during a few visits at the hospital and executed at home at symptom-free walking speed; n = 1087)[1]. The number and date of deaths, hospitalizations and peripheral revascularizations for a 5-year period were collected from the Regional Registry.

Results: A total of 401 patients were excluded. The remaining patients, due to between-group baseline differences, were harmonized with a propensity score-matched analysis. The three groups were composed of 119 patients each, without any differences but the age of Rev group (69 ± 10 vs 71 ± 9 of both SHB-Ex and UC; $p < 0.001$). Revascularizations procedures were mainly surgical (54%); SHB-Ex was daily performed for 20 min for 9 months (adherence rate of 89%); patients of UC group mostly reported to surgeon an increased physical activity level, even not measured. A lower all-cause mortality rate ($p < 0.001$) was observed for Rev and SHB-Ex (n = 13; 11% for both) respect to UC (n = 53; 45%) with a Hazard Ratio (HR) of 0.24 (95%CI 0.15–0.41) for Rev and of 0.29 (95%CI 0.17–0.50)

for SHB-Ex. A lower hospitalization rate ($p < 0.001$) was observed for both Rev (n = 61; 56%) and SHB-Ex (n = 71; 60%) respect to UC (n = 111; 95%). Finally, no significant differences between groups were observed for peripheral revascularizations, with a lower rate observed for SHB-Ex (11%) compared to Rev for a second intervention (17%) and UC (19%).

Conclusions: In PAD patients both peripheral revascularization and home-based structured exercise, possibly by facilitating mobility, were associated to lower mortality and all-cause hospitalizations respect to the usual care. Structured home-based exercise with a low economic burden for health system and families, represents a useful therapeutic option for claudication.

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Effects of concurrent, within-session, aerobic and resistance exercise training on functional capacity and muscle performance in patients with chronic heart failure

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Purpose: The best format of exercise training (ET) in the setting of cardiovascular performance and exercise tolerance in patients with chronic heart failure (CHF) is still to be defined. Current guidelines recommend aerobic exercises, such as running and cycling, including some sessions per week of resistance exercise. The aim of this study was to address the effectiveness of a concurrent exercise training program utilizing a circuit of sequential endurance and resistance exercises on functional capacity and muscular strength in patients with CHF.

Methods: Ninety-five consecutive male patients (age 63.1 ± 6 years) with CHF (EF < 40%) in NYHA functional class II/III, were randomly assigned on 1: 1 basis to a 12-week aerobic continuous training (AT) or concurrent CT), aerobic + resistance, training (CT), three times a week, with each session lasting 80 min. We used high quality, specifically designed ergometers, connected with each other and governed by a central console. Before and after training all patients performed a symptoms-limited exercise test on a treadmill and a 6-min walking test (6MWT). Patients in the CT group also performed resistance exercises of upper and lower body.

Results: The 6MWT and exercise duration at ergometric test increased significantly in both AT and CT groups, with the increase being greater in CT group ($p < 0.001$; ES = 0.13; $p < 0.01$; ES = 0.07). Muscular strength increased significantly in the CT group, particularly in the lower body muscular districts ($p < 0.001$). Quality of life improved in both groups, with a significantly greater improvement in the CT group ($p < 0.05$). No side effects leading to discontinuation of training were observed.

Conclusions: These findings indicate that concurrent, within-session training results in larger improvements in functional capacity, in addition to muscle performance, in patients with CHF, in comparison to single-mode aerobic training.

The effects of aerobic training on physical and cognitive functioning in adolescents with intellectual disability

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Purpose: The beneficial impact of endurance training on physical and mental health is well-supported across various life stages, but its effects on individuals with intellectual disability remain underexplored [1]. This project aimed to investigate the effects of an aerobic training program on cognitive function, cardiorespiratory function, static and dynamic balance, and gait analysis in adolescents with intellectual disability. Additionally, the study hypothesized higher social inclusion, autonomy, and independence for individuals with disabilities.

Methods: Twenty students (Group with intellectual disability [DIS], N = 10, age = 17 ± 1 years; Group without intellectual disability [ND], N = 10, age = 17 ± 1 years) participated in this study. The DIS group included individuals with autism spectrum disorders, down syndrome, or mild intellectual disability. Five students within each group were randomly assigned to the experimental subgroup (DIS-SPER and ND-SPER) and underwent a 4-month aerobic training program. The program included walking and/or running activity for approximately one hour, three times per week, with heart rate monitoring. Control subgroups (DIS-CON and ND-CON) maintained regular activities. Participants were assessed for cognitive functions, cardiorespiratory function, static and dynamic balance, and gait analysis at 3 time points (Pre, Intermediate, and Post).

Results: Due to the small sample size for each subgroup, data are presented only as descriptive statistics. The MOCA scores improved for both DIS-SPER (Pre = 7 ± 3.9 pt, Post = 10 ± 9.2 pt) and DIS-CON (Pre = 13.8 ± 7 pt, Post = 17.8 ± 7.3 pt). DIS-SPER showed increased walking distance during the 6-min walking test (Pre = 496 ± 110 m, Post = 539 ± 76 m) and reduced variability in step length (Pre = 7.68 ± 3.6%, Post = 6.42 ± 2.2%) and stance phase (Pre = 8.82 ± 4%, Post = 7.66 ± 4%) compared to ND-SPER. DIS-SPER also improved static balance under closed eyes condition and reduced variability in contact time for dynamic balance.

Conclusions: The training program had a positive impact on cognitive functions and physical functioning in adolescents with intellectual disability, particularly regarding gait parameters and balance. Additionally, the intervention contributed to enhanced autonomy and independence, indicating practical implications for public health. These preliminary results highlight the potential benefits of aerobic training to promote physical and cognitive well-being in individuals with intellectual disability. Further studies with larger sample sizes are warranted to confirm and strengthen these findings.

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A pilot study on the autonomic control during indoor static skydiving Section II: exercise physiology

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Purpose: Indoor skydiving has witnessed a substantial growth in popularity worldwide. It recently expanded from military to recreational application, becoming a training ground for paratroopers and athletes. Individual and collective competitions have been thus introduced, requiring athletes to fluctuate along predefined paths inside the wind tunnel, assuming different postures (supine, prone, sit and the reversed up-side-down). It is well known that postural transitions activate several cardiovascular reflexes to counteract gravity effects on blood shift. As indoor skydiving is a relatively young expanding discipline, an evaluation of the autonomic control might give valuable insights for training purposes and preventing undesired physiological responses. The present study investigated the autonomic modulation during static indoor skydiving by heart rate variability analysis.
Methods: Nine expert indoor skydiving instructors (8/1 M/F; age 31±6 yr; body mass: 70.0±10.5 kg; stature: 1.74±0.08 m; mean ± standard deviation (SD)) were recruited. The heart rate (HR) was recorded beat-by-beat by a wearable device with the participant in the supine position outside the wind tunnel (SUPOUT), and during the following 5-minute static position assumed inside the tunnel: SUPIN, PRONE, and SIT. Head-down (HD) length differed among participants (45-150 s). Mean RR, RMSSD, LF/HF, and SampEn have been determined for each posture. A one-way ANOVA RM evaluated the differences among postures, considering SUPOUT and SUPIN as the reference conditions. The statistical significance level was set to alpha = 0.05.
Results: RR significantly decreased in all the inside tunnel postures ($p<0.05$). HD RR furtherly decreased, compared to SUPIN and SIT ($p<0.05$). Compared to SUPOUT, all inside wind tunnel postures showed lower RMSSD ($p<0.05$), with the lowest value found in HD ($p<0.01$). LF/HF did not differ among postures. No differences were found among postures in SampEn but HD which reduced significantly ($p<0.001$).
Conclusions: These findings indicate a vagal input reduction upon entering the wind tunnel. The most parasympathetic inhibition was observed during HD. LF/HF, the sympathovagal balance index, did not exhibit any difference among inside postures likely due to a respiratory-related increase in HF. Given the influence of respiratory activity on HF band, spectral analysis outcomes might be compromised during those postures/movements requiring a substantial respiratory contribution.
Acknowledgments: All authors are grateful to the Aerogravity General Manager and the instructors of Aerogravity Milano

Proportionality, somatotype, anthropometrical, and bioelectrical characteristics of elite international soccer referees

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Purpose: this study aimed to assess the physical characteristics of elite international soccer referees and compare them with other populations by somatotyping, the bioelectrical impedance vector analysis (BIVA), and the Phantom proportionality methods.
Methods: forty-one elite international soccer referees (age 38.8 ± 3.6 years) participated in the study. the participants underwent body composition assessments, bioelectrical impedance vector analysis, and anthropometry. The Somatotype Attitudinal Distance (SAD), the two-sample Hotelling's T^2, and the Mahalanobis tests were used to determine somatotype and bioelectrical vector differences with the literature. The Phantom Z-score (Z_p-score) was used for proportionality comparisons.
Results: the average somatotype was balanced mesomorph. Elite international referees significantly differed from Zimbabwean, Brazilian, and South African referees (SAD = 2.1,2.6, 2.9, respectively). The bioelectrical vector was significantly different from the general and the athletic population falling respectively on the left ($T^2 \leq 76.6$ D = 1.44; $P < 0.001$) and the right ($T^2 \leq 25.3$; F = 12.6; D = 0.8; $P < 0.001$) sides. The Phantom method displayed a similar profile to South American soccer players, except for humerus diameter and tight girth (Z_p = – 0.48 and 1.13 and -0.83 and 0.76 for referees and soccer players, respectively).
Conclusions: elite soccer referees have good fitness in terms of body composition, although they are still not comparable to the top-level athletic and soccer populations.

Sedentary behaviors and dietary habits in active and inactive subjects

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Purpose: Modifiable lifestyle choices such as doing less exercise and consuming more energy-dense meals are responsible for the global rise observed in the last decades in overweight and obesity (1). Due to their lifestyle, athletes reach recommended guidelines on physical activity more easily than the general population, and often choose healthy diet models. However, sedentary behaviors and unhealthy dietary habits can be common even in individuals practicing sports or attending gyms (2). The aim of this survey was to investigate the sedentary and dietary habits in active and inactive subjects.
Methods: A mixed-methods anonymous online survey was used to collect socio-demographic and behavioral data from healthy adults in the Campania region. The Sedentary Behaviour Questionnaire (SBQ) was used to quantify the time spent in sedentary behaviour (SB) and the Healthy Dietary Habits Index (HDHI) was used to collect information about food consumption.
Results: A total of 411 participants (mean age 30, 5 ± 13, 3 years, 52% females) completed the questionnaires. 25% of them were inactive, 34% were gym practitioners and 41% practiced different sport disciplines. Considering the results to the SBQ for the week-days significant differences were found between athletes and inactive participants ($p < 0.001$), although considering the week-end days no

differences were found (p = 0.115). The daily total amount spent in sedentary behaviour was 14.1 ± 7.3 h. Inactive participants reported more sedentary time spent using smartphone (p = 0.01) and moving from one place to another compared to individuals practicing sport (p = 0.05). Also, there were significant differences in HDHI scores between athletes and inactive participants ($p < 0.001$). Gym practitioners presented a significative lower frequency in the consumption of fast food, pizza and hamburger (p = 0.048), with a higher choice of light products compared to inactive individuals (p = 0.015). On the other hand, athletes presented a significant higher consumption of fruits and vegetables compared to inactive subjects (p = 0, 011 and p = 0, 002 respectively). Athletes reported the breakfast habit more than gym practitioners (p = 0, 045).

Conclusions: The results of this study show that sports and exercise practice seem to have a positive impact on both eating behavior and sedentary lifestyle, even if the total daily time spent in sedentary behaviors seems to be high in all groups examined.

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A novel approach to investigate the effect of music tempo on cardiorespiratory and psychological variables during cycling exercise

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Purpose: It is commonly believed that music tempo (i.e. bpm) is the feature that primarily mediates the effect of music on physiological and psychological variables during exercise. However, the methodological approaches used so far do not allow us to effectively distinguish between the effect of music tempo and that of other music features. Indeed, music tempo is often modulated by providing different pieces of music from different music genres. It is also problematic to leave participants free to modulate their pedalling cadence, which may be a confounding factor when attempting to investigate the effects of music tempo. To overcome these issues, the present study proposes an innovative approach to systematically investigate the effect of music tempo per se on cardiorespiratory and psychological variables during cycling exercise.

Methods: Sixteen young recreationally active individuals performed an incremental test and three randomised experimental sessions in separate visits. During the experimental sessions, participants exercised for 14 min both at moderate and heavy intensities, and music was played in two of the three sessions. The same music soundtrack was administered in the two music conditions, in which a linear increase (100–180 bpm) or decrease (180–100 bpm) in music tempo was provided without altering other music features.

Results: Both during moderate and heavy intensities, respiratory frequency (f_R) increased ($P < 0.05$) in the two music conditions irrespective of changes in music tempo, and this increase was counteracted by a decrease ($P < 0.05$) in tidal volume. No significant effect of music was observed for heart rate (HR), oxygen uptake ($\dot{V}O_2$), carbon dioxide output, rating of perceived exertion and pedalling cadence, neither at moderate nor at heavy intensities. Arousal and pleasure during exercise increased in the two music conditions compared to the control condition and were affected by variations in music tempo.

Conclusions: f_R is among the most sensitive physiological variables to music, but its response is largely independent of music tempo. Changes in arousal and emotional states can at least partly explain the increase in f_R observed in the two music conditions. Music tempo does not appear to influence HR and $\dot{V}O_2$ when pedalling cadence is kept constant.

Biophysical, thermo-physiological, and perceptual determinants of cool-seeking behavior during exercise heat-stress in younger and older women

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Purpose: Hot weather and heat extremes have severe detrimental effects on women health, comfort, and productivity [1]. Yet, women continue to be largely unrepresented in autonomic and behavioral heat-stress research [2]. This knowledge gap provides barriers to develop interventions (e.g. personalised cooling) and solutions (e.g. body-mapped sport garments) that meet the thermal needs of women across different life stages [3]. This study aimed to evaluate the biophysical, thermo-physiological, and perceptual determinants of cool-seeking behavior during exercise heat-stress [4] in younger and older women.

Methods: Eleven younger (25 ± 5y; 1.7 ± 0.1 m; 63.1 ± 5.2 kg) and 11 older women (53 ± 6y; 1.7 ± 0.1 m; 65.4 ± 13.9 kg) performed a 40-min incremental cycling test (workload: 20 to 80W; 20-W increments at 10-min intervals) on a cycle-ergometer in a thermoneutral environment (22 ± 1.7 °C; 36 ± 4 RH). Throughout the test, a cooling probe ($25cm^2$) was secured to the participants' wrist, and they freely adjusted the probe's temperature to offset thermal discomfort arising from exercise heat-stress. We continuously recorded the probe-wrist interface temperature (T_i) to quantify participants' cool-seeking behavior. We also measured participants' rate of metabolic heat production (H_{prod}), changes in core temperature (T_{core}), in mean skin temperature (T_{sk}) and wetness (w) throughout the exercise. Finally, we quantified participants' cold sensitivity at the wrist via quantitative sensory testing prior to exercise.

Results: We found no differences in cool-seeking behavior's onset time (1.4 min [95%CI -4.8, 7.7]; p = 0.633), cooling amplitude (2.2 °C [-3.2, 7.7] p = 0.406) and minimum temperature recorded (-0.3 °C [-5.5, 4.9]; p = 0.908) between younger and older women. We also found no association between wrist cold sensitivity and cooling amplitude in younger (0.1; p = 0.349) and older women (0.08; p = 0.396). Multiple regression models indicated that changes in T_i were primarily described by changes in T_{core}, followed by w, T_{sk} and H_{prod} ($R^2 = 0.95 \pm 0.05$; $p < 0.001$) in both younger and older women. However, we observed a statistically significant decrease in the relative contribution of T_{core} to changes in $T_i$in the older women (-22% [3, 40]; p = 0.016).

Conclusions: Younger and older women present similar cool-seeking behavior characterization during exercise heat-stress; however,

older women' thermal behavior appears less reliant on changes in core temperature and more dependent on changes in multiple thermo-physiological (w, T_{sk}) and biophysical (H_{prod}) variables. Predictions of female cool-seeking behaviors based on thermo-physiological and biophysical variables should therefore consider the modulatory effect of ageing.

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A novel approach to assess metabolic flexibility by indirect calorimetry and related circulating metabolic parameters in humans

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Purpose: Metabolic flexibility (MF) is the ability to efficiently use and store glucose and fat, matching fuel availability and demand to periodic fasting. We propose a novel approach to assess MF by indirect calorimetry examining the metabolic responses and the relationships between peak fatty acid oxidation (PFO) and the maximum oxygen consumption (VO_2max) during ramp exercise tests.

Methods: 20 healthy volunteers (10 F; 10 M), aged 45–65, were stratified into two groups, high intensity (HI) and low intensity (LI) according to their referred physical activity intensity. Following overnight fasting, volunteers executed exercise tests on a leg cycle ergometer connected to a calorimeter to assess the gas respiratory exchange profile. We suggest a numerically measurable new MF index (MFI), calculated by the product of PFO, normalized per kg of free fat mass, and %VO_2max at PFO.

Results: We observed a two-fold difference of MFI values between the two groups ($p < 0.001$).HI had higher circulating levels of DHA/EPA ratio ($p < 0.05$), a marker of peroxisomal beta-oxidation induced by peroxisome proliferator activated receptor (PPAR)alpha, and oleoylethanolamide ($p < 0.01$), aPPAR alpha ligand, and lower levels of 2-arachidonoylglycerol ($p < 0.01$). MFI resulted positively correlated to DHA/EPA ratio and OEA, and negatively to 2-AG.

Conclusions: Our data suggest a modulation of the MF by the balance between PPARalpha and endocannabinoid systems activity. Ongoing studies are evaluating whether personalised nutritional and physical activity approach by modulating the balance of PPAR alpha/endocannabinoid system activityis able to modify MFI in order to validate it as reliable index of MF.

Performing swimming tests on pentathletes to estimate their performance

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Purpose: Modern pentathlon include horse riding, fencing, swimming, and combined laser shooting/cross-country running. Events can last 8 h during which the athletes face almost maximal energy and physiological demands. Even though the swimming phase accounts for just a 20% of the overall score, it is always the last discipline competed before the laser run. Since the effort exerted during previous events can influence the outcome of the following ones, achieving higher efficiency in swimming can be profitable to both, the swimming phase score and the laser run performance. The purpose of the study was to determine which parameter could be the most accurate predictor of swimming performance in pentathletes.

Methods: Fourteen male pentathletes (age 19.4 ± 0.9 years; height 182.1 ± 4.0 cm; weight 73.8 ± 7.2 kg) competing and training at Tier 4 Elite/International Level, underwent several testing sessions in the swimming flume and 50 m pool, with open and standard starts and turns, to detect their VO_2peak, critical velocity (CV); velocity at 2 and 4 $mM{\cdot}l^{-1}$ of blood lactate (v2, v4) and energy cost (EC).

Results: 200 m swimming time was 2: 18–2: 32 m: s (340 FINA points). CV was 1.21 ± 0.04 $m{\cdot}s^{-1}$, v2 resulted 1.14 ± 0.09 and v 4 1.23 ± 0.08 $m{\cdot}s^{-1}$. VO_2peak was 3540.1 ± 306.2 $ml{\cdot}min^{-1}$ or 48.8 ± 4.6 $ml{\cdot}kg^{-1}{\cdot}min^{-1}$. EC at 1.24 $m{\cdot}s^{-1}$ was 45.7 ± 2.4 $ml{\cdot}kg^{-1}{\cdot}min^{-1}$. A large correlation of CV with 200 m swimming performance ($r = -0.920$; $p < 0.001$) represents the main finding, with CV accounting for 85% of the variability in the performance.

Conclusions: Although the pentathletes included in the study competed at Elite/International level, the swimming phase resulted not critical for their performance in competition, with their 200 m swimming best time corresponding to a low swimmer's word ranking (340 out of 1000 FINA points). Among all the protocols analysed, CV is the most predictive and discriminative of individual swimming performance in this group of pentathletes. CV is accepted as the theoretic maximal swimming speed that can be maintained without exhaustion for a long period of time and has been proposed as invaluable in predicting the best possible race time for a given distance and for choosing race tactics that should optimize the performance outcome. Thus, CV appears as the most suitable aspect for an effective swimming training planning in elite pentathletes, being also costless and easy to administer.

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Comparison of the acute effects of foam rolling, foam rolling with dynamic movement and static stretching on the properties of ankle plantar flexors

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Purpose: The Foam Roller (FR) is effective in increasing the range of motion (ROM) without impairments in performance. Recently, non-rolling methods with FR have been investigated, but the effects of these methods are still unclear. This study aimed to compare and examine the effects of different FR interventions and static stretching (SS) on the plantar flexor (PF) muscles.
Methods: The dominant PF of 12 male participants (25.9 ± 2.9 years, 72.7 ± 14.5 kg, 170.6 ± 7.5 cm) was investigated. Each subject underwent four conditions at least 48 h apart and at the same time of the day (± 2 h): Control (CON), FR, FR with dynamic movement (FRD), and SS. Each condition (apart from CON) was performed unilaterally for 4 sets with a 30 s rest between each set. The FR included 30 rolls (15 in each direction) over a period of 30 s. The FRD included 15 plantar flexions and 15 dorsiflexion's of the ankle over a period of 30 s while compressing the PF at the mid of the muscle belly on the FR. SS included stretches of 4 sets with 30 s. The FR, FRD and SS intensity were performed until maximum tolerable. Outcome variables were ankle dorsiflexion ROM, pain pressure threshold (PPT), tissue hardness, localized Bioimpedance analysis (L-BIA), and unilateral drop jump (DJ) height. Measures were compared before (T0), immediately after (T1), and 10 m after the intervention (T2).
Results: Our results showed that ankle ROM ($p < 0.01$) and PPT ($p < 0.01$) significantly increased. In particular, PPT increased in all experimental conditions (except for CON), while ROM increased only for FR and SS but not for FRD despite a trend observed. Conversely, tissue hardness, L-BIA-derived vector length, and DJ height showed no significant change for all conditions. The results of this study showed that FR and SS were effective in increasing ankle ROM and increasing PPT. All values returned to baseline at T2.
Conclusions: Acute changes in ROM of the PF can be achieved by either FR or SS by a modification of pain perception without any variation in tissue morphology and hydration. No effects on performance were observed.

The effects of a static or dynamic stretching warm-up in preparing the knee for a change of direction exercise: a pre-post observational study

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Purpose: This research aimed to explore the impact of different warm-up methods and a 90° change of direction exercise (COD) on the thermal response of the knee using infrared thermography.
Methods: The study involved 40 healthy volunteers (20 males, 20 females) aged between 20 and 31 years, with thermograms collected using the FlirE54 infrared camera. The participants were divided into two groups, each assigned a static or dynamic warm-up routine. The investigation focused on four time points: baseline (T0), warm-up (T1), COD (T2), and rest (T3). Four regions of interest (ROI) were analyzed: anterior knee upper half (AUH), anterior knee lower half (ALH), posterior knee upper half (PUH), and posterior knee lower half (PLH). The statistical analysis involved repeated measures ANOVA with post hoc Tukey HSD test for pairwise comparisons and independent t-tests to identify temperature differences between the right and left knees at T1 and T2.
Results: The repeated measures ANOVA resulted significant for gender differences ($p < 0.001$) and temperature variations across the time points ($p < 0.001$) for all ROI, except but not for stretching. However, the post hoc test revealed significant differences between static and dynamic warm-ups in the female group during rest (T3) for AUH ($p = 0.047$; $p = 0.005$), PUH ($p = 0.010$; $p = 0.023$), and PLH ($p = 0.012$; $p = 0.025$). The independent t-test comparing the right and left knees at T1 and T2 did not yield any significant findings.
Conclusions: Static warm-up was found to be more effective in preparing the knee to perform subsequent exercise in ALH and PUH for both males and females, and in the PLH only in females.

Application of video analysis integrated with artificial intelligence for Performance assessment in artistic roller skating: a pilot study

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Purpose: This study aims to present the use of modern 2D Human Pose video analysis techniques integrated with artificial intelligence in artistic roller skating. This allows us to analyze and evaluate athletes' performance in a more sophisticated and accurate way.
Methods: Two athletes of different levels (high-level and middle-level) performed two types of technical jumps double Toe-loop and Axel. Measurements regarding the kinematic parameters of the jumps were conducted with a Stereolabs ZED2 camera. The camera was positioned 132 cm above the ground and, the reference system has its origin position in the left camera of the stereoscopic device, which is positioned on the y-axis; the x-axis is the one that crosses the optical plane, and the z-axis is the one orthogonal to the previous two pointing upward. The image resolution was 2560 × 720 at 60 fps, and the left and right images were 1280 × 720 pixels each.
Results: The comparison of the double Toe-loops of the high-level subject shows that the horizontal forward velocity is similar in the tests performed while the values of the angular velocities in the last half turn seem to be related to the jump height (978.26°/s-39.42 cm; 1090.90°/s- 34.96 cm). The axel analysis showed that the horizontal velocities between the high and middle level were different (5.21Vs4.37 m/s), and especially in the high-level there was a lower

horizontal velocity in the phase from loading to take-off (3.76 m/s) while in the middle-level there was a higher velocity (5.31 m/s). In the phase from the take-off to the finish, on the other hand, the highest velocity was recorded in the high-level athlete 4.75 m/s. There are also differences in angular velocities as reported by (Romagnoli et al., 2020) in the case of the axel, the middle-level athlete records a higher angular velocity (1208.05°/s) than the high-level athlete (636.04°/s), especially in the last half-turn phase of the jump.

Conclusions: This study shows the potential application of 2D human pose video analysis integrated with artificial intelligence in artistic roller skating performances. The results of this study seem to align with the kinematics and biomechanics of the various jumping techniques of artistic roller skating present in the scientific literature. Further studies need to verify the application of this new assessment method in artistic roller skating with a more appropriate dimension of sample size and also in other sportive disciplines.

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GET ahead of the game: the benefits of specific tennis training with flywheel device in over 40 adults

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Purpose: Tennis is evolving to demand greater dynamism and speed, with faster game actions related both upper and lower limbs. Flywheel devices offer the advantage of enabling maximal force development throughout the complete range of motion in a specific manner. This is a Randomized Controlled Trial (RCT) to evaluate the effect of 8 weeks of accentuated eccentric training on physical performance and shot precision in adult tennis players, compared to an isotonic training protocol.

Methods: Twenty-seven male tennis players (age = 54.67 ± 9.24) were recruited and randomly assigned to the accentuated eccentric training group (AET) (n = 13) and to an isotonic training group (IT) (n = 14). The training protocols were performed two days per week, after 10 min of moderate intensity warm-up. The AET consisting of 3 sets of 8 repetition of 7 exercises, all performed with the device positioned behind the athlete: forehand and backhand movements (low, middle and high each one), and One-handed shoulder press; the control group performed the same number of sets and repetitions of 7 typical strength exercises such as chest and shoulder press and butterfly and lateral raises. The Borg's Rate of Perceived Exertion scale CR-10 (RPE) was used to ensure a similar workout intensity between the two protocols. The assessment included 30 s-arm curl test, Medicine ball throw test (MBT) and forehand and backhand shoot precision test.

Results: Significant effect of time ($F_{(1,25)} = 13.09$; $p = 0.001$) for the AET and interaction time*group was found ($F_{(1,25)} = 5.21$; $p = 0.031$) in 30 s-arm curl. Significant difference was found between group ($F_{(1,25)} = 8.70$; $p = 0.007$) in forehand shoot precision test where AET group achieve better score than the control group and significant interaction time*group was found ($F_{(1,25)} = 8.35$; $p = 0.008$), while, in shoot backhand precision test, significant effect of time ($F_{(1,25)} = 5.01$; $p = 0.034$) and significant interaction time*group was found ($F_{(1,25)} = 4.50$; $p = 0.044$), but no significant difference between groups.

Conclusions: The direct application of device overload to specific athletic movements enhanced neuromuscular coordination by training the nervous system and automating movements during physical activities. This process strengthens motor patterns, resulting in improved neural efficiency and enhanced neuromuscular performance.

Listening to pre-task music enhance reaction time and affective states in elite taekwondo athletes

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Purpose: Listening to different types of music during exercise could influence sport performance differently. Indeed, both motivational (RM) (tempo > 120 beats per minute) and self-selected music (SM) have been reported to improve athletes' performance. However, it is unclear whether the main effect of music on performance is due to its intrinsic characteristics or by the evoked affective responses. Therefore, the aim of the study was to investigate the effect of SM and PM on choice visual reaction time and affective responses in elite Taekwondo athletes.

Methods: Twenty young Taekwondo athletes (mean age: 17.5 ± 2.5 years) performed a visual choice reaction time composed by thirty stimuli using the FitLight training system after three different warm-up conditions: self-selected music (SM), research-selected music (RM) or no music (CC). Athletes performed the roundhouse kick at different heights according to the colour stimuli: green colour—roundhouse kick to the head; blue colour—roundhouse kick to the abdomen; and red light—no action. Moreover, before (T_0) and after the warm-up (T_1), the Feeling Scale (FS) and the Felt Arousal Scale (FAS) were administered in all test conditions.

Results: Reaction time was significantly lower in SM (813.0 ± 68.7 ms) and RM (806.2 ± 69.8 ms) conditions compared to CC (844.1 ± 76.3 ms, $p < 0.01$ and $p < 0.05$, respectively). No difference between SM and RM was observed. FS was significantly ($p < 0.05$) higher at T_1 compared to T_0 (4.0 ± 1.8 vs 3.0 ± 2.0, respectively) in SM and RM conditions (4.0 ± 1.0 vs 3.0 ± 2.0, respectively). No difference was observed for FS between T_1 and T_0 in CC. FAS was significantly ($p < 0.01$) higher at T_1 than at T_0 in the SM (5.0 ± 1.0 vs 3.0 ± 2.5, respectively) and RM conditions (5.0 ± 1.0 vs 4.0 ± 1.7, respectively). No difference was observed for FAS between T_1 and T_0 in CC.

Conclusions: Both pre-task SM and RM improved choice visual reaction times in elite Taekwondo athletes. Moreover, athletes perceived a pleasant high activation state after being exposed to music (T_1). These results suggest that music may be used as a performance-enhancing tool prior to combat competition or training in martial arts.

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Prediction equation for estimating isometric knee extension strength using handgrip test in obesity

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Purpose: Muscular function is negatively affected by obesity and ageing. Grip Strength (GS) is a simple and reliable measure of maximum voluntary muscle strength and is a powerful predictor of functional limitation and poor quality of life. However, GS as a marker of global muscle function is debated in obesity. Therefore, the use of other evaluation protocols involving lower limbs may be considered in clinical settings. This study investigates the correlation between GS and isometric Knee Extensors' Strength (KES). Moreover, a practical reference equation to estimate KES will be established.

Methods: Anthropometric characteristics, body composition, GS and KES were evaluated in thirty-nine males (age: 46.3 ± 13.4 years, BMI: 33.8 ± 6.7 kg/m^2) and thirty-nine females (age: 43.6 ± 14.5 years, BMI: 35.4 ± 6.3 kg/m^2). GS was evaluated on the dominant hand using the handgrip test, while KES was assessed on the dominant lower limb using an isometric dynamometer. Multiple regression analysis for KES, including anthropometric, body composition, and GS parameters as independent variables was performed for both genders.

Results: In males, a positive correlation between KES and body weight (r = 0.318, p = 0.05), body mass index (r = 0.318, p = 0.05), muscle mass (r = 0.375, p = 0.02), and GS (r = 0.589, $p < 0.01$) was found. In females, KES was positively correlated with GS (r = 0.453, $p < 0.01$), and negatively with age (r = – 0.706, $p < 0.01$). Two gender-specific equations were developed: for males KES = – 76.130—(body weight [kg] x -3.096) + (BMI [kg/m^2] × 16.116) + (GS [kgf] × 7.764) and for females KES = 448.623—(age [year] × 3.799) + (GS [kgf] × 2.841).

Conclusions: GS correlates with isometric knee extension strength in-patient affected by obesity. GS together with anthropometric parameters and age may be used to predict KES when isometric maximal tests cannot be performed. Moreover, the prediction equations are gender related.

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Exists an estimate point from which physical activity has a moderator effect on the relationship between sleep and bmi in obese adults?

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Purpose: Aim of the present study was to evaluate the physical activity moderation effect on the relationship between sleep quality and BMI in obese adults since studies suggest that increased physical activity lowers the risk of obesity that is one of the main causes of sleep disorders [1]. Likewise, inadequate sleep duration and quality may be considered as new risk factors for the development of obesity and its complications [2].

Methods: 589 white European subjects (50 ± 12.2 yrs; 65% females) were recruited from the International Center for the Assessment of Nutritional Status, University of Milan, Italy. They filled out the *Godin-Shephard Leisure Time Physical Activity Questionnaire* (GSL-TPAQ) and the *Pittsburgh Sleep Quality Index* (PSQI) to evaluate physical activity levels and sleep behavior respectively.

Results: Based on the questionnaires scores, the participants were classified as inactive (n = 93, 16%), moderately active (n = 119, 20%), active (n = 377, 64%), bad sleepers (n = 274, 46%) and good sleepers (n = 315, 54%). Moderation analysis revealed a significant moderation effect of physical activity in the relationship between sleep quality and BMI, with higher levels of physical activity leading to better sleep quality. In particular, the adverse effect of reduced sleep quality, based on PSQI score, on BMI could be ameliorated for those who were more active.

Conclusions: The present findings suggest new aspects relating to the effect of physical activity as an important aspect that seem to be favorable in improving the obesity condition. Therefore, maintaining an active lifestyle could represent a good integrative strategy for fighting obesity.

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Analysis of intrinsic and extrinsic barriers to physical activity practice in people with type Ii diabetes: preliminary results from a survey conducted in hospital by kinesiologists

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Purpose: Regular physical activity (PA) is a protective factor and represents a key challenge for people with chronic diseases, such as diabetes, in a view of their own health. Therefore, the World Health Organization guidelines, recommend at least 150 min of moderate-intensity PA per week to this target. Nonetheless, PA levels are worryingly low among people with diabetes. In this scenario, kinesiologists can play a fundamental role in raising awareness about healthy lifestyle in order to promote PA, reducing sedentary behavior, hence improving health. Thus, the aim of this survey was to introduce and inform about the kinesiologists' role and investigate barriers towards PA practice in people living with type II diabetes, in a view to tackle the situation providing future PA promotion strategies.

Methods: People with type II diabetes recruited by the Therapeutic Educational Team of the Diabetes Operating Units coordinated by the Endocrinologist, were involved in the survey carried out at the Hospital of Rimini. During the usual check-ups carried out by the Endocrinologist, patients were invited to participate in the survey conducted by the kinesiologists. The following surveys were conducted: Intrinsic and Extrinsic Barriers to PA adherence (adapted from Korkiakangas et al., 2009); PA levels using the International Physical Activity Questionnaire (IPAQ) and finally attitude to change using the Patient-centered Assessment and Counseling for Exercise (PACE) questionnaire.
Results: Preliminary analysis was conducted on a sample of 31 subjects with type II diabetes, mean age 55.02 ± 15.44 years (51.6% females, 48.4% males). Concerning Intrinsic and Extrinsic Barriers to PA, results show that the main intrinsic barriers reported were: fatigue (51.6%), laziness (45.2%) stress and pain (41.9%). Interestingly, 35.5% declared that performing PA has low priority. Among the extrinsic barriers the majority of the sample reported none (32.3%). In connection, the other extrinsic options selected by participants were the following: no one to perform PA with (29%) and bad weather (25.8%).
Conclusions: Preliminary findings suggest that people living with type II diabetes need to be trained in order to tackle barriers and support PA promotion. In light of this, kinesiologists, collaborating with healthcare professionals, can play a crucial role to implement new intervention strategies enhancing people self-efficacy, empowerment and health.

Effects of physical exercise on depression and anxiety following mastectomy

Purpose: Chronic post-mastectomy pain is a condition characterized by pain in the anterior chest, armpit, and/or upper arm, usually ipsilateral to surgery, which begins after mastectomy or quadrantectomy and persists for longer three months after surgery; it interferes with daily life and can lead to depression and anxiety. Several sudies suggest a probable links between chronic postsurgical pain and psychological vulnerability, depression and stress. Moreover, catastrophizing is a well-documented risk factor for poor relief for chronic pain. The benefits of physical activity on the general population have been extensively studied. It has been shown that physical activity in cancer patients allows the recovery of the previous functional capacities, strength and flexibility, improvement of the pain symptom, depression and axiety level, as well as the reduction of alterations in the haematological picture such as neutropenia, anemia, thrombocytopenia. Objective of the study is to evaluate the effects of physical exercise on chronic post surgery pain perception, depression and axiety and related haematological biomarkers (Brain Derived Neutrophic Factcor, AdrenoCorticoTropic Hormone, and cortisol) in women undergoing postmastectomy.
Methods: **A** prospective observational unicentric cohort study was designed by recruiting women undergoing unilateral or bilateral mastectomy due to resection of stage II and III breast cancer followed by immediate breast reconstruction o delayed aging 18 years or over. Stages 0 and I were excluded due to possible and frequent absence of pain. Stage IV was excluded as pain can be originated from any metastases. Pain assessment and the motor activity of each participant in the study was measured 3 and 6 months after the intervention. At the same timepoints biomarkers such as BDNF, ACTH and cortisol were measured in the blood of patients. To assess pain, depression and anxiety were assessed by verbal administration of the following questionnaires: Numeric rating Scale, Brief Inventory Pain, Beck Depression Inventory and General Anxiety Disorder-7 respectively. Physical activity was measured with International Physical Activity Questionnair. Haematological biomarkers considered BDNF, ACTH and cortisol, were evaluated 3 and 6 months after mastectomy.
Results: Results show that physical exercise reduces intensity of pain and its interference with quality of life; moreover, in women with higher physical activity, results show a reduction of anxiety and depression levels and an increase of BDNF and reduction of cortisol and ACTH levels in comparison with women with lower physical activity level.
Conclusions: Physical exercise seems to reduce pain intensity, anxiety and depression together with increase of BDNF level and reduction of cortisol and ACTH.

Dose–Response effects on low back pain, sleep disturbances and depression of an online prenatal, and post-partum pilates-based program during the covid-19 lockdown

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Purpose: this study was designed to primarily test, in pregnant women, the health effects of a pre-partum, online Pilates-based program on low back pain (LBP) severity, sleep disturbances, mood and depression levels. Secondly, we verified whether continuing the program post-partum resulted in further beneficial effects. Finally, we planned to appraise the magnitude of the effect depending on the amount of exercise accomplished.
Methods: 136 voluntary pregnant women were screened against the eligibility criteria (being under the care of a gynecologist certifying low-risk pregnancy; 18–45 years of age; single pregnancy; 20–28 weeks gestational age, normal body mass index). Participants completed a Pilates-based telerehabilitation program during pregnancy and after delivery, through an online platform (*Gravidanza in Forma*® https: //www.gravidanzainforma.com/) guided by a Pilates, Yoga and Lagree Method Certificate Instructor. The outcome mea sures (weight control, LBP disability, sleep quality, mood, and mental health) were assessed at baseline and at the completion of the pre-partum and post-partum programs.
Results: significant gains in weight at large effect sizes only in low (+ 12.2%; $p < 0.0001$; $d = 1.0$) and intermediate exercisers (+ 9.6%; $p < 0.0001$; $d = 1.0$) were found. A significant increase in LBP-related disability in low (+ 93.1%; $p < 0.0001$; $d = 0.99$) and intermediate exercisers (+ 84.9%; $p < 0.0001$; $d = 0.99$) was detected, while high exercisers did not display significant increase in disability (+ 42.7%; $p = 0.21$; $d = 0.24$). Significant increase in sleep disturbance in low- (+ 24.3%; $p = 0.005$; $d = 0.80$) but not in intermediate- (+ 4.6%; $p = 0.50$; $d = 0.10$) and high-amount exercisers (-0.1%; $p = 0.91$; $d = 0.10$) was found. Significant increases in depression in all groups of exercisers, at large effect sizes, were detected. Regarding mental health, no effects were detected. After post-partum intervention, for sleep disturbances and depression, significant reductions only in intermediate exercisers were found (-24.1%; $p = 0.003$; $d = 0.89$ and -15.9%; $p = 0.04$; $d = 0.55$; respectively).
Conclusions: in a cohort of 136 pregnant women, approximately 270 min of home-based, tele-Pilates exercise were needed to prevent LBP worsening, and sleep deterioration. A different pattern was outlined for those women who resumed the Pilates activity post-

partum, as a "dose" of 150 min emerged as the amount of exercise capable to induce the larger improvements in LBP, sleep, and mood disturbances.

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Association between fitness, fatness, and all-cause mortality in outpatients with cardiovascular disease: a prospective cohort study

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Purpose: Cardiorespiratory fitness (CRF) levels and obesity conditions have been recognized as well-established predictors of cardiometabolic risk and premature mortality. This study aims to investigate the relationship between CRF, fatness, and all-cause mortality in a cohort of cardiac patients.

Methods: Data were extracted from the ITER study (NCT05817305). The sample was composed of 2375 cardiac patients involved in a secondary prevention program between 1997 and 2020 with available data in this analysis. CRF was estimated through the 1-km Treadmill Walking Test. Body Mass Index (BMI) was measured at each visit. Body Fat Percentage (%BF) was estimated through the Jackson-Pollock equation. The main outcome was all-cause mortality. Patients were subdivided into two groups based on the median of CRF and subsequently categorized considering BMI or %BF levels. Therefore, six fitness-fatness categories were created. For each patient, the follow-up ended on the first date between death or the end of the follow-up. Cox proportional hazard models, adjusted for traditional confounding factors, were performed. People with higher CRF and lower fatness values were considered the reference group. All results are reported as hazard ratios (HR) and 95% confidence intervals (CI).

Results: The median follow-up period was 10.4 years, during which a total of 677 patients died. After adjusting for confounding factors, all combinations were associated with an increased risk of mortality as compared with the reference group. Considering the association between CRF and BMI, relevant variations were observed in overweight-unfit (HR 1.99 [95% CI: 1.49, 2.63; $p < 0.0001$]), and obese-unfit patients (HR 1.77 [95% CI 1.31,2.38; $p < 0.0001$]), compared to those with higher CRF. This trend was confirmed by considering the association with %BF, where similar magnitudes were observed in the normal BF-unfit and high BF-unfit groups (HR 2.29 [95% CI: 1.73, 3.03; $p < 0.0001$], and HR 1.99 [95% CI: 1.51,2.65; $p < 0.0001$], respectively).

Conclusions: CRF is confirmed to be a powerful predictor of mortality. While a high BMI has been associated with an increased risk of death, maintaining physical fitness can mitigate this risk among overweight or obese people. The magnitude of this impact is significant for the general population, and even more for cardiac patients. Therefore, these findings support the pivotal role of CRF in exercise assessment and prescription within secondary prevention programs.

The influence of maturation on jump performance and dynamic postural control in youth female volleyball players

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Purpose: Volleyball performance heavily relies on biomechanical determinants related to the ballistic nature of the sport, such as vertical jump, reactive strength, and postural control.[1,2] Although it has been shown that movement patterns are altered across maturation in female adolescent athletes[3], no research has investigated how these key determinants may be influenced. This study aimed to compare jump variables and postural control among young volleyball players of different age categories.

Methods: Thirty-eight female volleyball players belonging to three different age categories (12 U13: 12.53 ± 0.46 yrs; 11 U14: 13.86 ± 0.29 yrs; 15 U16: 15.43 ± 0.59 yrs) participated in the study. After anthropometric measurements, the maturity offset (MO) was computed as the estimated time to/from the peak height velocity.[4] Countermovement jumps (CMJ) and dynamic postural control during 90° squats were evaluated on 3-D force plates. For CMJ, jump performance and force production variables were computed, while the center of pressure (CoP) displacement was quantified during the squats. One-way ANOVA tested the differences among age groups ($\alpha = 0.05$, Tukey correction for pairwise comparisons).

Results: MO significantly differed among all age groups (0.8 vs. 2.0 vs. 3.4 yrs, ps < 0.001). U16 and U14 demonstrated greater CMJ height ($p < 0.001$ and $p = 0.004$), momentum ($p < 0.001$ and $p = 0.001$), flight time (ps < 0.001), takeoff velocity ($p < 0.001$ and $p = 0.009$), and concentric peak power (ps < 0.001) than U13, while U16 exhibited higher reactive strength index ($p = 0.006$) and U14 greater concentric peak force ($p = 0.025$) than U13. U16 exhibited an increased anterior–posterior (AP) CoP range during squats compared to U13 ($p = 0.021$).

Conclusions: The results demonstrated that groups varied in biological maturation, quantified by MO. U16 outperformed U13 in terms of all jump performance variables. However, force production in the eccentric CMJ phase and postural control (except for the AP range) were similar among the categories. The present findings suggest that biological maturation may affect some key determinants in young volleyball players, such as jump metrics, while force production and postural control seem more stabilized in the investigated age range.

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Throwing and catching in real and virtual environments: a novel approach for studying complex motor behavior and motor skills

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Purpose: Our goal was to design a novel approach for conducting rigorous studies of naturalistic motor behavior. We focused on a throwing-catching paradigm exemplifying the production and control of complex actions during the interaction with others.
Methods: We recorded full-body kinematics of throwing and catching actions in real and virtual environments. The analysis of real throws kinematics followed different steps. A spatio-temporal principal component analysis (stPCA) was designed to achieve low-dimensional descriptions, which next fed machine learning algorithms. Classification and clustering were applied at the interindividual level to characterize throwing behavior across non-trained adults. Classification methods applied at the individual level served the extraction of spatio-temporal maps quantifying the accuracy with which it is possible to anticipate the outgoing ball direction based on chunks of kinematics from different body segments. These results supported the design of an experimental protocol aimed at assessing predictive skills and their role in a throwing-catching task. The protocol was implemented as an immersive virtual reality scenario whereby participants had to intercept balls thrown by avatars animated with real kinematics previously recorded and characterized in terms of their predictability and throwing strategy.
Results: The whole-body throwing kinematics can be described in a stPCA space of 5 (to 20) dimensions, with variance explained of 75% (to 95%). Interindividual comparisons of these compact descriptions revealed clear differences across individuals and genders, and a set of four throwing strategies that resemble the main phases of throwing skill acquisition during development. The spatiotemporal structure of the throwing predictability revealed how the throwing kinematics brings advanced information (up to 400 ms before ball release) about the outgoing ball direction, via a set of body segments that varies with the individual throwing strategy. Analysis of the catching performance in the VR experiment showed that non-trained adults can decode this information to improve their interceptive performance.
Conclusions: Beside providing new insights into the sensorimotor mechanisms involved in throwing and catching performance, our approach provides a practical paradigm that can be extended to other interactive motor tasks to support the quantitative study of complex motor behavior and skill acquisition in naturalistic settings.

Are rate of force development and force complexity the two sides of the same coin? Concurrent effects of fatigue after repeated explosive contractions of dorsiflexor muscles

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Purpose: The loss of maximal voluntary force (MVF) and rate of force development (RFD) are considered valid approaches to measuring muscle fatigue[1]. Moreover, the changes in the magnitude and complexity of force fluctuations may have important functional consequences[2]. We hypothesised that muscle fatigue would induce a decline in contraction quickness and a deterioration in force control as evidenced by a decrease in force steadiness and complexity. We furthermore hypothesized that the decline in RFD would influence the decline in force steadiness and complexity.
Methods: 14 male adults were seated with the ankle inserted in the dynamometer with 64-channel HDsEMG placed over the tibialis. The fatiguing protocol consisted of a series of explosive dorsiflexions, interspersed by 4 s, with a holding phase of 6 s at 70% of MVF. All the data were divided into five equal blocks to compare the effects of the task, making the number of contractions between subjects comparable. RFD_{peak}, RFD_{50}, RFD_{100} and RFD_{150} were calculated with the ascending part of the onset while approximate entropy (ApEn), detrended fluctuation analysis (DFAα) and the coefficient of variation (CoV) were calculated with the stable part.
Results: Subjects performed 24 ± 11 contractions. RFD_{peak} decreased over the time by -40% ($F(1.75, 22.76) = 23.736$; $p < 0.001$; $\eta2 = 0.646$), RFD_{100} by -39% ($F(1.90, 24.72) = 12.632$; $p < 0.001$; $\eta2 = 0.493$), RFD_{150} by -36% ($F(1.81,23.61) = 24.203$; $p < 0.001$; $\eta2 = 0.651$) while RFD_{50} did not change ($F(2.46, 32.04) = 2.456$; $p = 0.09$). EMG signals did not change significantly. ANOVA showed an increased in DFAα by 10% ($F(2.09, 27.23) = 8.856$; $p < 0.001$; $\eta2 = 0.405$). ApEn showed a tendency to decrease but not significantly ($F(1.75, 22.79) = 1, 790$; $p = 0.192$) while CoV increased by 15% ($F(4, 52) = 13.465$; $p < 0.001$; $\eta2 = 0.509$). Repeated measures correlations analysis showed a negative correlation between RFD_{peak} and DFAα ($\approx$-51%), CoV ($\approx$-37%), while ApEn showed a positive correlation ($\approx$44%).
Conclusions: The slowing of force production capacities, as evidenced by RFD decline, smooth out the complexity and decreases the force control because it lessens the rapidity of adjustments around the target force. The fatiguing task worsened the force production capacity and control overall which was evidenced by a decreased MVF, a longer time to peak force, a lower RFD, greater force fluctuations and lower force complexity.
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Gait variability reduction during rhythmic acoustic stimulation in elderly subjects: a network-based approach

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Purpose: Rhythmic acoustic stimulation(RAS) is a promising approach to improve motor control in the elderly. Numerous studies demonstrated that RAS based on average cadence positively impacts dynamic balance[1]. However, the effects of RAS appear to have no significant effect on gait variability in terms of spatiotemporal parameters[2]. Our study aimed to evaluate the potential of RAS to reduce gait variability in elderly individuals using a comprehensive body-based network analysis approach.

Methods: We recruited 12 healthy elderly individuals aged 65 to 85 years. 3D-gait analysis data were obtained and 55 passive markers placed on anatomical landmarks of the body. Participants performed walking trials under 4 experimental conditions: simple walking(SW) and walking with RAS at frequencies corresponding to 90%, 110%, and 100% of their mean cadence. By treating the body as a network, with anatomical landmarks as nodes and kinematic synchronisations as connections, we constructed subject-specific covariance matrices (kinectomes). Within each experimental condition, we calculated the similarity score (S-scores) by correlating the kinectomes of gait cycles. The experimental conditions were compared with SW.
Results: Our analysis revealed significant differences in the S-scores among the experimental conditions. Specifically, the S-scores for RAS at 100% and 90% of the mean cadence were significantly higher than the S-score for SW ($p = 0.018$ and $p = 0.007$). However, no statistically significant difference was observed when comparing SW with RAS at 110% of the mean cadence ($p = 0.07$).
Conclusions: The S-scores of the experimental conditions were higher than those of SW. Hence, RAS reduces movement variability, which is in contrast with previous literature, failing to consider the interrelationship between different body parts, thus overlooking valuable information[2]. In conclusion, our study highlighted the importance of adopting novel methodological approaches that consider the entire body, rather than focusing solely on specific parts.
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Kinematic analysis of the barbell trajectory during the deadlift exercise

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Purpose: Our study analyzed the effects of fatigue on the barbell kinematic in the Deadlift exercise under maximal and submaximal conditions in a group of amateur Resistance Training practitioners.
Methods: 9 young males (26, 8 ± 4, 2 yrs, weight 76, 8 ± 9, 1 kg, height 179, 1 ± 10, 2 cm, BMI 23, 9 ± 1, 6) with 22, 2 ± 17 months of experience in Deadlift took part in the two sessions of the study. The first one aimed to measure the 1RM of each participant. The second one consisted in three sets to technical failure at the 85%, 70%, 50% of the 1RM. 2D kinematic analysis of the barbell displacement was conducted through the video recording of each set. Data were processed through Kinovea and Excel. For our study we considered the Horizontal Displacement (HD), the Vertical Displacement (VD) normalized on each participant's height, Mean Vertical Velocity (MVV), Peak Vertical Velocity (PVV), Distance (D), Trajectory (T), Length (L), which is the length of the line joining the lowest and the highest points reached by the barbell, and TL Index, which is the Trajectory / Length ratio. Statistical analysis were carried out by ANOVA and Bonferroni's post-hoc test.
Results: Analyzing VD, repetitions comparisons during the sets showed a significant difference (P = 0, 007), with decreasing values between the first and the last repetitions. MVV showed a highly significant difference between submaximal loads ($P < 0, 0001$) and a significant difference between 1RM and submaximal loads (P = 0, 001). PVV showed a highly significant difference between 1RM and submaximal loads (P = 0, 0007). TL index value increases and deviates from the ideal reference (1). Mean differences of TL index between loads show a decreasing trend when submaximal loads increase: difference 1RM vs 50% = 0, 02024; 1RM vs 70% = 0, 01814; 1RM vs 85% = 0, 01364.
Conclusions: Sets to failure modify technique at a point which potentially makes them unsafe. Fatigue is responsible for technique modifications as well: during the set HD and T increase while VD, MVV and PVV decrease. Load affects the technique too: higher loads induce lower MVV, PVV and VD and higher HD and TL. The ideal T for the Deadlift is not defined: TL index supplies useful information to establish the adherence of the barbell displacement to a vertical trajectory. Still, it doesn't supply a qualitative evaluation of the lift because it's not sure whether a totally vertical trajectory is the best.
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Effect of a four-week training with unstable boards on postural control mechanisms

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Purpose: The center of pressure (CoP) trajectory could be analyzed as a physiological time series through a stochastic framework (Stabilogram Diffusion Analysis—SDA) and quantifying the CoP regularity (Sample Entropy—SampEn). We aimed to understand whether the training with unstable boards could influence postural control mechanisms showing a shift from automatic to voluntary control in the trained balance task. Moreover, we aimed to study whether the balance training was transferred to (i) a more challenging and (ii) an untrained balance task.
Methods: The eight recruited subjects (25.1 ± 3.6yrs; 1.75 ± 0.09 m; 69.3 ± 10.7 kg) underwent a one-month training (3 days/week) with unstable boards. They performed a testing session before (T_0) and after (T_1) the training program consisting of three tasks: static balance (ST), dynamic balance on easy (EAL) and hard (HAL) level unstable boards, and balance under unexpected perturbation of the base of support (PER). During ST, the subjects quietly stood on a force plate. During both EAL and HAL, subjects stood on an unstable board over a force plate, aiming to maintain the board parallel to the ground. During PER, subjects received an expected perturbation of the base of support (direction: backward; displacement: 50 mm; ramp rate: 200 mm/s). The displacement (Area95) and mean velocity (Unit path) of the CoP were considered. During EAL and HAL, an inertial measurement unit recorded the angular displacement to calculate three parameters of balance performance: full (FB), fine (FiB), and gross (GB) balance. During PER, the first peak, the maximal oscillations, and the standard deviation of the CoP trajectory were calculated in the 2.5 s window after the perturbation.
Results: Two-way ANOVA showed improvements of balance performance (T_0 vs. T_1) both in EAL and HAL conditions for FB ($p < 0.001$), FiB ($p < 0.05$), and GB ($p < 0.01$). The PER task had no significant increases (T_0 vs T_1). SDA and SampEn parameters showed a less random ($p < 0.01$) and automatic ($p < 0.001$) postural control system, respectively.
Conclusions: The one-month training successfully improved dynamic balance performance. A transfer of the balance ability was observed towards a more difficult (i.e., easy to hard) but no to an

untrained (i.e., unexpected perturbation) balance task. The non-linear CoP measures (i.e., SDA and SampEn) showed a more tightly regulated control system and a shift from voluntary to automatic postural control mechanisms.

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Sprinting on different surfaces: performance decrements in young soccer players

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Purpose: The sand surface, in the face of widespread and widespread use in both rehabilitation courses and specific training sessions, is only recently gaining research attention in soccer (Rago et al., 2019). In a particular way, soccer training at both youth and professional levels tries to make use of new motor tasks and new strategies to prepare the athlete, whether young or advanced, in a way that is increasingly adapted to the demands of the performance model (Pereira et al., 2023). The aim of the study is to analyse and understand the differences in performance in sprint tests performed on sand and on a conventional surface in young soccer players.

Methods: 25 young male soccer players (16.22 ± 0.54 years, 53.16 ± 2.69 kg; 171.1 ± 5.2 cm, age training: 9.1 ± 1.1 years) were involved in the study. In two different evaluation sessions, the young players performed two acceleration tests (10 m and 20 m) on a conventional surface (natural grass) and two acceleration tests on sand. They random performed four tests for each and were considered the best (3 min recovery). The tests were measured with photocells (Globus, Italy).

Results: The results of the 10-m sprint tests on a conventional surface (natural grass) and sand showed statistically significant differences in favour of performance on grass (1.29 ± 0.11 s vs. 1.68 ± 0.12 s, $p > 0.001$, ES: 3.38). The results of the 20-m sprint test on a conventional surface (natural grass) and sand showed statistically significant differences in favour of performance on grass (2.19 ± 0.33 s vs 2.72 ± 0.29 s, $p > 0.001$, ES: 1.71).

Conclusions: Sand constitutes a popular medium for stressing acceleration ability in soccer training. The performance decrements in the 10-m (-23%) and 20-m (-19.5%) sprint tests, lead to the assumption that sand constitutes a functional overload for the needs of the young soccer player.

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The role of normoxic ventilation and peak blood lactate for the prediction of acute mountain sickness

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Purpose: Acute mountain sickness (AMS) is a common condition in those with reduced tolerance to high altitudes. Hypoxemia is the substrate for AMS development: in detail, SaO_2 after 30' of acute exposure to hypoxia is the most predictive clinical parameter for AMS. Efforts have been made to estimate AMS susceptibility in normoxic conditions, by focusing on ventilatory parameters and, with less emphasis, on anaerobic metabolism. Our hypothesis is that AMS susceptibility could be estimated by focusing on cardiorespiratory parameters and lactate ([La]) metabolism during exercise.

Methods: 25 healthy volunteers (age 30.6 ± 3.5 years; M: F = 19: 6) were evaluated on two occasions within a 1-week period. Normoxia session included 30 min of seated rest, followed by maximal incremental treadmill exercise at 25% incline. Hypoxic session took place in an environmental chamber with $FiO_2 \sim 12\%$ and consisted of 30' of seated rest. SaO_2 was continuously monitored on the right auricular lobe. Subjects were divided into AMS non-susceptible (NS) and susceptible (S) groups based on SaO_2 threshold of 78%. Blood [La] and pulmonary $\dot{V}O_2$ were recorded. Results were evaluated using parametric tests and correlation analysis. Logistic regression model used normoxia variables to predict $SaO_2 < 78\%$ during hypoxic exposure.

Results: S group had lower rest hypoxic SaO_2 than NS, with a more pronounced decrease after 30' (72.7 ± 4.4 vs. 80.9 ± 2.1%; $p < 0.001$). Normoxia rest ventilation ($\dot{V}E$) decreased with rest ($p = 0.033$), but in NS group it is always higher than S group, especially during the first 5' (11.4 ± 1.7 vs 9.7 ± 1.2 L/min; $p = 0.033$). No differences at peak exercise in exhaustion time ($p = 0.584$) and $\dot{V}O_{2max}$ ($p = 0.123$). There was higher [La] in S group at peak exercise (13.8 ± 1.9 vs 11.2 ± 1.8 mmol/L; $p = 0.016$). SaO_2 after 30' of hypoxia correlated with [La] at peak ($r = -0.447$; $p = 0.025$) and rest $\dot{V}E$ after 5' ($r = 0.423$; $p = 0.039$). With these variables, a logistic regression predicting $SaO_2 < 78\%$ in hypoxia was predicted with 88% accuracy (Sensitivity = 94%; Specificity = 78%; AUC = 0.924).

Conclusions: Our study suggests that an assessment of resting $\dot{V}E$ and [La] at the peak of exertion can help predict AMS. This could be useful to evaluate trekkers and athletes who aim to reach high altitudes, adding important information to overall cardiorespiratory fitness and planning of the training.

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Athletic bioimpedance-based equations underestimate fat free mass components in elite soccer players: development and validation of new soccer-specific predictive models

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Purpose: Bioelectrical impedance analysis (BIA) is a fast and user-friendly technique for assessing body composition in sports. To date, no sport-specific predictive equations are available, and the use of generalized formulas can lead to systematic bias. The aims of this study were i) to develop and validate new predictive models for estimating fat-free mass (FFM) components in elite soccer players; ii) to assess the accuracy of existing predictive equations.

Methods: One-hundred and two elite soccer players (age 24.7 ± 5.7 yrs) were assessed during the first half of the in-season period and randomly split into development and validation groups. Foot-to-hand BIA and anthropometry were applied to collect independent variables to include in the development of models. Dual-energy X-ray absorptiometry was used to obtain reference data of FFM, lean soft tissue (LST), and appendicular lean soft tissue (ALST).

Results: Developed models were: FFM = – 8.843 + (body mass*0.697) + (stature^2/resistance*0.223) + (reactance*0.092) + (age*0.061) + (race*1.053), $R^2 = 0.97$, SEE = 1.0 kg; LST = – 0.979 + (body mass*0.646) + (stature^2/resistance*0.239) + (reactance*0.099) + (age*0.050) + (race*0.992), $R^2 = 0.97$, SEE = 0.9 kg; ALST = – 24.068 + (body mass*0.347) + (stature^2/resistance*0.308) + (reactance*0.152), $R^2 = 0.88$, SEE = 1.4 kg, where race is 1 for black and 0 for white. Train-test validation revelated that generalized formulas for athletes underestimated all the predicted body mass components ($p < 0.01$), while the new predictive models showed no mean bias ($p > 0.05$), with r^2 values ranging from 0.83 to 0.91, and no trend ($p > 0.05$).

Conclusions: The use of generalized athletic BIA-based predictive equations results in an underestimation of FFM and ALST in elite soccer players. The new soccer-specific formulas allow for the estimation of body composition with accuracy, precision, and no mean bias.

The peak and the distribution of maximal demands during official match in U19 elite soccer players

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Purpose: The most demanding passages of match-play (MDP) and the distribution of match-activities relative to maximum-intensities during official match were investigated in top-class football. However, few information for MDP and none for the distribution of match-activities are still available for youth football. The present study aimed to determine these issues in youth football.

Methods: Twenty-four (n = 24) U19 elite male players competing in European youth championship were monitored during 32 official matches (186 individual-samples). Maximum relative ($m \cdot min^{-1}$) total distance (TD), high-speed running (HSRD), very high-speed running (VHSRD), sprint, acceleration and deceleration distances were calculated across different durations (1–5, 10, 15, 90-min) using a rolling method. Maximum-intensities (1-min$_{peak}$) were used as the reference value to determine the distribution of relative intensity across the whole-match demands (90-min$_{avg}$). Time and distance higher than 90-min$_{avg}$ (> 90-min$_{avg}$) were also calculated.

Results: MDP showed large to very-large [effect-size (ES): 1.43/4.85] differences between 1-min$_{peak}$ vs all durations for each parameter. The relative ($m \cdot min^{-1}$) 1-min$_{peak}$ than 90-min$_{avg}$ was about + 64% for TD, + 321% for HSRD, + 678% for VHSRD, + 1641% for sprint, + 822% for acceleration and + 638% for deceleration. The total distance covered > 90-min$_{avg}$than 90-min$_{avg}$ was ~ 63.6(5.2)% for TD, ~ 83.4(3.4)% for HSRD, ~ 98.2(1.9)% for VHSRD, ~ 100(0.0)% for sprint, ~ 100(0.0)% for acceleration and ~ 100.0(0.00)% for deceleration. The relative distance > 90-min$_{avg}$ was large (ES: 1.81; CI: 1.22 to 2.39) for TD and very large (ES: 2.67 to 5.36) for VHSRD, sprint, acceleration and deceleration.

Conclusions: The MDP and the locomotor intensity > 90-min$_{avg}$ could be considered for maximizing performance in elite youth football players.

Predictive power of vo2max and %VO2max at ventilatory thresholds in determining trail-running performance of different distances

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Purpose: The aim of this study was to evaluate the predictive power of $VO2_{max}$ (mL/min/kg) and sustainable fraction of $VO2_{max}$ (%$VO2_{max}$ at VT1 and VT2) in determining trail running performance over different race distances and to model the relationship between predictors and effective performances.

Methods: In total, 271 races and cardiopulmonary data of 105 mountain runners (89 M and 16F, $VO2_{max}$: 62.7 ± 8.7 mL/min/kg), collected over a 9-year period (2014–2023), were analysed. Considered races were divided based on ITRA classification[1] in XS(20 km, 1350D + , ≈3 h), S(35 km, 2180D + , ≈4.30 h), M(59 km, 3600D + , ≈9 h) and L(120 km, 7180D + , ≈22 h) distances. A performance index ($PERF_{rel}$)[2] was derived for each subject's concluded race. Commonality analysis[3] identifying unique and common coefficients of each independent variable were used to determine the best predictors for each trail distance. Finally, the relationship between performance and its predictor(s) was modelled, and comparison of best fit between a single rather than 4 different models for each distance was carried out.

Results: Pearson correlations showed that for all race distances $VO2_{max}$ was the only considered variable correlated with performance (r = – 0.82, r = – 0.87, r = – 0.78 and r = – 0.69 for XS, S, M

and L races, respectively). The analysis of unique and common coefficients of $VO2_{max}$ and $\%VO2_{max}$ at VT1 and VT2 provides higher prediction of XS and S (R^2 = 0.67 and 0.71) if compared to M and L (R^2 = 0.61 and 0.60) performances. However, independently from race distance, $VO2_{max}$ showed the highest unique contribution (XS: 91.3%; S: 91.9%; M: 99.8%; L: 84.2%) to the regression equation, whereas the unique and common contributions of $\%VO2_{max}$ at VTs were negligible. A single exponential model (99.9% probability of accuracy) rather than 4 different models described the relationship between performance and $VO2_{max}$ (shared R^2 = 0.72) regardless of race distance.

Conclusions: Similar $VO2_{max}$ is required to produce comparable $PERF_{rel}$ in all race formats, but relatively low power prediction of the proposed model underlines the importance of other factors in determining trail running performances, especially with increasing race distance. Sustainable fraction of $VO2_{max}$ did not add any predictive ability compared to $VO2_{max}$ alone.

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Self-regulated learning assessment in young football players: beyond competitive levels

Purpose: While previous literature has established differences in self-regulated learning (SRL) between athletes' level of play[1,2], no research investigated whether variations in sport-specific abilities impact SRL, regardless of competitive ranking. This aspect is innovative and may reveal new insights into the association between sport-specific abilities and psychological skills. Therefore, this study aims to explore SRL among young football players, transcending the traditional focus on competitive levels.

Methods: One-hundred and twenty football players of regional (n = 66) and provincial (n = 54) level from under 14 to under 17 age groups voluntarily participated in the study and combined into a single group. Median-split method was employed to separate players into low (LP) and high (HP) performers from a football-specific task. The football-specific task consisted of a dribbling ball test with a 90° change of direction (90° dribbling test). Three bouts for each direction were allowed, with a 2 min in between. Total times of both directions were recorded and averaged individually. The best mean time between the right and left directions was taken for the analysis. The self-regulation of learning–self-report scale for sport practice (SRL-SRS-SP) with a five-factor solution (planning, reflection, effort, self-efficacy, and self-supervision) and 31 items was employed[3]. The score was based on a 1–5 Likert scale. Total and subscales scores were computed for the analysis.

Results: From the best times coming from 90° dribbling test (median = 2.828 s), 62 players were categorized as HP and 58 players were classified as LP. The best times of HP players were significantly lower than those of LP players ($p < 0.001$, $d = 2.68$). The SRL-SRS-SP total score by HP players differed significantly from that of LP players ($p = 0.019$, $d = 0.43$). In terms of each subscale, HP players showed significantly higher scores than LP players ($p = 0.009$, $d = 0.48$) for planning, while no differences were observed for the remaining factors ($p > 0.05$, $0.10 < d < 0.35$).

Conclusions: HP football players had a greater level of engagement in the learning process with a remarkable ability to set specific goals of improvement than LP peers, regardless of their level of play. These findings suggest that sport-specific abilities may influence the development of SRL skills in young football players. This also suggests that competitive level might not be the sole determinant of differences in SRL.

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Effect of long-term strength training exposure on motor unit discharge properties and estimated neural drive during rapid contractions

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Purpose: Recent cross-sectional studies reported no differences in motor unit (MU) discharge properties during slow submaximal and maximal contractions between long-term strength-trained (LT-ST) and untrained (UT) individuals (1,2). However, MU adaptations in LT-ST during rapid contractions are less clear. Here we concurrently assessed changes in rate of force development and MU discharge properties during rapid contractions after multiple years of strength training exposure.

Methods: Thirteen LT-ST (> 6 yr training practice) and twelve UT individuals performed maximal voluntary isometric contractions (MVC) and a series of rapid-hold elbow flexion contractions where they had to achieve the 80% of MVC as quickly as possible. Concurrently, myoelectrical activity from biceps brachii was recorded with two high-density surface EMG grids. EMG recordings from rapid-hold contractions were decomposed into individual MU discharge timings. Absolute (RFD_{ABS}) and normalized (RFD_{REL}) rate of force development, motor unit discharge rate in the initial (MU $DR_{INITIAL}$) and plateau (MU $DR_{PLATEAU}$) phase of contractions, and estimated neural drive to the muscle were extracted and compared between groups.

Results: LT-ST individuals had a greater MVC (+ 59%, $p < 0.001$) and produced greater RFD_{ABS} in all time windows (0-50 ms: + 55%; 0-100 ms: + 52%; 0-150 ms: + 59%; 50-100 ms: + 51%; 100-150 ms: + 59%; $p < 0.001$ in all cases) compared to UT, but these differences were eliminated with respect to RFD_{REL}. Similarly, LT-ST individuals exhibited a greater MU $DR_{INITIAL}$ (+ 19%, $p = 0.021$) and estimated neural drive to the muscles (+ 16%, $p = 0.020$) in the first 50 ms from contraction onset. However, no between-group differences were observed for MU $DR_{PLATEAU}$.

Conclusions: We assessed for the first time the rate of force development and motor unit discharge characteristics during rapid contractions in individuals with multiple years of strength training

experience. LT-ST exhibited greater RFD_{ABS}, enhanced MU $DR_{INITIAL}$ and estimated neural drive to the muscle. Interestingly, these neural differences did not result in a greater RFD_{REL}, likely due to the opposing effect of prolonged strength training on slowing of the intrinsic contractile muscle properties (3). Overall, the present study provides novel evidence about the capacity and adaptability of the nervous system to generate force rapidly after years of strength training exposure.

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Never too late to get a black-belt: psychophysiological impact of a judo grading examination in older adults

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Purpose: Stress-related effects of sport competitions and examinations have been studied in youth populations (Filaire et al., 2001). This study aims to investigate the psychophysiological impact of simulated and actual black belt grading evaluation on older judo practitioners.

Methods: The experimental group encompassed six brown belt examinees (Tori) undergoing black belt examination (F=2, M=4; 75.6±4.5 yr) and six 2nd-5th Dan black belt partners (Uke; M=6; 36.5±10.8 yr). Salivary alpha-amylase [sAA] and cortisol [sC]), perceived anxiety, effort and enjoyment were evaluated in 2 experimental conditions (simulation, exam) and in a rest day. Cotton swabs were used to collect saliva samples at awakening (T0), pre (T1) and post (T2) exam, and at 15' (T3), 30' (T4), and 60' (T5) of the recovery phase and at the same time during simulation and rest. Enzyme immunoassay and kinetic enzyme assay kits were used to assess sC and sAA, respectively. For the anxiety, the participants completed the STAI-Trait questionnaire at rest, whereas the STAI-State was administered before and after the experimental sessions. The 10-point Rating of Perceived Exertion (RPE) and Enjoyment Visual-Analogue (ENJ) scales were administered after the experimental sessions. ANOVAs for repeated measures ($p<0.05$) with Bonferroni corrections were applied.

Results: No differences emerged between Tori and Uke for sC, sAA, and anxiety. Differences were found for sampling and condition ($P<0.05$). Post-hoc maintained differences only for the actual examination, with highest T2 values, returning at baseline levels at T3 for sAA and at T5 for sC. Trait and state anxiety were normal for age-reference population, with higher pre- state anxiety values during exam ($P<0.05$). ENJ scores were higher for Tori and during simulation. RPE was higher for Uke during simulation and exam conditions.

Conclusions: Judo examination pose high psychophysiological strain in adults and older individuals. However, Tori enjoyed the black belt exam, substantiating that judo is suitable for older individuals (Palumbo et al., 2023). Ecological models are needed to evaluate the actual impact of psychophysical efforts in older individuals.

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Effects of upper- and lower-body muscle fatigue on swimming performance and biomechanics

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Purpose: To compare the effect of muscle fatigue between upper- and lower-limb on velocity and stroke mechanisms in front-crawl.

Methods: Ten swimmers (FINA points = 725 ± 74) were recruited for the crossover randomized and counterbalanced study design. The participants completed 4 experimental visits over 1 mth with a cadence of 7-day. During visit 1, swimmers completed a 7 × 200-m incremental protocol until exhaustion in front-crawl to determine velocity at lactate threshold (Dmax). In visits two to four, the experimental conditions were: 1) lower-body fatigue (LBF), 2) upper-body fatigue (UBF), and 3) control condition (CON). Pre- and post-condition, fatigue was measured using the 1RM test in the bench press and leg extension. Immediately after each condition, a 12 × 100-m at Dmax, and a 400-m maximal effort in front-crawl (5-min passive recovery between) were completed to test performance and biomechanics. Heart rate, lactate, RPE, stroke rate (SR) and stroke length (SL) as index of propelling efficiency were measured at the end of step 4, 8 and 12 of the incremental protocol and in the 1-min after for the maximal bout. The General Estimated Equations (GEE) were used to verify differences and interactions between variables and Bonferroni post-hoc correction was applied to significant variables ($p < 0.05$).

Results: For the 1RM values, there was an interaction between condition x time ($p < 0.001$). It revealed a significant 1RM reduction after both LBF ($p < 0.001$) and UBF ($p < 0.001$) conditions but not different from each other ($p > 0.05$). Regarding technical parameters for the 12 × 100-m test, significant differences between conditions for SR ($p < 0.001$) and SL ($p < 0.001$) were found. Then, swimmers after LBF ($p < 0.001$) and UBF ($p = 0.002$) presented higher SR and lower SL compared to CON. For the 400-m performance, a condition effect was found ($p < 0.001$). The UBF ($p = 0.002$) and LBF ($p < 0.001$) conditions presented a decreased performance compared to CTRL but not different from each other ($p > 0.05$).

Conclusions: Although the swimmer's propulsion is essentially generated by the arm pull, muscle fatigue induced in the lower limbs reduces the swimming performance and propulsive efficiency as well as that induced in the upper limbs.

Anaerobic power reserve, glycolytic power reserve and maximal aerobic power to prescribe high-intensity interval training: variability in performance and physiological responses

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Purpose: The aim of this study was to compare the inter-subject variability in performance and physiological responses during supramaximal interval training based on anaerobic power reserve, glycolytic power reserve and maximal aerobic power.
Methods: Twelve trained cyclists (VO_{2max}: 58.56 ± 9.70 ml × kg^{-1} × min^{-1}) completed a cardiopulmonary exercise test (CPET), a Wingate anaerobic test and three HIIT sessions until-exhaustion. Initially, both the CPET and Wingate tests were performed to determine the power associated with the VO_{2max} (MAP), the anaerobic peak power output (PPO) and the mean power output of the Wingate (MPO). Then, the Anaerobic power reserve (APR) was calculated as PPO-MAP, while the glycolytic power reserve (GPR) was as MPO-MAP. Subsequently, participants performed in a randomized order and separated by 72 h, three HIIT until-exhaustion sessions with 1 min of work phase and 1 min of active rest, based on APR ($HIIT_{APR}$: MAP + 10% APR), GPR ($HIIT_{GPR}$: MAP + 20% GPR) and MAP ($HIIT_{MAP}$: 120%MAP), respectively. In all HIITs, the rest period was fixed at 45%MAP. Variability in time to exhaustion (TTE), heart rate (HR), oxygen uptake (VO_2) and blood lactate concentration ($[La]^-$) was calculated as coefficient of variation (CV) and as mean of the square root of the squared difference between the individual value and the mean value. Then, values were compared between conditions via repeated-measures analysis of variance with a statistical significance set at $p \leq 0.05$.
Results: CV in TTE was lower in $HIIT_{MAP}$ (21%) rather than in $HIIT_{APR}$ (35%) (effect size [ES] = 0.47), and $HIIT_{GPR}$ (45%)(ES = 0.78). Mean CV in VO_2 was lower in $HIIT_{GPR}$ (6.7%) rather than in $HIIT_{MAP}$ (8.8%)(ES = 0.52) and $HIIT_{APR}$ (9.1%)(ES = 0.47). Mean CV in HR was similar (∼ 4.5%)(ES = 0.16) between conditions. Mean CV in $[La]^-$ was lower in $HIIT_{APR}$ (24.9%) rather than in $HIIT_{GPR}$ (28.1%)(0.36) and $HIIT_{MAP}$ (26.5%)(ES = 0.28). However, for all dependent variables, no significant difference in inter-subject variability was found.
Conclusion: Our findings indicate that HIIT based on APR and GPR does not reduce the inter-subject variability in performance and physiological responses compared to MAP-based prescription. In addition, our results potentially indicate that prescribing HIIT based on MAP could be a better prescription training method than APR and GPR in trained cyclists.

Breathe in, breathe out for acute post-exercise stress management

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Purpose: Changes in cardiac parasympathetic activity (CPA) can be evaluated by measuring heart rate variability (HRV), with the root mean square of successive differences (RMSSD) being a primary time-domain measure used to estimate vagally mediated changes in HRV. Controlled breathing (CB) during resting has a significant impact on HRV and serves as a strategy to influence CPA. However, the effects of CB on HRV and RMSSD after exercise remain poorly understood. Therefore, the objective of this study was to assess the effects of CB following a submaximal incremental treadmill exercise (SITE) on HRV and RMSSD.
Methods: 9 subjects (7 men; 2 women) performed 2 SITE with a 24-h recovery between sessions. SITE protocol included 3-min warm-up at a fixed slope of 1%, followed by a speed increase of 1 km/h every 2-min. The exercise ended when the participants reached 95% of their maximal heart rate. 15-min before (PRE) and 15-min after (POST) each SITE, HRV and RMSSD were measured in a quiet and distraction-free room using a heart rate monitor connected to the "Elite HRV" app. During PRE, subjects were instructed to maintain a calm state and breathe freely for 5-min. In POST, two breathing conditions, uncontrolled breathing (UB) and CB following the guidance provided by the "Elite HRV" app, were randomized and performed by each participant. The CB pattern involved 6 breaths per minute with an inhalation/exhalation ratio of 1: 1, consisting of 5 s for inhalation and 5 s for exhalation, for a total of 5-min. Repeated measures mixed models were used to examine the effects of different breathing conditions (UB vs CB) on HRV and RMSSD. Statistical significance was set at $p < 0.008$.
Results: Significant differences ($p < 0.0001$) were observed, indicating lower HRV (49.5 ± 10.1 ms) and RMSSD values (29.8 ± 18.8 ms) in POST UB compared to all other UB (HRV PRE = 59.0 ± 8.8 ms; RMSSD PRE = 53.2 ± 27.4 ms) and CB (HRV PRE = 58.8 ± 7.3 ms; HRV POST = 57.7 ± 11.5 ms; RMSSD PRE = 50.1 ± 19.3 ms; RMSSD POST = 51.9 ± 31.4 ms) time points. On average, UB resulted in a decrease of 8.9 ms and 21.9 ms in HRV and RMSSD, respectively.
Conclusions: The study findings highlight the significance of CB in modulating CPA during stress-inducing conditions, such as exercise. Post-exercise HRV and RMSSD in the UB were markedly lower compared to CB. Consequently, practitioners and athletic trainers can employ slow and CB strategies, either during recovery or as a cool-down strategy after exercise, to enhance CPA and counterbalance excessive activation of the sympathetic branch.

The VO2 slow component in different exercise intensities and domains: association with markers of metabolic instability and muscle fatigue

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Purpose: The appearance of the slow component of VO_2 ($\dot{V}O_{2sc}$) in the heavy and severe exercise domains is explained by a combination of metabolic instability (measured with NIRS and hematochemical markers) and muscle activation (measured by EMG). To the best of our knowledge, no studies investigated how these parameters are associated with the $\dot{V}O_{2sc}$ in two different intensities of the moderate, heavy, and severe domains. Moreover, no studies have tested exercise intensities based on physiological thresholds: gas exchange threshold (GET), respiratory compensation point (RCP) and maximum oxygen uptake (VO_{2max}).
Methods: Eleven active men performed 6 × 9 min constant work cycling trials at 33% and 66% of the moderate (> VO_2rest/ < GET; M1, M2), heavy (> GET/ < RCP; H1, H2) and severe (> RCP/ < VO_{2max}; S1, S2) domain. During each session, VO_2, hematic markers (i.e. $[La^-]$, pH, HCO_3^-), as well as local muscle O_2 extraction (deoxyhemoglobin, [HHb]) and muscle activity (EMG) of the vastus lateralis were measured. We tested the hypothesis that the VO_{2sc} is intensity and domain-dependent and can be predicted by metabolic instability and muscle activation. More specifically, within the domains: i) no presence of VO_{2sc} in the moderate; ii) VO_{2sc} being larger with increasing intensity within the heavy domain with the only contribution of metabolic instability iii) VO_{2sc} being larger with increasing intensity in the severe domain with both contribution of metabolic instability and muscle recruitment.

Results: The slope of [HHb] and RMS between minutes 3 and 9 were calculated and the relationship with $\dot{V}O_{2sc}$ evaluated by simple and multiple linear regressions. The post-hoc analysis comparisons between the six different intensities of [HHb] and RMS with $\dot{V}O_2$ beyond the third minute of exercise showed that [HHb] kept increasing significantly in all the intensities within severe and heavy, but not within the moderate domain. RMS increased significantly over time only in the S2. Moreover, beyond the third minute of exercise, VO_{2sc} was significantly correlated with the slope of [HHb] ($r = 0.56$, $p < 0.001$) and RMS ($r = 0.58$, $p < 0.001$) and both were significant predictors of the $\dot{V}O_{2sc}$ ($r = 0.68$; SSE 0.94% ml•min^{-2}, $p < 0.001$).
Conclusions: We confirmed the contribution (i.e., 68%) of both metabolic instability and muscle activation to the dynamic of the VO_{2sc} across different exercise intensities. However, the insurgence of the $\dot{V}O_{2sc}$ in the heavy domain stem especially from metabolic instability, while in the severe domain it stem also from muscle activation.

The VO2 slow component in different exercise intensities and domains: association with markers of metabolic instability and muscle fatigue

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Physical education to enhance health related-fitness in adolescents: a mediation analysis from the regional observatory of motor development and health prevention in apulia

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Purpose: The Regional Observatory of Motor Development and Health Prevention is a regional project involving secondary schools of first and second grade in Apulia aimed at (a) assessing the levels of physical efficiency and health status of children and young adolescents, and (b) defining national recommendations and guidelines for the practice of physical activity and healthy habits. Previous studies have showed that physical self-perception (PSP) and enjoyment are key factors to promote greater adherence to physical activity (PA), and PA is strictly linked to better physical fitness and inversely related to body mass index (BMI). In the light of these evidence, the present study aims to assess the mediation role of PSP and enjoyment in enhancing PA and physical fitness according to BMI values.
Methods: The sample (N = 180, age = 11–13 years; M = 90, Nw = 30, Ow = 30, Ob = 30; F = 90, Nw = 30, Ow = 30, Ob = 30) was recruited by the school that joined the Regional Observatory of Motor Development project with a simple randomization. The total sample was divided according to gender (male and female) and BMI group (normal weight, overweight, and obese). Physical efficiency was assessed with standing long jump (SLJ), Medicine Ball Throw (MBT), 10 × 5 shuttle run (10 × 5), One Mile Run Walking Test (MRWt), while three validated questionnaires were used for the evaluation of levels of physical activity, enjoyment and PSP. The assessment took place during curricular physical education lessons and was conducted by a team of Experts in Motor and Sports Sciences, and in Preventive and Adapted Motor Activities. The results of the descriptive analyzes were reported in terms of mean ± standard deviation for all continuous variables considered. Analysis of variance (ANOVA) was performed to highlight the differences between variables, and Post Hoc Test was carried out to describe differences betweengroups. To detect and analyze the relationship between variables, the Pearson relationship coefficient (r) was calculated. Preacher and Hayes method was used to carry out mediation analysis between variables.
Results: The results of this study can be summarized as follows: Both normal weight boys and girls showed better motor performance for all variables considered (both physical tests and questionnaires); PSP represents a significant mediating variable between BMI and strength (SLJ), and between BMI and endurance (10 × 5 and OMRWt), while physical activity levels positively mediate the relationship between fun and physical sefl-perception.
Conclusions: This study suggests the importance of BMI, PAL, enjoyment and PSP in determining proper physical fitness as health status indicator. Due to the small sample involved, further researches are need to better understand the relation between these variables and (a) provide more generalizable results, (b) define best practice for physical education teachers and (c) develop regional and national recommendations and guidelines for health promotion in young adolescents.

Localized neuromuscular fatigue of postural muscles is efficiently compensated during a force-field motor adaptation task

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Purpose: Muscle fatigue (MF) is a physiological state that has transient impacts on performance. To date, effects of localized MF (i.e., single muscle) on neural processes of human postural control are still poorly understood. Motor adaptation processes allow to adapt motor outputs to unexpected changes of the environment or task parameters based on sensorimotor feedback integration. We want to study how fatiguing a postural muscle—contributing to the control of vertical posture—impacts on the motor adaptation mechanisms controlled by the central nervous system (CNS).
Methods: Participants (14 M; 14 F) were randomly assigned to fatigue (FAT) or control (CON) group. The task consisted of mediolateral hand reaching movements, using a KINARM End-point robot. Instructions were to reach as fast and accurate as possible the target. After familiarization, participants performed a block (n = 30 trials) of unperturbed reaching tasks (BASE). Before each of the following 10 blocks—they performed sustained, cyclical isometric exercise (40 s; 75% duty cycle) with their tibialis anterior muscles. Exercise intensity differed between groups (FAT: 65 ± 5%; CON: 7.5 ± 5% MVC). In the 8 successive blocks, the robot applied a viscous force-field perpendicular to the direction and proportional to the speed of the hand movement (ADAPT). The last 2 blocks of the protocol were unperturbed—washout (WASH). Three out of 30 trials in each ADAPT block were unperturbed (CATCH). Hand path, speed and force applied at the handle, force plate GRF and surface EMG data (12 muscles) were recorded. Variables were compared at different protocol stages: late baseline (LB), early adaptation (EA), late adaptation (LA), early catch (EC), late catch (LC), early washout (EW) and late washout (LW).

Results: Trajectory error, measured at different stages was similar between groups (LB: 0.9 ± 0.3 and 0.9 ± 0.4; EA: 6.6 ± 1.8 and 6.0 ± 1.9; LA: 1.2 ± 0.4 and 1.0 ± 0.3; EW: -3.8 ± 0.8 and -3.2 ± 1.1; LW: 0.9 ± 0.3 and 0.9 ± 0.3 cm, for CON and FAT, respectively). We found significant differences in upper limb EMG activity between the groups.
Conclusions: Despite comparable performance in the task, FAT group increased the activity of upper limb muscles, presumably to compensate for increased postural instability. Results suggest the processes within the CNS effectively compensate for the postural perturbation induced by MF under a force-field perturbation.

Assessment of biofeedback during attentional tasks using 3D virtual reality technology in young female elite volleyball players

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Purpose: The virtual reality system implies three characteristics: immersion, perception to be present in an environment, and interaction with it, allowing an experience similar to reality. The aim of this study was to assess the physiological responses during two attentional tasks in female elite volleyball players and to correlate these parameters with the attentional indexes obtained.
Methods: In this observational cross-sectional study 24 young female elite volleyball players (17, 7 ± 0, 9 years) performed two attentional tasks, based on "Multiple Object Tracking" paradigm, using 3D virtual reality technology with an immersive system. The program used allow to determine an attentional index for each task using the Staircase method.
The first task was based on the traditional "Multiple Object Tracking" paradigm with 4 targets and 4 distractors, instead in the second one there were 1 primary target, 2 secondary targets and 5 distractors. The speed of the targets was adaptive and based on the error rate. During these two tasks some parameters were measured with sensors placed on the left hand and a respiration belt: a) Heart rate; b) Blood volume pulse; c) Skin conductance level; d) Heart rate variability; e) Respiratory rate. These tests were conducted in a quiet room in the team's training center.
Results: Results showed a non-significant correlation between the attentional index in the first task and heart rate variability (r = – 0.12, p = 0.57); and between the attentional index of the second task and heart rate (r = 0.25, p = 0.23) as with the blood volume pulse (r = 0.26, p = 0.22). A moderate correlation has been noticed between the attentional index in the first task and heart rate (r = 0.38, P = 0.07) and respiration rate (r = 0.47, p = 0.02); and, in the same way, between the attentional index of the second task and skin conductance level (r = 0.41, p = 0.05) and respiration rate (r = – 0.37, p = 0.07).
Conclusions: In this study didn't emerge strong correlations, this is probably due to the fact that each player has a different way to deal with emotions, cardiac and neural activation during the tests. This could be helpful for trainers to understand how their players face a challenge, it reflects what happens during a match.
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Assessing body posture with artificial intelligence: applicability and reliability in healthy adult population

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Purpose: Musculoskeletal disorders are among the top causes of disability in young adults, as reported in the Global Burden of Disease. Timely postural analysis can identify significant changes and prevent acute or chronic discomfort. Traditional assessment methods, however, may be subject to operator bias or require advanced techniques. Digital solutions have surfaced as more accessible options for human motion analysis. One such solution is Google's MediaPipe Pose, a machine learning (ML) method that provides 3D estimations of human poses with standard digital cameras, eliminating the need for specialized equipment or settings. Hence, this study aims to validate the applicability and reliability of a digital approach for postural analysis.
Methods: We analyzed the posture of 100 males and 100 females, with an average age of 27.4 (SD ± 3.2) years. We collected a frontal and back photo with a camera placed on a tripod. A sample of 30 males and 40 females underwent the analysis twice to assess the reliability. We assessed the joint angles, as well as the horizontal and vertical angles using an algorithm capable of aligning the 3D position of the same landmarks in both the front and back photos.
Results: The postural parameters obtained matched the 3D parameters of the front and back images. They provided significant differences between males (m) and females (f) with a medium to large effect size for almost all the parameters. For the joint angles, the shoulder angle was m = 16.67° ± 2.49 vs f = 14.34° ± 1.98 ($p < 0.001$, d = 1.03, ICC = 0.83), elbow angle m = 8.54° ± 4.89 vs f = 4.64° ± 2.95 ($p < 0.001$, d = 1.03, ICC = 0.79), hip angle m = 10.03° ± 2.63 vs f = 7.02° ± 1.95 ($p < 0.001$, d = 1.30, ICC = 0.81), knee angle m = 2.91° ± 1.37 vs f = 2.39° ± 1.40 (p = 0.014, d = 0.37, ICC = 0.65). For the horizontal angles, the shoulders line was m = 1.33° ± 0.92 vs f = 1.35° ± 1.12 (p = 0.701, d = – 0.02, ICC = 0.11), hips line m = 1.26° ± 0.87 vs f = 1.68° ± 1.25 (p = 0.085, d =—0.40, ICC = 0.51), knees line m = 2.46° ± 1.51 vs f = 2.49° ± 1.70 (p = 0.992, d = – 0–01, ICC = 0.66). For the vertical angles the body balance was m = 1.03° ± 0.51 vs f = 1.27° ± 0.62 (p = 0.079, d = – 0.42, ICC = 0.66).
Conclusions: This machine learning method demonstrated significant results in postural analysis, revealing specific gender differences and a substantial to almost perfect agreement for reliability. This technique does not necessitate anatomical expertise since the algorithm automatically identifies and measures the angles. Upcoming studies will examine its validity to analyze athletic movements to prove its applicability also in the sports sciences. Due to its simplicity, it could be consistently employed by health professionals and biomechanics experts to track progress in rehabilitation and training.

Effectiveness of an audio-guided protocol training to improve motor function in people with severe visual impairments: preliminary findings

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Purpose: Blindness and low vision negatively impact mobility and motor function, leading to sedentary lifestyles and poor quality of life. This study aimed to investigate whether a self-administered and audio-guided protocol training improves motor function in people with severe visual impairments.

Methods: Visually impaired and inactive adults were enrolled at the laboratory for ophthalmology of ICS Maugeri (Pavia, Italy) and were assigned to two groups: audio-guided training (AUD) or supervised training (SUP). The AUD group performed a multimodal training twice a week at home for 3 months, listening to an audio track provided by the instructor. Audio instructions covered the steps to perform the training safely and were updated every four weeks with load increments. Meanwhile, the SUP group performed the same training protocol in the gym under the supervision of the instructor. Before the start, and every 4 weeks until the end of the protocol, motor function was assessed with the following tests: Timed Up and Go Test -Low Vision version (TUG-LV), 1-Minute Sit to Stand Test (1-MSTS), the 3-Minute Step Test (3-MSTEP) and Sit and Reach test (SR). A two-factor (group x time) repeated measures analysis of variance with a $p < 0.05$ (Tukey correction) was used to determine significant changes.

Results: Thirteen people (8 AUD and 5 SUP; 59.3 ± 11.4 years, BMI 24.4 ± 4.8 kg/m^2, 38% Females) with severe low vision (visus 0.1 ± 0.4) or completely blind, completed all sessions and assessments. AUD enhanced TUG-LV performance from 14.2 ± 3 to 11.1 ± 2.9 s. (-21.8%; $p = 0.07$), while SUP from 12.9 ± 4.9 to 9.7 ± 3.1 s. (-24.8%; $p = 0.31$), with a significant effect of time ($p < 0.001$) but not for time x group ($p = 0.93$). 1-MSTS increased significantly for both groups (AUD + 27.5%, $p = 0.03$; SUP + 47.3%, $p = 0.002$; time $p < 0.001$), with a significant difference in time x group ($p = 0.03$). Similarly, 3-MSTEP increased for both groups (AUD + 24.9%, $p = 0.08$; SUP + 45.7%, $p = 0.004$; time $p < 0.001$), with a significant difference in time x group ($p = 0.007$). Lastly, SR improved in both groups (AUD + 86.7%, $p = 0.83$; SUP + 245.4%, $p = 0.47$; time $p < 0.003$), without significant differences for time x group ($p = 0.52$).

Conclusions: Audio-guided training has been effective in enhancing motor function in people with visual impairments. Although supervised training would be preferred due to similar or higher improvements in most assessments, we can consider audio-guided training as an effective alternative when supervision is not possible.

Prevention of falls by prescription of adapted physical activity (apa) supported by ICT in sedentary patients

Purpose: With increasing age, muscle deficits, sarcopenia and a sedentary lifestyle can lead to an increased risk of falls. The main risk factors for falls are: age, reduced balance and strength of the lower limbs, cognitive decline, and hearing and vision impairment. Fall prevention takes place through multidisciplinary paths, one of which is represented by the APA.

The aim of the study was to evaluate the strength of the lower limbs using the Chair test and the exercise tolerance during the exercise test on the cycle ergometer in a population of sedentary patients who had been prescribed APA via APP (Telerevalidatie) installed on their mobile phone.

Methods: We enrolled 61 sedentary patients (mean age 61.6 ± 2.3 years, 49% women) who were prescribed APA with alternating programs of muscle strengthening, flexibility and aerobic physical activity at 60% of theoretical maximum heart rate.

Results: 37 patients completed a minimum FU of 3 months. Adherence to the APA program, assessed by counting APP accesses with respect to the prescribed program, was approximately 55 + 7%. Comparing the parameters measured at enrollment with those of the last available FU, we observed a significant improvement in lower limb strength (from 14.3 ± 0.6 to 17.1 ± 0.8 repetitions $p < 0.05$) and exercise tolerance (from 6.1 ± 0.4 to 7.6 ± 0.4 min $p < 0.05$).

Conclusions: The prescription of APA with technological support through APP represents an interesting therapeutic aid in the improvement of lower limb strength and effort tolerance in sedentary patients.

Physical activity and aminoacids in mci: their role in progression towards dementia

Purpose: Mild cognitive impairment (MCI) is a condition in which individuals shows overt cognitive impairment with minimal impairment of instrumental activities of daily living (IADLs). Although MCI can be the first cognitive expression of Alzheimer disease (AD) or other forms of dementia, it can also be secondary to other disease processes such as sarcopenia and frailty, that are two of the most important geriatric syndromes have been clearly indicated as risk factor for MCI and dementia. The aim of our project is to evaluate the effect of physical training alone and combined physical training and dietary intervention on MCI progression towards AD.

Methods: The participants are over 65 years old both men and women and they have a diagnosis of MCI. They are divided in two cohorts. The first cohort follows according to standard treatment, physical activity intervention and essential amino-acids supplementation. The second one follows according to standard treatment and a physical activity intervention. For each participant in the control group, a twice a week plan of up to 60 min of adapted physical activity is conducted by a Kinesiologist (Master's Degree in Adapted Physical Activity). Physical activity programme last two months and will be scheduled at month 4, and then rescheduled at month 10, month 16 and month 21. A battery of physical tests is carried out at the beginning and at the end of the two months of work every time. In addition to the same twice-a-week physical activity exertion plan scheduled for the control group, a supplementation of essential amino acids pharmacological preparation, according to WHO daily ratio is furnished for participants in the intervention group. It is taken daily and cyclically, during the physical exertion periods. The duration of the follow-up will be 2 years.

Results: In the preliminary data we have 8 participants, divided in two cohorts (4 intervention group, 4 control group). Partial results are very promising, with an improvement in the most physical tests, SPPB (from 10, 4 to 11, 9), 6 min walking test (from 359, 12 m to 425 m) and handgrip test (from 29, 25 kg to 31 kg). There was too an excellent adherence to the programme.

Conclusions: The effect of physical training alone and combined physical training and dietary intervention on MCI, seems to be effective to improve physical parameters. At the end of the two years, of the study, the effectiveness of the overall treatment will be evaluated.

Can animal assisted interventions counteract apathy and improve physical activity levels in psychiatric patients with cognitive disability? a case study

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Purpose: Psychiatric disorders affect many subjects, reducing patients' quality of life due to the first-generation antipsychotic drugs that negatively effects patients' cognitive abilities. A healthy lifestyle, such as physical activity, can affect both the functional abilities and mental health of patients with a dual diagnosis, psychiatric and cognitive. Despite this knowledge, these people are more sedentary than the general population. Animal Assisted Interventions (AAIs) seem to be a valid tool to stimulate them to practice physical exercise thanks to the empathy generated by the relationship with the animal.
Methods: This case study aims to evaluate the effect of 4 months AAIs, on apathy in 2 patients with dual diagnoses. The second objective is to evaluate the effects of these interventions, on the physical efficiency of these patients. Patient A and patient B, affected by psychiatric disorders and mild cognitive impairment, were recruited and one performed the AAIs with a dog and the other with a horse.
Results: Data showed a decrease of apathy at the end of the study in both patients: -20, 6% in patient A and -9.8% in patient B, as well as a reduction of psychiatric symptoms. Moreover, both patients improved the functional parameters evaluated through the Short Physical Battery Test (patient A = + 33.3%; patient B = + 28.6%).
Conclusions: Despite this is a case study, the preliminary results suggest that well-structured, individualized AAIs, with a horse or with a dog, could be considered as a useful adjunctive therapy to the usual treatment programs to counteract apathy in psychiatric patients with mild cognitive impairment.

"We Wheel Dance" at the University of Pavia: effects of an ama program of wheelchair dance and functional exercises on the conditional skills of a female student with myelomeningocele. case report

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Purpose: There are many competitive sport activities for people using wheelchair but there are few opportunities to train only for wellbeing and fun. The literature reported that wheelchair dance has effects equal to the physical activity to moderate intensity. Therefore, wheelchair dance could be the right balance between physical activity and playful aspects such as music, socialization and emotional well-being. At the University of Pavia, in October 2022, the adapted motor activity project "ABILI SI DIVENTA", organized by SAISD in collaboration with the Laboratory of Adapted Motor Activity (LAMA), the Degree Course in Motor Sciences and the CUS Pavia, activated the wheelchair dance course "WE WHEEL DANCE". The course is dedicated to all people who, regardless of their abilities, want to dance, using the wheelchair to improve their health while having fun. For this reason, the effects of an adapted motor activity (AMA) program, consisting of wheelchair dance and functional exercises, were investigated.
Methods: FG (33yrs), a female university student living with myelomeningocele and using a wheelchair, was recruited. From 13th October 2022 (T0) to 05th June 2023 (T1) she underwent a bi-weekly AMA program consisting of two 90-min sessions: one of wheelchair dance, the other of functional exercises. The first session included warm up, dance exercises, choreography and cool down. The other was based on functional exercises for the improvement of conditional capabilities and the ability to use wheelchair. At T0 and T1,28 m sprint test (28MST) and Vanlandevijck's multistage field test (MFT) were carried out. 28MST is commonly used to measure acceleration, maximal sprint power output and velocity. MFT for wheelchair users was developed to evaluate physical fitness and predict peak oxygen consumption (VO2). To assess adherence, the number of sessions performed was recorded.
Results: Compared to T_0, all results are improved at T_1: 28MST (54 m; 56 m), MFT (200 m; 220 m). FG completed 49 sessions out of 55, without adverse events.
Conclusions: An AMA program, consisting of wheelchair dance and functional exercises, seems to improve peak oxygen consumption, power and anaerobic capacity in a playful, inclusive and safe environment for people using wheelchair. It would be interesting to evaluate the effects of this program on a larger sample.

Strengthening the hip joint: unleashing the power of pilates and ACSM guidelines

Purpose: The aim of this study is to investigate the effectiveness of the classic Pilates method, adapted to align with the latest guidelines from the American College of Sports Medicine (ACSM), in strengthening the hip joint. By exploring this hypothesis, we seek to address the need for effective strategies to enhance hip joint strength.

The adapted Pilates method integrates the new ACSM guidelines, which encompass specific recommendations for exercise testing and prescription for the elderly population. The study will employ a range of measurements, including exercises targeting the hip joint, tests assessing flexibility and muscular endurance, and evaluations of posture control, balance, and breathing. By examining the impact of the adapted Pilates method on hip joint strength, this research aims to contribute valuable insights for promoting improved physical well-being and addressing musculoskeletal conditions among sedentary individuals with mild diseases of the musculoskeletal system.

Methods: This study draws its structural framework from the comprehensive 2018 report by the World Health Organization (WHO) on frailty, sarcopenia, and falls prevention in the elderly. The research focuses on the effects of an 8-week program (Sept-Oct 2022), 1 × week x 45 min. The program comprised 32 classic Pilates matwork exercises. One hundred volunteers, 55 women and 45 man, with no prior experience participated in the study. Statistical analysis included calculating standard deviations (SD) and means for HR, RPE, estimated energy expenditure (EE), and maximum oxygen uptake (VO2max) for each exercise. Pearson's correlation analysis was conducted to determine the association between HR and RPE in each exercise. Statistical significance was considered at $p < 0.05$. The analysis was performed using SPSS 18.0 statistical software.

Results: HR and RPE were continuously monitored using the CR-10 scale throughout the Pilates sessions. These measurements allowed for the estimation of VO2max using the submaximal Astrand-Ryhming step test and EE using a linear regression equation. A significant, strong, and positive correlation ($r = 0.82$; $p = 0.001$) was observed between mean HR and RPE values and their respective maximums (HRmax and RPEmax) across all exercises. Notably, in 10 exercises, the HR value reached 60% higher than HRmax.

Conclusions: The findings of this study demonstrate that the classical Pilates Method exhibits a dose–response effect, aligning with the cardiovascular and respiratory fitness requirements outlined in the new ACSM guidelines. This structured program ranging from mild to moderate intensity, ensures muscular endurance of thsafety while delivering significant benefits in terms of cardiovascular health, respiratory fitness, and overall well-being.

Effects of a 10-week multi-component outdoor exercise program on physical fitness and quality of life in cardiovascular disease patients

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Purpose: Cardiovascular diseases (CVDs) are the leading cause of death globally. Evidence suggests that both regular physical activity (PA) and increased cardiorespiratory fitness delay the development of CVDs and reduce the incidence of heart disease. However, there is a lack of evidence about the effects of a multicomponent protocol exercise performed in an outdoor environment. Therefore, this non-randomized controlled study aimed to assess the effects of a multi-component outdoor exercise program on physical fitness and quality of life (QoL) in subjects with CVDs.

Methods: Twenty subjects (12 M and 8F; age 68.5 ± 8.6 years; BMI 28.49 ± 4.98 kg/m^2) suffering from CVDs voluntarily participated in the study and were divided into two groups: an experimental group (EG; 6 M, 5F) who underwent a 10-wk progressive multi-component training (60', 2d·wk^{-1}), or a waitlist control group (CG; 6 M, 3F) who did not engage in any PA. Participants had not previously been engaged in other exercise activities over the last 3 months and were free of any acute medical conditions, according to ACSM and AHA statements. Each session included a combined progressive training of cardiorespiratory, resistance, mobility and breathing exercises. Physical fitness was assessed via a 30″ chair stand test (30SCST), timed up and go (TUG) test, 2' step test (2MST) and handgrip strength test (HST). Hemodynamic parameters were assessed through RHR and P-SBP/P-DBP. The QoL was evaluated with SF-12 and WHOQoL-brief.

Results: After the intervention, EG showed significant improvement in physical fitness parameters (30SCST: $p < 0.001$, ES = 0.92; TUG: $p = 0.001$, ES = 0.67; 2MST: $p < 0.05$, ES = 0.79), hemodynamic parameters (RHR: $p < 0.001$, ES = 0.98; P-SBP: $p < 0.001$, ES = 0.53; P-DBP: $p < 0.001$, ES = 0.78) and the physical component of SF-12 (PSC-12: $p < 0.05$, ES = 0.42) compared to CG; no significant changes were observed in the HST, QoL and mental health component of the SF-12 ($p > 0.05$). Results showed high compliance with no dropout.

Conclusions: The findings showed significant improvements in physical fitness, hemodynamic parameters and physical health status suggesting the effectiveness of the multi-component outdoor exercise program on individuals with CVDs. No adverse effects or health problems were observed. However, improvements in handgrip strength, QoL, and mental health status may take longer. Further research is needed to confirm these findings and explore additional factors influencing the outcomes.

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Is it real perception? self-reported versus measured physical fitness in children with obesity before and after 3-months of supervised online training

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Purpose: Childhood obesity (OB) refers to an excess of body fat which poses a risk for health mainly due to the adoption of an unhealthy lifestyle. Studies report that children with OB tend to have lower level of physical activity and poor self-esteem with augmented self-perceived barriers to exercise and sports participation. The aim of this study is to evaluate the efficacy of an online training program on self-reported physical fitness (SRPF) in children with OB.

Methods: 32 children with OB (Female = 9 n; Age = 10.92 ± 2.08 years) participated in the study and performed 3-months of 60-min-3 days per week online supervised training. Children were assessed through the Standing Broad Jump (SBJ), the 6-Minute Walking Test (6MWT) and the 4 × 10 m sprint test and completed

the International Fitness Scale (IFIS) questionnaire. Changes in performances were assessed by paired Student-t and Wilcoxon tests.
Results: After the 3-months of online training program children with OB significantly increased their performance in SBJ, 6MWT and 4×10 m sprint tests (in each case $p < 0.05$). No differences were found in children's PF perception.
Conclusions: Our study highlighted improvements of PF in children with OB after a supervised online training program while SRPF slightly improves. The low differences in SRPF after the training suggests further investigation in this population planning a longer training period, to ameliorate SRPF and consequently improve PA participation of children with OB.

"Patients-Oncologist" conversation about physical exercise: a cross-sectional study

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Purpose: Exercise (EX) is inversely associated with mortality and recurrence risk in cancer and may help patients (pts) cope with treatment adverse events and improve their quality of life. The purpose of this study is to investigate the role of oncologists in promoting exercise.
Methods: A self-administered, anonymous questionnaire was proposed to pts visiting the facilities at the Oncology Unit of Verona Hospital. The questionnaire assessed demographic, health, and EX parameters. EX variables, drawn from a prior study, included: the level evaluated with Godin's Leisure Time Exercise Questionnaire and information regarding: whether EX was discussed; whether oncologists assess, advise, reinforce, and refer (AARR process) pts effort to exercising; and whether pts preferred that EX be discussed. Descriptive statistic, presented as mean, frequencies, and percentages, was utilized to analyze data.
Results: With a 76% response rate, 202 pts completed the survey. Upper gastrointestinal (45%) and breast (19%) were the most frequently diagnosed cancers. Only 9% of pts were sufficiently active, according to the last recommendation of the American College of Sports Science. Regarding the current EX discussion, 29% of pts reported that their oncologist started a discussion about EX, 12% initiated the discussion themselves, and 60% referred that the issue was not considered. Concerning the AARR process, 26% of pts stated that their oncologists assessed their EX-level, 14% and 33% received advice or reinforcement to increase their EX, respectively, and 9% were referred to an appropriate EX service. On the other hand, the items related to the preferred modality of EX discussion showed that 69% of pts thought that oncologists should initiate an EX-discussion, 3% that only pts should start the discussion, and 23% thought that EX should not be discussed.
Conclusion: Our preliminary results show that over half of patients stated that EX has never been discussed during cancer consultation. Nevertheless, most pts would prefer that oncologists initiate a discussion about EX. Strategies to support clinicians in promoting EX to their pts should be developed according to these findings.

Adherence level and efficacy of a one-year exercise-based intervention program in patients with myocardial infarction

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Purpose: Statistics demonstrate that elderly patients with myocardial infarction (MI) exhibit higher levels of sedentary behavior and lower adherence to traditional cardiovascular rehabilitation and secondary prevention programs. This observational study aims to analyze adherence to an exercise-based intervention program in patients hospitalized for MI, while also evaluating the effectiveness of the intervention at the end of the one-year follow-up period.
Methods: Data from 65 patients who completed the one-year cycle of visits were analyzed. Participants underwent functional assessments through a submaximal 1-km treadmill walking test, based on which a home-based physical activity program was prescribed, evaluated, and potentially adjusted at the end of each assessment session. The level of physical activity carried out at home was assessed using the 7-day Physical Activity Recall, which analyzes the type of exercise performed, intensity, and frequency, and then provides estimates of energy expenditure (kcal/week) and the amount of physical activity calculated, indicated in MET-hours/week.
Results: Throughout the sessions, a positive maintenance of program adherence percentage (63.1%) was observed. The higher risk of dropout was observed in the early stages of the program, specifically between the first and second visit. This dropout is primarily attributed to logistical challenges and skepticism towards the proposed intervention. Weekly physical activity significantly increased from baseline to the end of the follow-up period (from 7.5 to 13.2 MET/h-week; $p < 0.001$). Moreover, both average speed (from 3.0 to 4.4 km/h; $p < 0.0001$) and oxygen consumption (from 16.8 to 21.2 ml/kg/min; $p < 0.0001$) significantly improved. When comparing male and female participants, a comparable increase in values was observed between the two groups. Specifically, regarding physical activity, it is notable that women, who started from a lower level at the baseline, increased their activity progressively, eventually reaching the levels of men.
Conclusions: The adherence rate to the 1-year program (63.1%) is high, considering that prescribed programs typically last up to 12 weeks and considering the higher risk of drop-out among older patients. This, coupled with the sustained maintenance of a significant level of weekly physical activity, underscores the effectiveness of the proposed intervention, indicating that it can improve physical performance and functional abilities.

Physical activity levels and fitness perception in adolescents with inflammatory bowel disease: implications for health promotion and intervention strategies

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Purpose: Adolescents with inflammatory bowel disease (IBD) could develop metabolic and cardiovascular disease due to the presence of systemic low-grade chronic inflammation. Physical exercise modulates the inflammatory process and improves cardiovascular fitness. Therefore, it is crucial to investigate this population's physical activity (PA) and perceived fitness levels to effectively promote PA programs aimed to improve lifestyle and health. For these reasons, this study aims to evaluate the PA levels and fitness perception of adolescents with IBD.
Methods: 54 adolescents with IBD (14.6 ± 2.2; M = 22) participated in the study including 27 with Crohn's disease (CD), 24 with ulcerative colitis (UC) and 3 with IBD unclassified. The control group consisted of 70 healthy adolescents. The Physical Activity Questionnaire for Older children (PAQ-C) and the International Fitness Enjoyment Scale (IFIS) were assessed in all groups. A Student's *t*-test or a one-way ANOVA was used to test the differences between groups.
Results: PAQ-C showed differences in PA levels in adolescents with IBD compared to controls ($p < 0.001$). A decrease in general fitness ($p = 0.003$), cardiorespiratory fitness ($p = 0.002$), strength ($p = 0.01$), speed agility ($p = 0.003$), and flexibility ($p = 0.01$) were also found between IBD and controls. Speed agility was related to age ($p = 0.02$) and BMI z-score ($p = 0.01$); flexibility was related to BMI z-score ($p = 0.05$).
Conclusions: Adolescents with IBD had lower PA levels and poorer physical perception compared to healthy adolescents. Supervised exercise could provide multiple benefits at both physical and psychological levels. Therefore, an integrated treatment, including specific exercise programs, may be useful in providing tailored therapeutic strategies and preventing cardiometabolic comorbidities and other preventable disorders.
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Effects of eccentric exercise in patients with rheumatoid arthritis: a feasibility study

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Background: Rheumatoid arthritis (RA) is a major rheumatic disease, affecting about 1% of the population. It is characterized by systemic inflammatory status and joint limitations. Individuals with RA may have a variety of comorbidities such as cardiovascular, metabolic and musculoskeletal disorders. Eccentric resistance training (ECC) improve strength with lower metabolic cost[1] and it seem to increase joint mobility through the increase of muscle fascicle length[2].
Purpose: this is a feasibility study, which aims to investigate the effects ECC in patients with rheumatoid arthritis. Specifically, it aims to shed light on the changes in joint mobility, strength, balance, and body composition following three months of ECC.
Methods: Nine volunteers with RA (61 ± 14 years, 3 M; 6F) underwent three months of ECC. Body composition, active range of motion (ROM), static balance, handgrip, isometric maximum voluntary contraction (MVC) of quadriceps, time up & go test (TUGt), 30'' chair stand test (CSt) were measured before and after the training period.
Results: lower limb lean mass decreased significantly ($p = 0.018$); while MVC increased significantly ($p = 0.014$), as such muscle quality, expressed as strength per muscle volume, drastically improved ($p = 0.016$). Handgrip test remain unaltered. TUGt and 30''CSt showed strong significant improvements ($p < 0.001$). All detected joint ROMs were significantly enhanced except for the ankle. In static balance we observe significant improvement in both unit path ($p = 0.032$) and center of pressure area ($p = 0.014$).
Conclusions: eccentric exercise is feasible and especially well tolerated in patients with RA, as no drop out or symptoms exacerbations were reported, and we observed improvement in all physical outcomes. It could therefore be a viable strategy to improve active ROM in this population where joint deficits are the main functional limitation. Due to the limited sample size, further studies will be needed to improve the significance of these preliminary data in the context of adapted motor activity in rheumatoid arthritis.
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From Europe to local contests: impact of an adapted karate training protocol on locomotor skills and physical activity level in people with intellectual disability (ID)

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Purpose: The effectiveness of an adapted karate program in Down Syndrome (DS) individuals in terms of locomotor function improvement has been demonstrated in the framework of a European project (IKONS[1]).This study was aimed to test the efficacy of a 16-weeks of adapted IKONS training on a small group of people with ID through the Test of Gross Motor Development version 3 (TGMD-3) [2] and the assessment of physical activity level (IPAQ questionnaire).
Methods: Six subjects (Age: 33.5 ± 7.7 yrs; Stature: 1, 6 ± 0.18 m; Body Mass: 71.6 ± 10.2 kg) underwent the TGMD-3 before and after 16-weeks adapted IKONS training program. The total TGMD-3 score (^{TOT}TGMD-3), including the locomotor (^{LOC}TGMD-3), and object control skills (^{OBJ}TGMD-3) scores, were computed. Moreover, subjects physical activity level was assessed through IPAQ. Mean values were calculated for ^{OBJ}TGMD-3, ^{LOC}TGMD-3 and total TGMD-3 changes (^{OBJ}TGMD-3 + ^{LOC}TGMD-3). In agreement with the instructions of IPAQ, participants were classified (total IPAQ below 700 METs), sufficiently active (total score ranging between 700 and

2519 METs), and very active (IPAQ score > 2519 METs). Differences between pre-post training investigated parameters were assessed through paired T-Test ($p < 0.05$).
Results: After training, ^{TOT}TGMD-3 increased by 9.67%. Namely, ^{LOC}TGMD-3 and ^{OBJ}TGMD-3 improved by 13.41% and 7.78%, respectively (n.s.). These results, though not significant, are in line with previous findings[3].The IPAQ test showed a general improvement in the activity level (from 2300 ± 1741 to 3645.8 ± 2415, 8 METs).
Conclusions: In spite of the lack of statistical significance attributable to the small sample tested, the results obtained following the adapted IKONS protocol are in the same direction as those obtained in the IKONS project on people with DS. Adapted IKONS method seems confirmed as a valuable tool to be applied to other contests and disabilities, in a logic of inclusion and improvement of the quality of life through adapted physical activity.
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"We Wheel Dance" at the university of Pavia: effects of an ama program of wheelchair dance and functional exercises on the conditional skills of a female student living with quadriplegia. Case report

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Purpose: There are many competitive sport activities for people using wheelchair but there are few opportunities to train only for wellbeing and fun. The literature reported that wheelchair dance has effects equal to the physical activity to moderate intensity. Therefore, wheelchair dance could be the right balance between physical activity and playful aspects such as music, socialization and emotional well-being. At the University of Pavia, in October 2022, the adapted motor activity project "ABILI SI DIVENTA", organized by the Assistance and Integration Service for Disabled Students (SAISD) in collaboration with the Laboratory of Adapted Motor Activity (LAMA), the Degree Course in Motor Sciences and the CUS Pavia, activated the wheelchair dance course "WE WHEEL DANCE". The course is dedicated to all people who, regardless of their abilities, want to dance, using the wheelchair to improve their health while having fun. For this reason, the effects of an adapted motor activity program (AMA), consisting of wheelchair dance (WD) and functional exercises (FE), were investigated.
Methods: SM (30yrs), a female university student living with quadriplegia and using a wheelchair, was recruited. From 13th October 2022 (T0) to 05th June 2023 (T1) she underwent a bi-weekly AMA program consisting of two 90-min sessions: one of WD, the other of FE. The first session included warm up, dance exercises, choreography and cool down. The other was based on FE for the improvement of conditional capabilities and the ability to use wheelchair. At T0 and T1,28 m sprint test (28MST) was carried out to measure acceleration, maximal sprint power output and velocity. To assess adherence, the number of sessions performed was recorded.
Results: At T1, compared to T0, the result on 28MST has improved (30 m; 28 m). SM completed 38 sessions out of 55, without adverse events.
Conclusions: An AMA program, consisting of WD and FE, seems to improve power and anaerobic capacity in a playful, inclusive and safe environment for people living with quadriplegia and using wheelchair. It would be interesting to evaluate the effects of this program on a larger sample.

Case series investigating exercise as prehabilitation in patients with lung cancer scheduled for surgical resection

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Purpose: Surgery is the best treatment options for patients with lung cancer. Enhancing the individual's functional capacity through exercise to optimize physiologic reserves and to withstand the stress of surgery is known as prehabilitation, and its use is rapidly increasing in this setting. This study explores the effects of a four-week intense exercise prehabilitation in patients with lung cancer.
Methods: Three patients referred by the Thoracic Surgery Unit in the Verona Hospital participated in the intervention before surgical treatment. A four-week exercise program to perform three times per week was proposed. Each session was composed of a warm-up, high-intensity aerobic interval training, five rounds of 2 min at high intensity interspersed by 2 min of active rest, progressively increasing over the weeks, two multiarticular strength exercises, and two breathing activities, one thoracic and one diaphragmatic. Baseline and post-intervention evaluations enclosed: functional capacity, with the six minutes walking test (6MWT), muscle strength, using the hand-grip strength test, flexibility, with the back scratch and chair sit and reach tests; anthropometric measures, using the body mass index (BMI) and the waist-hip ratio, and quality of life assessed with the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ C-30).
Results: Adherence to the intervention was 89% and no adverse events related to an exercise program. Two out of three patients reported an increase in functional capacity (case 1: 280 vs 340 m; case 2: 377 vs 371 m; case 3: 200 vs 331 m). No differences were found in muscle strength and flexibility among the three cases. All patients experienced an improvement in QoL, especially in physical functioning (case 1: 53, 34 vs 80 pts; case 2: 40 vs 33, 34 pts; case 3: 73, 34 vs 93, 34 pts), emotional functioning (case 1: 83, 34 vs 75 pts; case 2: 75 vs 75 pts; case 3: 25 vs 50 pts), fatigue (55, 56 vs 55, 56 pts; case 2: 44, 45 vs 55, 56 pts; case 3: 0 vs 0 pts), constipation (case

1: 33, 34 vs 0 pts; case 2: 33, 34 vs 33, 34 pts; case 3: 0 vs 0 pts) and global health status (case 1: 33, 34 vs 50 pts; case 2: 41, 67 vs 58, 34 pts; case 3: 66, 67 vs 75 pts) domains.
Conclusions: This case series study provides preliminary evidence that a preoperative exercise program may be effective for enhancing the functional capacity and quality of life of patients with cancer scheduled for lung surgery.

Exercise and nutrition intervention for improving lean body mass in patients with cancer: a systematic review

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Purpose: Loss of muscle mass frequently occurs in cancer, with potential negative impact on patients' prognosis. Nutrition and exercise interventions are key strategies to protect against these adverse effects, yet their impact alone or in combination has not been comprehensively understood in cancer. This study aims to systematically review the current evidence in order to determine the effect of exercise and nutritional intervention, alone or in combination, on lean body mass in patients with cancer.
Methods: Systematic research on Pubmed was conducted. Randomized controlled trials exploring the effect of physical exercise and/or nutritional intervention in comparison with usual care on lean body mass in adult patients with cancer were included. The RoB2 tool was used to determine the quality of the study. PRISMA guidelines were used to report the qualitative findings.
Results: The search produced a total of 13.514 results. After the screening for title/abstract and subsequently, for full-text, a total of 32 studies were included in the qualitative analysis. Overall, 24 studies investigated exercise, four nutrition, and five a combined exercise plus nutrition approach. In total, 903 patients were allocated to the intervention, whereas 895 to the controls.
Analyzing the impact on lean body mass, 17 out of 24 studies investigating exercise showed significant improvements in the experimental arm compared to the control. Of the 24 studies, four proposed an aerobic exercise program, ten a resistance intervention, and nine a combined aerobic and resistance approach. With regards to cancer type, 11/24 studies enrolled patients with breast cancer and 8/24 enrolled patients with prostate cancer; cancer stage was I-IV in 11/24 studies. Regarding nutrition, 3/4 trials reported a positive impact on lean body mass of which 3/3 used whey supplementation and the other one nutritional counseling. Cancer stage was I-IV in 3/4 of nutritional studies. Whereas 2/4 investigations in prostate cancer testing the combined approach found significant improvements.
Conclusions: Exercise and nutrition alone seem more effective for improving lean body mass in patients with cancer. Given the impact of lean muscle mass on cancer prognosis, exercise, and nutrition should be recommended as intervention treatment in this population.

Biocircuit®: artificial intelligence for personalized fitness. research methods in a cardiovascular secondary prevention program

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Purpose: A lot of evidences suggest that physical activity is associated with benefit in both primary and secondary cardiovascular prevention The purpose of this study was to evaluate the efficacy of Biocircuit® (Technogym, Cesena), a circuit training fully automated and adaptable, in the functional capacity and in the prescription of physical activity for the long-term improvement of the cardiovascular and musculoskeletal function in subjects with cardiovascular diseases.
Methods: All participants refer to an extra-hospital rehabilitation clinic, ABCardio in Bologna. The Biocircuit® (Technogym) is fully automated and guides patients throughout the whole workout, on specific loads related to their calculated 1RM, repetition number, time and range of motion. The equipment is also pre-sets in reference to individual's anthropometric parameters. The circuit for improving muscle strength is made up of machines based on the "Biodrive" electromechanical motor. Biodrive is a motor controller built on aerospace technology, which allows a precision training to help the healthcare professional to prescribe a correct, safe, effective and fast rehabilitation plan.
Results: Biocircuit will make it possible to carry out adapted physical exercise, which will lead to an improvement in cardiovascular, respiratory, metabolic and musculoskeletal function, adapted to the characteristics of each subject. This type of activity is indicated in cardiovascular pathologies in order to improve functional capacities through physiological adaptations that lead to improve central and peripheral cardiocirculatory efficiency and to an increase in the percentage of oxygen saturation in the blood. The expected results of the project concern also in a validation of a new algorithm for the estimation of VO2peak on Biocircuit instruments and its use in the prescription of physical exercise on a sample of subjects.
Conclusions: Biocircuit applied to secondary prevention by controlling numerous physiological parameters through artificial intelligence can provide high quality exercise training contributing to the formulation and monitoring of personalized programs in cardiac patients.

Comparison of postural training versus physiotherapy treatments in people with low back pain: effects induced by 10 sessions on disability and postural control

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Prupose: Low back pain (LBP) is one of the major spine disorders which seriously impairs many daily activities and limits functional skills. The role of exercise and physiotherapy treatments in LBP management is well documented, even if the debate about the most effective type of intervention is still present. The aim of this study is to compare the effects of 10 sessions of specific training and physiotherapy practice on LBP symptoms and disability, static postural control and gait in adult people suffering from this pathology.

Methods: Twenty people (11 females and 9 males) were recruited for the study. All participants were untrained and affected from chronic non-specific LBP. Participants were divided into 2 groups composed by 10 people each one: Training Group (TG—mean age: 47, 8 ± 6, 2 years old) and Physiotherapy Group (PG—mean age: 45 ± 6, 4 years old). TG performed 10 sessions of postural training with focus on respiratory function, lumbar-pelvic stabilization, trunk strength and flexibility exercises, while PG was submitted to 10 sessions of physiotherapy treatments (physical therapy and manual therapy). All participants were assessed pre and post training to evaluate pain and disability (Roland Morris Disability Questionnaire—RMQ), static postural control in eyes open (EO) and closed (EC) conditions (Prokin® stabilometric system), trunk sway and lower body mobility and symmetry during gait (WalkerView® multi-sensor treadmill—GAIT).
Results: RMQ significantly improved in both TG and PG ($p < 0.01$), with better results observed in TG. Center of pressure area (COP area) and displacement (COP length) decreased in TG for both EO and EC conditions, with significance evidenced in EO COP area ($p < 0.05$). Conversely, PG significantly increased EO COP length ($p < 0.05$). Both group improved hip and knee range of motion on right and left side during GAIT, even if not significantly. Trunk sway increased in both group, with significance for PG only ($p < 0.05$). Finally, load symmetry during GAIT enhanced in PG ($p < 0.05$). No differences were reported during TG and PG comparison ($p > 0.05$).
Conclusions: Previous results suggest that both type of intervention are effective for pain and disability reduction, while only postural training increased static postural control in eyes open condition. In addition, physiotherapy treatments leaded to improvements in load symmetry during gait. Since postural exercises, physical and manual therapy seem to enhance LBP symptomatology and neuromuscular control, the combination of both type of intervention could be useful in people suffering from this pathology.
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Nordic walking training improves functional status and perceived fatigue in persons with multiple sclerosis

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Purpose: Multiple Sclerosis (MS) is a chronic neurologic disease with clinical manifestations that include sensory, motor, cerebellar, or visual system abnormalities. Pharmacologic interventions manage most MS-related manifestations, but non-pharmacologic interventions, such as exercise training, may help alleviate such symptoms. Nordic Walking (NW) is a popular mode of exercise consisting of walking with hand-held poles, but, despite its growing popularity, no evidence has been published on the NW training effect in the MS population. Hence, the present study examined the effectiveness of a NW training intervention on functional status, perceived fatigue, and quality of life in persons with MS.
Methods: Thirteen individuals (4 men and 9 women, age: 44 ± 11 yr; BMI: 23.7 ± 2.2 kg.m^2) with definite relapsing–remitting MS (EDSS score ≤ 6) participated in this study. All participants were trained twice weekly for 8 weeks, followed by 12 weeks of detraining. They were tested before and after the intervention period and after training cessation (follow-up). Aerobic endurance (2-min walk test), upper- (handgrip) and lower-body (30-s chair stand test) muscle strength, gait speed (10-m walk test performed at both fast and self-paced walking speeds), and overall functional mobility (timed up and go test) were assessed. Perceived fatigue (Modified Fatigue Impact Scale) and quality of life (MS Quality of Life Questionnaire) were also evaluated.
Results: The adherence rate was > 80%. There were significant changes in aerobic endurance ($P = 0.004$), lower-body muscle strength ($P = 0.001$), overall functional mobility ($P = 0.019$), and gait speed following the NW intervention ($P = 0.023$). These changes persisted after training cessation ($P > 0.05$). Upper-body muscle strength, otherwise, did not change following the NW intervention ($P > 0.05$). Similar findings were found for quality of life, which did not change over time ($P > 0.05$). Perceived fatigue was reduced following the NW intervention ($P = 0.017$), a result that did not persist after training cessation ($P = 0.038$).
Conclusions: These results suggest that a NW training intervention improves functional status and perceived fatigue in persons with MS. Some changes persisted even after training cessation. Such findings have clinical implications for managing MS and encourage exercise professionals and other healthcare providers to support NW training in the MS population.

Monitoring functional, motor and body composition effects of a fencing-based exercise program on breast cancer survivors

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Purpose: The aim of this pilot study was to investigate the anthropometric profile, body composition, functional and psychological effects of a 12-week fencing-based exercise program in a group of breast cancer (BC) survivors.
Methods: This pre-post interventional study included ten voluntary women diagnosed with BC enlisted among the members of the "Mariangela Pinna Oncohematology Association" of Sassari. The fencing-based exercise program lasted 12 weeks (24 sessions, 2/week), and was held at the Circolo Schermistico Sassarese (Sassari). All the outcomes measures *(i.e.,* anthropometric profile, body composition, balance, muscular strength, flexibility, cardiorespiratory fitness, and quality of life) were assessed at the baseline and at the end of the program.
Results: Significant reduction in arm circumferences (lymphedema-free forearm, -22, 5%, p = 0, 018; lymphedema forearm -20, 65%, p = 0, 036; lymphedemafree arm -20, 47%, p < 0, 001; and lymphedema arm -16, 50%, p = 0, 015) were detected. On muscular strength and flexibility, data showed significant changes in the Wall-sit-test (+ 55, 80%, p = 0, 041) and in the Sit-and-reach-test results (-36, 28%, p = 0, 046). The One-Mile Rockport Walking Test showed a significant reduction in heart rate recorded at the end of the test (-13, 02%, p = 0, 041). A non-significant trend of change was observed for handgrip data measured at lymphedema arm (+ 11, 61%, p = 0, 080).

Conclusions: A 12-week of fencing-based exercise program has proven to be useful, safe and effective in improving the anthropometric profile, lower limbs muscular strength, flexibility and cardiorespiratory fitness in a group of BC survivors. These preliminary findings will have to find confirmation over a larger sample of participants with additional controls.

Effects of exercise-based interventions on health related quality of life of patients and survivors affected by hematological malignancies

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Purpose: Adults affected by hematological malignancies often face treatment-related side effects that could negatively impact their health-related quality of life (HRQoL). In this setting, the potential beneficial role of exercise remains under-investigated. This systematic review and meta-analysis aim to explore the effects of exercise-based interventions on HRQoL of patients with hematological tumors during and after the completion of treatments.
Methods: The systematic review was registered in PROSPERO (CRD42022347819). PubMed, Web of Science, and Scopus databases were systematically screened, and randomized clinical trials comparing EX to UC in adults with hematological malignancies were included. The standardized mean differences (SMD) between the EX and UC changes in the HRQoL domains were analyzed by means of random-effects meta-analyses using the package of the software R (version 4.0.4), with $\alpha = 0.05$. The SMD were interpreted as negligible (≤ 0.2), small (0.2–0.5), medium (0.5–0.8), large (> 0.8).
Results: A total of 1091 articles were analyzed and 7 reported sufficient information to compute the SMD between the EX and UC changes in HRQoL domains. Among the 494 participants included, 456 were receiving anticancer therapies while 38 were survivors during the intervention. The majority had acute myeloid leukemia (49%). Regarding EXs, 6 studies proposed a combined aerobic and resistance training for a period ranging from 1 to 12 weeks, whereas one study proposed aerobic training for approximately 4 weeks. The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ C30) was used to assess HRQoL in all the studies. The SMD (mean [95% CI]) between EX and UC showed non-significant negligible differences in global health status (0.043 [-0.215; 0.301]), physical functioning (0.119 [-0.180; 0.417]), role functioning (-0.004 [-0.228; 0.219]), emotional functioning (0.200 [-0.070; 0.471]), and social functioning (0.054 [-0.170; 0.278]), whereas there was a significant (0.046) small difference in cognitive functioning (0.277 [0.007; 0.547]).
Conclusions: Our preliminary results show the positive effect of exercise-based interventions solely in improving cognitive functioning, with contrasting results in the selected studies in the other HRQoL domains. Therefore, future research analyzing the methodological and clinical factors affecting the efficacy of exercise-based interventions are needed to improve their efficacy.

Exploring the effect of structured exercise intervention in patients affected by metastatic cancer

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Purpose: Patients with metastatic cancer experience a high-symptoms burden and a deterioration in quality of life (QoL). Exercise (EX), may ameliorate the symptomatology in patients with metastatic cancer, but the evidence is scarce. This research aims to assess the effect of an EX program on patients affected by metastatic cancer.
Methods: The study was led on a sample of twenty-nine patients with metastatic cancer, undergoing anticancer treatment at the Oncology Unit of Verona Hospital. A 3-month EX program was proposed, including aerobic and strength training performed twice a week. Each prescription was individually tailored based on the patient's baseline condition and symptoms. The aerobic activity progressively increased from 10 to 30 min at moderate intensity, i.e., 3–5 of the 10-point Borg Rating of the Perceived Exertion Scale (RPE). The strength component consisted of body weight or elastic-bands exercises, performed in 2–3 sets of 8–12 repetitions at moderate intensity. Adherence to the program, and the dropout rate was recorded. Safety was assessed through the number of adverse events during the training sessions. Among secondary outcomes, cardiorespiratory fitness was evaluated with the "Six minutes walking test" (6MWT), strength by the leg press test and handgrip test, and QoL with the European Organization for Research and Treatment of Cancer Quality of Life and Core Questionnaire. Paired t-tests were used to evaluate pre-post changes.
Results: Of the 29 patients included in this analysis, 24% had breast cancer, and 24% had a pancreatic malignancy. The most frequent metastatic sites were bones (41%) and liver (31%), and patients were undergoing chemotherapy (65%), radiotherapy (31%), and target therapy (20%). While only four non-serious adverse events were registered, the adherence to the EX session was an average of 91%, and no dropout occurred. Post-intervention assessments revealed no significant improvements in functional capacity and lower limb strength, whereas an increase in upper ($p = 0.02$) and lower ($p = 0.002$) limb flexibility and upper limb strength ($p = 0.01$) was detected. Several QoL domains improved post-intervention including: physical functioning ($P = 0.001$), role functioning ($P = 0.035$), emotional functioning ($P = 0.001$), fatigue ($P = 0.042$), and loss of appetite ($P = 0.016$).
Conclusions: A individually tailored EX program is safe, and tolerated and may improve physical function and enhance QoL in patients affected by metastatic cancer.

The use of whole-body vibration as an alternative exercise in a person with scleroderma: a six-month intervention

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Purpose: Scleroderma is a multi-systemic disease that can lead to motor impairments, through muscle atrophy processes or directly in the joint, with a significant reduction in range of motion (ROM). It was hypothesized that individualised whole-body vibration (IWBV), could positively interact with neuromechanical and densitometry variables. We aimed to investigate the IWBV effect on postural control, locomotion and bone density over a six-month intervention.
Methods: A person affected by Scleroderma (PsSD) with a left weaker side than contralateral, and comorbidities like Reynard syndrome and osteoporosis, took part in the present study. The IWBV magnitude was determined by recording sEMG in the lower limbs. Angle-angle diagrams were determined by plotting the angles at adjacent joints against each other (hip-knee and knee-ankle angle) using a 3D motion capture system. The balance was assessed by measuring the body sway on the force platform during different bipodalic standing positions (bipodalic static/bipodalic dynamic); open eyes/closed eyes. To evaluate the difference in maximal voluntary isometric contraction (MVIC) in the upper and lower limbs, the subject performed a leg extension, and a Hand-grip strength test with synchronised sEMG activity of upper and lower limbs muscles. In addition, was also evaluated the bone densitometry through the MOC and the ROM by sit and reach test (SRT).
Results: The area of the hip-knee and, knee-ankle angle-angle diagrams increased by $\Delta = 22\%$ and decreased by $\Delta = -18, 2\%$ respectively in the left weaker side. MVIC increased during the monopodalic execution by $\Delta = 3, 1\%$ in the weaker leg with also, an increase of the RFD by $\Delta = 25, 2\%$. ROM of the posterior kinetic chain increased by $\Delta = 10.8\%$. The densitometry reveals an improvement of the Lumbar t-score by $\Delta = 19.2\%$.
Conclusions: The results of this investigation show that IWBV could be a promising exercise to improve locomotion, balance, flexibility, and densitometry variables.
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Relationship between cognitive functions and motor skills in athletes with intellectual disabilities

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Purpose: Previous studies suggested that people with intellectual disability (ID) have delays in motor development and cognitive deficits. Although in the general population the relationship between motor and cognitive domains has been largely explored, only a few studies analyzed this association in persons with ID. To the best of our knowledge, this association has not been examined yet in athletes with ID. This study aimed at examining the relationship between motor skill, strength and cognitive functions in athletes with ID regularly practicing an adapted sport.
Methods: Thirty-seven male athletes with ID aged 20.5 years ($\pm$ 6.4) who had been practicing an adapted sport for at least one year were enrolled in this study. The Timed Up And Go test (TUG), and the Box and Block test (BB) were used to evaluate motor skill; the Handgrip test (HG) and the Standing Long Jump test (SLJ) were employed to evaluate upper and lower limb strength, respectively. Cognitive functions were evaluated by means of the Tower of London test (TOL) and Corsi test (CT). The associations between variables were estimated by partial correlation coefficients (r_{PC}) and the level of statistical significance was set at $p = 0.05$.
Results: The results showed a positive and statistically significant association between the CT and the BB test ($r_{PC} = 0.457$, $p = 0.006$), as well as CT and HG ($r_{PC} = 0.489$, $p = 0.003$). Similarly, statistically significant associations were observed between either cognitive test and TUG or SLJ (r_{PC} ranging 0.518—0.689, $p < 0.05$ for all), as well as TOL and BB ($r_{PC} = 0.590$, $p < 0.001$). Finally, a positive, statistically significant association was found between TOL and HG ($r_{PC} = 0.780$, $p < 0.001$).
Conclusions: In line with previous literature dealing with non-athletic people with ID, the results showed that cognitive functions are associated with both motor skill and strength in athletes with ID. The results seem to underline that the measurement of strength in athletes with ID can be an indicator of their level of cognitive functions. Future research should consider longitudinal studies enabling better understanding of the association between motor and cognitive domains in this athletic population and possibly establishing a cause-effect relationship between motor and cognitive characteristics.

Effects of exercise intervention on physical fitness outcomes in individuals diagnosed with lung cancer: preliminary results of a systematic review

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Purpose: Lung cancer (LC) is one of the most common and lethal types of cancer globally. Individuals diagnosed with LC mainly follow exercise interventions within pulmonary rehabilitation (PR) medical services, which also include behavioral/educational management and physiotherapy. Drawing proper conclusions on the effectiveness of exercise is challenging due to the multidisciplinary nature of PR. Thus, we designed a systematic review, to identify the impact of exercise interventions alone amongst individuals diagnosed with LC.
Methods: A systematic search following the PRISMA guidelines was conducted in five research databases (Cochrane Central Register of Controlled Trials, EMBASE, PubMed, Sport Discus, and Web of Science) from the 19th of September, to the 24th of October 2022 (PROSPERO: CRD42022376291). Eligible experimental studies (randomized and non-randomized controlled trials) examined the effects of exercise interventions alone on physical fitness and patient-

reported outcomes (PROs) in individuals diagnosed with LC. Studies administering PR, breathing exercises, and/or multidisciplinary approaches were excluded. Risk of bias will be assessed for eligible studies.

Results: Following the exclusion of 6 932 duplicates, 29 372 unique records were screened on the COVIDENCE software. A total of 359 potentially relevant full texts were identified. Fifteen articles (13 studies) were deemed eligible, including a total of 638 participants diagnosed with LC age 63.8 [61–65] years (median [IQR]). Studies recruited LC during (n = 4; 31%), after active treatment (n = 1; 8%), or both during/after treatment patients (n = 2; 15%) and before or after surgery (n = 1; 8% and n = 5; 38%, respectively). Studies analyzed the effects of a broad variety of exercise interventions (n = 6 aerobic, n = 2 resistance, and n = 7 combined training). Exercise interventions lasted 12 [8–12] weeks, 3 [3–3] sessions per week (40 [25–54] minutes/session).

Conclusions: Studies mostly investigated the effects of combined training interventions on LC participants. Commonly reported primary outcomes were cardiorespiratory fitness (CRF—cardiovascular and pulmonary), muscle strength (MS), physical function (PF), and PROs. We expect that exercise interventions may improve CRF, MS, and PROs amongst LC patients undergoing surgery. Furthermore, we expect that exercise may reduce the loss of CRF, MS, PF, and PROs among those undergoing LC active treatments.

Feasibility and effect of an exercise therapy program on physical activity level, self-esteem and quality of life in breast cancer survivors: a 3-month intervention

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Purpose: Different modalities of rowing have been studied, and dragon boat or felucca or llaüt training modes are the most analyzed in breast cancer (BC)[1–3]. However, other types of boats, such as recreational rowing boats with sliding seats, use different biomechanical techniques, involving torso, legs, and arms in propulsion, and using two oars per rower. The aim of this study was to determine the benefits of an exercise therapy program, including recreational rowing, on physical activity level (PAL), self-esteem (SE) and quality of life (QoL) in patients with BC.

Methods: The name of the project is Effect and efficacy of RowIng in breast CancEr survivors/The Same Boat (ERICE/TSB). A pre and post within-subject intervention, with 3 training sessions per week (adapted physical activity or pilates, walking and rowing) lasting one hour each, was carried out for 3 months. The study sample included 20 women (age: 55.8 ± 6.1 yrs; BMI: 24.6 ± 3.3 kg/m^2) with BC (stages I, II, or III; surgery at least 6 months to a maximum of 20 years ago). The study was carried out at the Canottieri Corgeno of Lake Comabbio, Italy. The following questionnaires were administered before and after the intervention: General Physical Activity Questionnaire (GPAQ), Rosenberg Self-Esteem Scale (RSES), and EORTC Quality of Life Questionnaire-C30 (EORTC QLQ-C30).

Results: No dropouts occurred during the 3-month intervention and adherence to the exercise protocol was almost complete for all participants. The exercise therapy program did not lead to the development or worsening of pre-existing lymphoedema. The results showed improvements in PAL (1120 ± 1063 vs 1752 ± 1381 METs-min/sett), with a decrease in sedentary time (279 ± 153 vs 270 ± 121 min/day). No changes occurred in SE (20.4 ± 4.5 vs 19.8 ± 5.1). A positive effect on QoL was observed (70.0 ± 21.2 vs 73.8 ± 16.3). No significant differences were found.

Conclusions: This is a novel study as no studies on sculling have been undertaken previously on BC survivors. A 12-week exercise therapy program tailored to women who have had BC increases PAL, leading to improved QoL. Adapted physical activity or pilates, walking and rowing exercise should be recommended as part of the overall treatment plan.

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High-Intensity interval training versus usual care during cancer prehabilitation: a systematic review and meta-analysis of the impact on cardiorespiratory fitness

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Purpose: Prehabilitation in oncology is a comprehensive care process that occurs between the diagnosis of cancer and the initiation of acute treatment to enhance overall health of individuals (Silver & Baima, 2013), thereby improving their capacity to cope with the upcoming physiological stress associated with cancer-related therapy (Palma, 2021). Due to time constrains, high-intensity interval training (HIIT) is explored to accelerate physiological progression. This systematic review and meta-analysis aimed to evaluate the effect of HIIT on cardiorespiratory fitness (i.e., VO_2 peak) during the prehabilitation period in cancer patients.

Methods: Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist was used for this systematic review. Article screening was conducted using five electronic databases (i.e., Cinahl, Embase, PubMed, Scopus, and Web of Science). Search included studies about HIIT in cancer prehabilitation published from their inception to July 1,2023. Studies' quality was assessed with Cochrane Risk of Bias v2 for overall assessment and Consensus on Exercise Reporting Template for exercise interventions. A random effects model was employed for the meta-analysis. VO_2 peak data were analyzed and reported using standardized mean differences (SMD) with corresponding 95% confidence intervals (CI).

Results: 136 studies were initially identified. Based on the inclusion and exclusion criteria, 7 studies were finally included in the meta-analysis. Meta-analysis indicated that the combined effect size was SMD = 0.31, 95%CI: (0.09, 0.52), $p < 0.01$, suggesting a statistically significant difference compared to the control group and that HIIT was effective in enhancing VO2 peak during prehabilitation in cancer patients.

Conclusions: This meta-analysis shows that incorporating HIIT during prehabilitation in cancer patients can potentially improve cardiorespiratory fitness, particularly improving VO_2 peak. However, it is important to note that the exercise protocols and type of cancer exhibited high heterogeneity, highlighting the need for larger randomized controlled trials and further prospective, well-designed studies.

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Correlation between physical activity and neurological risk factors in patient with Parkinson's disease

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Purpose: Evidence suggests that physical activity (PA) exerts beneficial effects on neurodegenerative processes, either as symptomatic relief or disease-modifying strategy. Actually, it may represent a viable neuroprotective intervention in Parkinson's disease dementia (PDD), a severe, frequent, and untreatable complication of Parkinson's disease (PD).
Methods: According to such hypothesis, this cross-sectional study tested, in PD patients, the association between levels of PA and well-known risk factors for PDD, such as mood disorders and amyloid-β42 CSF content. Amount of PA was measured by the International Physical Activity Questionnaires-Short Form (IPAQ-SF) in 156 cognitively intact PD patients and correlated with the Hamilton-Depression (HAM-D) and the Hamilton-Anxiety (HAM-A) scores; in a homogenous sub-group of 44 patients, it was further correlated with a panel of CSF biomarkers, including amyloid-β42, total α-synuclein, total, and phosphorylated tau.
Results: The statistical model was corrected for the main potential confounding factors (motor impairment, dopaminergic treatment, disease duration, age, and sex). Both the HAM-A and HAM-D scores, as well as the Aβ42 CSF content, improved in parallel with the increase of the total week amount of PA.
Conclusions: Although with several limitations, we preliminarily demonstrated that a high level of PA is associated with a more favourable profile of PDD risk factors, in terms of both mood disturbances and CSF markers of neurodegeneration. However, confirmative studies are necessary to validate the efficacy of PA as protective intervention for PDD.

Association between manual dexterity and postural sway orientation in a young population: a cross-sectional study

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Purpose: Manual dexterity is the ability to manipulate objects essential for performing activities of daily living, typically developing before the age of 7 years. Several neurodevelopmental disorders are characterized by alterations in this ability. Published studies demonstrate an association between balance and manual dexterity. However, none refer to the influence of the specific sway orientation on manual dexterity. Understanding this might be helpful in planning specific postural control workouts to support the rehabilitation programs or hand-sport performances focused on this skill. The aim of our study was to investigate the association between manual dexterity performances and standing postural control in young subjects with particular reference to the orientation of postural oscillations in the plans.
Methods: 37 youths aged between 8 and 15 were recruited. Manual dexterity was assessed with two standardized tools: the Grooved Pegboard Test (GPT) and the Coin Rotation Task (CRT). Both tasks were performed with the dominant and non-dominant arms respectively two and three times each arm. Postural control analysis was performed with a standardized Sway test on the baropodometric platform in the Romberg position two times for 51.2 s: the first time with open eyes (OE) and the second time with closed eyes (CE). From the sway analysis, the following variables were taken into consideration: X-mean sway (frontal planes), Y-mean sway (sagittal plane), length of the sway, and the ellipse surface area.
Results: Association between right-left and forward–backward plane sway and non-dominant manual dexterity test performance were found. Particularly, the y-mean variable, indicating the back-forward sway, showed a positive correlation with non-dominant GPT performance in both OE (p: 0.01) and CE (p: 0.03) conditions; the x-mean variable, indicating the right-left sway, results correlated with the non-dominant CRT performance for the CE conditions (p: 0.04).
Conclusions: Forward–backward sways are associated with pegboard test performance. In contrast, right-left oscillations are associated with CRT performance. Thus, there is an association between postural sway and manual dexterity but the orientation of the associated postural sway depends on the manual dexterity task performed. Future studies could evaluate the muscles involved in different phases of manual dexterity tasks performed. Thus, focused postural training could help to improve manual dexterity development and contribute to reducing fine motor skill alteration linked to developmental disorders.
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What makes a karateka élite? kinematic analysis of kicking techniques

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Purpose: As in many other sports, in Karate the competition point system is based on technical and athletic performance scales, but judges establish the score subjectively. As well as a judge, the Karate national team coach provides evaluation to select the national team members from a pool of high-level karateka.This study aimed to investigate the potential link between the subjective evaluation of coaches or judges and the relevant biomechanical variables of basic kicking techniques. Thus, we aimed to compare kinematics between

karateka called to the National team (élite) and black-belt karateka (non-élite).

Methods: 7 élite and 7 non-élite karateka were asked to perform 3 kicking techniques with the dominant limb: *Mae-Geri* (front kick), *Ushiro-Geri* (back kick), *Mawashi-Geri* (roundhouse kick). All the techniques were performed at the highest speed possible. A 9-camera motion capture system provided Center of Mass (COM) position, hip adduction and flexion, and kick height (KH). KH and COM position were normalized by the karateka's height. T-tests were used to investigate group differences in age, anthropometrics, and training. The difference in the KH was evaluated through Mixed 2-Way ANOVA (Level, Kick). The entire time series of COM, hip adduction and flexion were analysed using a Mixed 2-Way ANOVA (Level, Kick) through Statistical Parametric Mapping (SPM), from the beginning of the movement to the highest point of the foot.

Results: The groups were comparable in age, weight, and height ($p > 0.05$). Élite karateka had more weekly trainings than non-élite ($p = 0.047$). Élite karateka showed higher KH (mean difference: 5.9 cm, $p = 0.018$). No statistical differences among groups were found in the entire time series of COM, and hip kinematics ($p > 0.05$). The Level x Technique interaction did not affect either KH or SPM analyses.

Conclusions: The kick height has been considered an indicator of joint mobility and muscle flexibility, higher in élite than in non-élite karateka. Despite this, we found no significant difference in hip and COM kinematics during the execution of basic kicks. Even if the preliminary results of this study are apparently incoherent with the discrimination of élite players according to judges' opinions, the investigation in biomechanics in Karate could provide a quantitative analysis of the technique execution, both for training and for the evaluation in competitions or Karate national team members selection.

Kinematic network variations before and after the levodopa intake in Parkinson's disease

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Purpose: Three-dimensional motion analysis is a reliable approach able to assess spatio-temporal and kinematic alterations in Parkinson's disease (PD) [1]. However, it focuses on specific body segments, discarding the whole-body interactions underlying the motor impairment in PD, thus leading to a loss of information. Here, we used the kinectome framework [2] to investigate how the levodopa intake affects the whole-body kinematic network in PD.

Methods: The kinectomes' participants were obtained by calculating the Pearson's correlation coefficients between the time series acceleration of 21 bone markers. A topological analysis was performed to evaluate the large-scale interactions between body elements. Specifically, we calculated the nodal strength which provide information about the importance of a node (i.e. bone marker) within the kinematic network. Finally, we performed a multilinear regression analysis in order to verify whether the kinectome's topological features could predict the clinical variation before and after the levodopa intake.

Results: PD patients showed lower nodal strength (i.e. lower synchronization) in the upper body in the medio-lateral acceleration in the on state with respect to the off state (p-head = 0.048; p-C7 = 0.032; p-T10 = 0.006). On the contrary, PD patients in the on state displayed higher nodal strength (i.e. higher synchronization) of both elbows (right, $p = 0.002$; left, $p = 0.005$), wrists (right, $p = 0.003$; left, $p = 0.002$) and knees (right, $p = 0.003$; left, $p = 0.039$) in the antero-posterior acceleration. Importantly, the predictive analysis revealed that the nodal strength variations of the arms, following the levodopa intake, significantly predicted the clinical variations assessed through the UPDRS-III ($R2 = 0.65$; $p = 0.025$).

Conclusions: Following the assumption of levodopa, we observed increased synchronization of the arms and reduced synchronization of the trunk with respect to the whole body, thus leading to enhanced coordination between the upper and lower limbs. Moreover, PD patients in the on state showed less rigidity during walking, proportional to the UPDRS-III variation. Finally, we showed that the levodopa intake led to greater harmony of the large-scale kinematic pattern in Parkinson's disease.

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Kinematical differents between healthy and shoulder-injured softball players

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Purpose: Softball is a sport that is growing in popularity. Injuries related to throw movement are increasing in softball players, particularly affecting the shoulder and elbow joints. To design and prescribe a sport-specific strength and conditioning program targeted at reducing the risk of injury, boosting performance, and improving health, it is essential to comprehend softball task mechanics. The aim of the study was to assess the kinematic differences in the upper limb and trunk between healthy and shoulder-injured softball field players.

Methods: A cohort of 11 first-division softball players (mean age 25.9 ± 8.1) were enrolled in the study. Among the participants, 5 experienced a shoulder injury with consequent surgery while 6 did not report previous shoulder injuries. The shoulder-injured and the healthy groups have been practicing softball for 15.8 ± 7.5 and 18.8 ± 9.3 years, respectively. The players were assessed while performing a typical field motor task, from the moment when they pick up a ball on the ground to the complete throw, perform 3 trials. For the analysis, the motor task was divided into 2 phases: Pickup, which starts from ball grabbing to throw position; Pass, from hand far in the back to the complete throw. Wearable inertial sensors (Xsens MTw Awinda) were used to collect kinematical data on the shoulder, elbow, and trunk. The kinematical parameters analyzed were peaks joint angle and range of motion (ROM).

Results: In the Pickup phase, the shoulder showed a higher internal-/external rotation ROM in healthy players than in injured ones ($p < 0.001$). The same results were observed for the elbow flex-/extension ROM ($p < 0.01$). Healthy players showed a higher peak of trunk flexion than the injured ones ($p < 0.01$). Concerning the Pass phase, the ROM of shoulder internal/external rotation and flex-/extension of healthy players was wider than the injured ones ($p < 0.001$). Healthy players showed a higher elbow flexion ($p = 0.01$).

Conclusions: The shoulder-injured players showed less ROM than healthy ones during the assessed motor task. Kinematics differences were found in the shoulder, elbow, and trunk. Despite being all returned to play at the pre-injury level, the injured players could voluntarily or unconsciously perform the motor task in a more conservative way than the healthy players. The kinematical analysis through wearable sensors could be used to assess compensatory movements in softball and inform the return-to-sport process after shoulder injuries.

Acknowledgments: softball team.

Total ankle replacement in-vivo kinematic evaluation: a prospective radiostereometric analysis

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Purpose: Ankle osteoarthritis (OA) represents a significant social burden and is one of the main causes of chronic disability. The degenerative articular pathology affects about 15% of the world's population of which about 1–2% is affected by ankle OA. Ankle arthrodesis has been and still is the gold standard for advanced stages of ankle OA, with good results in the medium to long term although not optimal. In this panorama, Total ankle replacement (TAR) has become increasingly popular despite the poor results obtained with the first dedicated designs. Through the innovation of new materials, new surgical techniques, and new designs, the TAR has evolved. Newer designs have attempted to replicate normal ankle anatomy and kinematics, ligamentous stability, and mechanical alignment. The purpose of this paper was to evaluate the ankle kinematics, in vivo and under weight-bearing conditions, of a TAR through dynamic model-based radiostereometric analysis (RSA).

Methods: All patients affected by ankle OA and eligible for TAR were screened and enrolled. This study was performed by prospectively collecting pre-operative (clinical outcomes) and post-operative (clinical and kinematical outcomes) data for all treated patients. The clinical evaluation was performed by administering the American Orthopaedic Foot and Ankle Society (AOFAS)—ankle hindfoot and Short Form-36 questionnaires. The kinematic evaluation was conducted through dynamic RSA during the execution of an open kinetic chain and a closed kinetic chain motor task. Double radiographic images of the ankle joint were processed using dedicated software to obtain a 3D reconstruction of the ankle prosthetic components' motion.

Resuts: Eighteen patients (5 females) completed the clinical and instrumental pre-and post-operative evaluations (age 59.1 $\pm$ 10.3). The clinical scores AOFAS ankle-hindfoot and functional (F) and mental (M) domains of SF-36 showed a statistically significant improvement between pre-operative and post-operative assessments (p-value < 0.005). During the closed kinetic chain motor tasks, the ankle showed a total range of motion (ROM) in dorsi-plantarflexion of 19.84°.

Conclusions: Physiological motion can be achieved in TAR, characterized by a wide range of motion and coupling of movements on the 3 planes. The results of this study can contribute to a better understanding of the actual movement in a commonly used TAR model and potentially aid in enhancing future designs and instrumentation.

Motor unit discharge characteristics as neuromarkers for evaluating training interventions in individuals with acute respiratory distress syndrome

Purpose: Physical functioning impairment is commonly observed in patients recovered in the intensive care unit (ICU) from acute respiratory distress syndrome caused by Covid-19 ([C]ARDS). ICU-acquired weakness is characterized by muscle fatigability and strength reduction which can persist several months after the discharge. This study aims to identify correlations between functional variables and Motor Units (MUs) properties in [C]ARDS patients. The objective is to use these correlations as markers for assessing the effectiveness of training intervention during and after hospitalization, with the goal of optimizing rehabilitation strategies and enabling patients to regain autonomy in daily activities.

Methods: The study involved sixty [C]ARDS adult patients (61 $\pm$ 9 years; 21 females) who attended the post-ICU clinic at ASST Spedali Civili University Hospital of Brescia, Italy, at three different time points (3, 6, and 12 months) after discharge. Several assessments were conducted to determine their psychophysical status, including measurements of muscle strength (MVC), perceived severity of fatigue (FSS), and functional capacity (6MWT). MUs properties were obtained from the decomposition process of the High-Density Surface EMG signals, which were recorded during submaximal isometric foot dorsiflexions at different levels of MVC (30, 50 and 70%), using a 64-electrodes matrix placed over the belly of the Tibialis Anterior muscle.

Results: The repeated measures correlation shows that from 3 to 6 months and from 6 to 12 months, MVC and FSS were strongly correlated with MUs properties. Specifically at 3–6 months the MVC was significantly related to mean discharge rate at 30% ($p = 0.02$), mean recruitment threshold at 70% ($p = 0.02$) and mean de-recruitment discharge rate at 70% ($p = 0.03$). At 6–12 months, MUs properties such as force covariation at 30 and 70% ($p = 0.02$ and $p = 0.03$) and mean discharge rate at 50% ($p < 0.01$) were significantly correlated to the FSS.

Conclusions: The MUs decomposition and analysis offer a non-invasive and objective method for assessing the severity and progression of physical functioning impairments in [C]ARDS survivors. The correlation between functional and central variables denotes that these two could be related to central nervous system impairments. Muscle weakness primarily affects the quality of life in the early stages, while the severity of perceived fatigue becomes more prominent in the long term. These findings suggest that MUs properties could serve as valuable neuromarkers for the neuromuscular impairments associated with [C]ARDS.

Mechanism of hamstring injuries in élite female football players

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Purpose: Hamstrings injuries (HSI) are the most recurrent musculoskeletal injuries in football, accounting for 34% of all muscle injuries and 17–26% of football players' lesions [1]. Understanding the injury mechanisms is crucial for effective prevention, yet gender-

specific patterns have been overlooked. This research aims to fill the gap by investigating the inciting events of HSI in élite women's football players through systematic video analysis.
Methods: Using an observational cross-sectional design, we implemented a well-established video analysis framework [2] to investigate consecutive HSI during official games from the 2015–16 season. Each case was included based on contextual information, diagnosis, severity, and video quality. Relevant situational information, injury patterns, mechanisms, and specific game situations leading to HSI were extracted from the videos.
Results: We retrieved 69 candidate injuries; 38 did not meet the inclusion criteria for video analysis. 42% of injuries occurred in the 1st quarter, and 28% and 30% in the 2nd and 3rd quarters, respectively. Seasons 2021–22 and 2022–23 accounted for 57% of all the HSI, probably for the increased popularity of female football and therefore media coverage.
Preliminary findings from the 31 retained injured players (age: 27 ± 5 y; height: 1.68 ± 6 m; weight: 59 ± 4 kg) showed that 77% were right-footed, but only 42% of HSI occurred on the right leg. Injury risk was high in the first (32%) and last (29%) 25 min of the game. 24/31 injuries occurred when the team was in possession, with the injured player often directly interacting with the ball. The offensive side (48%) had more injuries compared to defensive (19%) and middle (32%) parts of the pitch. Interestingly, 39% occurred on the left side, and only 7% occurred on the right.

Among non-contact injuries (21 cases), 67% were closed kinetic chain (CKC) and 33% were open kinetic chain (OKC) patterns. Sprint and stretch-type injuries were 16 and 15, respectively, with sprint-type showing a higher prevalence of CKC (88%) than OKC (12%); stretch-type had a more even distribution (53% CKC vs 47% OKC).
Conclusions: We provided evidence on how HISs occur in professional women's football and show typical situational patterns (sprinting, lunging-CKC, and kicking-OKC) that need to be considered for injury risk mitigation. By developing effective preventive strategies, the research can improve player performance and well-being and reduce healthcare costs.
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Exploring neural mechanisms underlying short-term skill acquisition: insights from alpha band oscillations estimated using motor unit spike trains and bipolar surface EMG

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Purpose: It is well-established that low-frequency oscillations in the synaptic inputs shared across the motor neuron pool directly impact the force output modulation. Among these oscillations, the alpha band components (5–15 Hz) are particularly implicated in introducing noise components that can reduce force precision. Consequently, when learning a new motor task that requires precise force generation, it becomes paramount to minimize these noise components unrelated to the intended motor task. In this study, we sought to investigate changes in alpha band oscillations during the short-term acquisition of a skilled motor task using two different approaches: EMG-EMG coherence and coherence between cumulative spike trains (CSTs) of motor units.
Methods: High-density surface EMG (HDsEMG) was obtained from the first dorsal interosseous (FDI; 13 participants) and the tibialis anterior (TA; 11 participants). Participants performed 15 trials of an isometric, challenging force-matching task. We selected the trials with the highest and lowest errors between the force and target (pre- and post-skill acquisition). We then simulated two bipolar EMG signals from the HDsEMG grid and calculated the coherence between these signals (approach 1). Moreover, we decomposed HDsEMG signals into motor unit spike trains and calculated the coherence between the CSTs obtained from these motor units (approach 2). For both approaches, we quantified the ratio (post/pre) of the area under the curve of coherence within alpha band.
Results: In the TA, improvements in force-matching were accompanied by significant reductions in alpha band oscillations, regardless of the approach used. For the FDI, a significant decrease in alpha coherence was also observed when using approach 2, but no changes were observed when using approach 1.
Conclusions: Our findings indicate that the short-term acquisition of a skilled motor task involves changes in alpha band oscillations, suggesting neural adaptations aimed at minimizing common synaptic components unrelated to the required force fluctuations. Importantly, we observed these alterations in both investigated muscles using the CSTs approach but not the EMG-EMG coherence approach. These results suggest that the CSTs may be a more suitable methodology for detecting modifications in shared synaptic input during the acquisition of skilled motor tasks.
Acknowledgments: European Research Council Consolidator Grant INcEPTION (no. 101045605).

Kinematic analysis of the barbell trajectory during the Bench Press

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Purpose: The objective of the study was to analyze the effects of fatigue on barbell kinematics in bench press lifts under maximal and submaximal conditions in a group of amateur "resistance training" practitioners.
Methods: 13 experienced male resistance training practitioners (age: 27.5 ± 7.7 years; weight: 75.9 ± 8.4 kg; height: 180.3 ± 9.1 cm; BMI: 23.4 ± 1.9) with 31 ± 19 months of experience in Bench Press took part in the two sessions of the study. The first one aimed to measure the 1RM of each participant. The second one consisted in three sets until technical failure at the 85%, 70% and 50% of the 1RM. The 2D kinematic analysis of the barbell displacement was conducted through the video recording of each set, performed with a Go Pro. Data were processed through Kinovea and Excel. For our study we considered the Horizontal Displacement (HD), the Vertical Displacement (VD), Negative Mean Vertical Velocity (NMVV), Positive Mean Vertical Velocity (PMVV), Negative Peak Vertical Velocity (NPVV), Positive Peak Vertical Velocity (PPVV), Distance (D), Trajectory (T), Length (L), which is the length of the line joining the lowest and the highest points reached by the barbell, and TL Index, which is the Trajectory / Length ratio. Statistical analysis were carried out by mixed-effect ANOVA and Bonferroni Post-Hoc Tests.
Results: T showed a significant difference (P = 0, 01) between mean of repetitions at 70% of 1RM and the 1RM (7, 6 cm higher in the 1RM). PMVV showed a highly significant mean difference (P = 0, 001) between 50% and the 1RM (65% of Velocity Loss from 50%

series), and a significant mean difference (P = 0, 01) for PPVV between 85% of 1RM and the 1 RM. TL Index reported a significant mean difference between 50% of 1 RM and 1RM.

Conclusions: The lift's technique is specific in terms of load used, in terms of speed and barbell trajectory. The number of repetitions to be performed with the given load should be carefully decided, as the higher you go with the repetitions, the more you risk changing the kinematic parameters. Getting out of the ideal trajectory is easier if the loads or numbers of repetitions, considered in the series, are higher.

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Neuromuscular characteristics of unilateral and bilateral exercise during Maximal voluntary isometric contractions following acl reconstruction

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Purpose: One of the criteria for a safe return to sports participation is based on the maximal voluntary isometric contraction (MVIC) performed unilaterally and comparison between the 'healthy knee' and the 'operated knee'. The present study aimed to investigate MVIC in athletes following ACL reconstruction during open kinetic chain exercise performed unilaterally and bilaterally exercises.

Methods: Twenty subjects participated to the present investigation: 10 male athletes of regional–national level (skiers, rugby, soccer, and volleyball players) who were previously operated in one knee and received a complete rehabilitation protocol (for 6–9 months) were included in the ACL group, whereas 10 male athletes formed the control group.

Results: MVICs synchronised with electromyographic (EMG) activity (recorded on the vastus lateralis, vastus medialis, and biceps femoris muscles) were performed during unilateral and bilateral exertions. The rate of force development (RFD) and co-activation index (CI) were also calculated. The differences in the MVIC and RFD between the two legs within each group were not significant ($P > 0.05$). Vastus lateralis EMG activity during MVIC and biceps femoris EMG activity during RFD were significantly higher in the operated leg than those in the non-operated leg when exertion was performed bilaterally ($P < 0.05$). Also, the CI was higher in the operated leg than that in the non-operated leg when exertion was performed bilaterally ($P < 0.05$). Vice-versa, vastus medialis EMG activity during RFD was significantly higher in the right leg than that in the left leg when exertion was performed bilaterally ($P < 0.05$) in the CG.

Conclusions: MVICs performed bilaterally represent a reliability modality for highlighting neuromechanical dysfunctions.

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Mechanical energy responses during walking of obese and non-obese children

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Purpose: Obesity prevalence has increased globally in recent years (NCD, 2016), indicating a significant global public health issue. Oliveira et al. (2020) recently reported that obese children have a similar walking economy to their lean counterparts, despite the greater internal mechanical work from obese children. The similar walking economy could be related to mechanical factors influencing energy recovery and the possible role of elastic energy usage. We aimed to compare the recovery, the phase shift, and the maximum possible elastic energy usage (MPEEu) between obese and non-obese children walking. We hypothesized that obese children may rely more on elastic mechanism, contributing to understand the similar cost of transport of walking in obese children in comparison to eutrophic children.Obesity prevalence has increased globally in recent years (NCD, 2016), indicating a significant global public health issue. Oliveira et al. (2020) recently reported that obese children have a similar walking economy to their lean counterparts, despite the greater internal mechanical work from obese children. The similar walking economy could be related to mechanical factors influencing energy recovery and the possible role of elastic energy usage. We aimed to compare the recovery, the phase shift, and the maximum possible elastic energy usage (MPEEu) between obese and non-obese children walking. We hypothesized that obese children may rely more on elastic mechanism, contributing to understand the similar cost of transport of walking in obese children in comparison to eutrophic children.

Methods: Twelve obese (6 female, 8.6 ± 0.51 years, 1.38 ± 0.04 m, 44.6 ± 6.65 kg and 24.1 ± 3.50 kg·m^{-2}) and 12 non-obese (6 female, 7.8 ± 0.90 years, 1.31 ± 0.08 m, 26.8 ± 2.24 kg and 16.4 ± 1.40 kg·m^{-2}) children walked on treadmill at five speeds: 1,2, 3, 4, and 5 km·h^{-1} The order of the speeds was randomized.

Kinematic data was collected with six infrared cameras (200 Hz, Vicon, UK) using 18 reflexive markers positioned bilaterally on the body. The raw kinematic data were filtered with a low-pass Butterworth filter (4° order, 5–10 Hz). The dependent variables were calculated by a custom mathematical routine in MATLAB (2020a, Mathworks Inc., USA). Generalized linear mixed models were used to test the effects from group and speed on the dependent variables (SPSS software v. 22, IBM, USA).

Results: The recovery ($p = 0.02$) was lower in obese children. The alpha shift phase ($p = 0.02$) was also lower in obese children, while the beta shift phase was similar between groups ($p = 0.51$). The obese children had a greater MPEEu ($p < 0.001$). With the speed increase, the recovery increased ($p < 0.001$), while the energy congruity and the MPEEu reduced ($p = 0.001$). Only the MPEEu had statistically significative interaction between group and speed ($p = 0.01$).

Conclusions: Our results indicated that although the mechanical energy response of the center of mass during walking is different between obese and non-obese children, and the obese children showed a greater usage of elastic energy during level walking.

Is rhythmic gymnast a healthy or deleterious sport for athletes? An exploratory study on eating disorders in the south of Italy

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Purpose: The sport concept is not always related to the health concept. One of the disciplines in which the participants are at risk of unhealthy behaviors is rhythmic gymnastics. The characteristics of this discipline could bring athletes to assume wrong eating behaviors, increasing the risk of eating disorders. This study aimed to evaluate a sample of Sicilian rhythmic gymnasts in terms of eating habits and eating disorders risk.
Methods: Only girls under 19 years of age who practice rhythmic gymnastics answered two questionnaires specific to detect eating disorders: the Eating Attitudes Test-26 (EAT-26); and the Bulimic Investigatory Test Edinburgh(BITE). Furthermore, the participants answered a health questionnaire in which information related the eating habits and menstrual cycles was collected. Everything was performed online.
Results: The mean body mass index was 17.9 (2.2) kg/m^2; 33.33% of the gymnasts reported the EAT, a score above 20, this score highlights the possible presence of eating disorders. The BITE Symptom subscale showed that 6.7% of the gymnasts obtained a score between 10 and 19 (abnormal eating behavior) and a 10% score above 20 (possible presence of binge eating).
Conclusions: Especially during development, the sport should be associated with healthy behaviors but the results of this study highlight that it is not always like this. The results suggest that rhythmic gymnasts, due to the characteristics of this sport where also the physical aspect influences the performance, require attention in terms of eating behaviors and education. Coaches, parents, and team managers have to adopt proper behaviors to prevent eating disorders and possibly serious problems during adulthood.
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Changes in hydration/body cell mass ratio through a rugby season

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Purpose: Bioelectrical impedance vector analysis (BIVA) and urine specificity of gravity (USG) are standard methods to assess hydration. The present study aimed to examine the sensitivity and relationship between BIVA and USG at multiple time points throughout a competitive rugby season in elite players to measure hydration and body cell mass status. We hypothesized that BIVA and USG methods are sensitive enough to detect the physiological changes in the body in the different stages of the season, with a correlation between them. In addition, we also hypothesized that the bioelectrical change, according to the time of the competitive season, is due to the adaptations of the physical training.
Methods: 34 elite male rugby players (25.1 $\pm$ 4.4 years; 184.0 $\pm$ 7.8 cm; 99.9 $\pm$ 13.4 kg) were enrolled. Differences over time were tested using one-way repeated measures ANOVA and Bonferroni's post-hoc test was applied in pairwise comparisons. Resistance-reactance graphs and Hotelling's T2 test were used to characterize the sample and to identify bioelectrical changes. A repeated measures correlation test was conducted for BIVA-USG associations.
Results: Two clear trends were seen: 1) from July to September, there was a vector shortening and an increase of the phase angle ($p < 0.001$); 2) from December to April, there was a vector lengthening and a decrease of the phase angle ($p < 0.001$). USG reported neither changes nor correlation with BIVA ($p > 0.05$). Vector variations indicated a body fluid gain (especially in the intracellular compartment) and a body cell mass increase during the preseason, suggesting a physical condition and performance improvement. During the last months of the season, the kinetic was the opposite (fluid loss and decreased body cell mass).
Conclusions: Results suggested that BIVA is sensitive to physiological changes and a better option than USG for assessing hydration changes during a rugby sports season.

Non-invasive brain stimulation and coordination performances in volleyball players

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Purpose: It is widely demonstrated that high frequency (HF) repetitive transcranial magnetic stimulation (rTMS) has facilitative effects and is therefore capable to inducing changes in motor responses. One of the most investigated areas is the dorsolateral prefrontal cortex (DLPFC) as it plays a special executive attention role in actively preserving access to stimulus representations and objectives in environments with plenty of distraction such as those of team sports. Volleyball is a team sport in which the attention and

coordination components are essential for achieving performance. The aim of this study was to investigate if HF rTMS in volleyball players can improve homolateral motor coordination and cortical excitability.
Methods: This study was a double-blinded (participant and evaluator) matched-pair experimental design. Twenty right-handed female volleyball players were recruited for the study and were randomly assigned either the active rTMS (n = 10) or the sham stimulation group (n = 10). The stimulation was performed in one session with 10 Hz, 80% of the resting motor threshold (RMT) of the right first dorsal interosseous muscle, 5 s of stimulation, and 15 s of rest, for a total of 1500 pulses. Before and after stimulation, the coordination and the cortical excitability were evaluated.
Results: HF-rTMS of the DLPFC improve performance in terms of the homolateral interlimb coordination, with a significantly decreased RMT and MEP latency of the ipsilateral motor cortex. After stimulation, in active group increase the time of correct execution of the interlimb test in both condition (in-phase/anti-phase). It seem that HF-rTMS could increase coordination performances when the velocity of the execution is higher (120 bpm and 180 bpm). Moreover, in active rTMS group significant differences emerged after stimulation in RMT and in MEP latency, while no differences emerged after stimulation in MEP amplitude.
Conclusions: The results of this study could provide useful tools to modulate sports training. In fact, these results, if confirmed, could lead trainers to offer their athletes rTMS sessions suitably blended with training. However, despite the interesting results, the study has some limitations such as a small sample, that should be increasing and investigated in the future to clarify all aspects. In conclusion we believe that these results could be of great interest to the scientific community and they could have practical implications in the future.

Running economy in young athletes: early specialization vs multiple disciplines

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Purpose: Running economy (RE) is considered one of the most important performance determinant parameters in distance-runners. Endurance training coupled with other training methods has been shown to improve RE in untrained and trained runners but there is a lack in literature about RE in young runners. The purpose of this study is to compare RE; performance and training volume between young athletes specialized in distance-running (SG) or involved in all the disciplines of the track and field program (MG).
Methods: Fifteen young athletes (age 13.3 ± 0.7 years, $V'O_2$ max 60.0 ± 10.2, height: 163.3 ± 10.3 cm, body mass 48.4 ± 9.2 kg) were recruited in the study. Each subject underwent a laboratory-based assessment on treadmill to determine (1) $V'O_2$ max and (2) running economy. In the two groups of athletes were calculated the mean weekly volume of running (km/week) all last year long. Training logs were considered to determine the volume of running sessions. For the statistical comparison analysis was performed a two-way ANOVA.
Results: The SG had an average weekly volume of 44.1 ± 4.2 km and a personal best on a 1000 m race of 184.7 ± 14.6 s ($P < 0.05$). The MG reported an average volume of 15.0 ± 6.5 km and a personal best on a 1000 m race of 208.8 ± 15.4 s ($P < 0.05$). The RE were 213.4 ± 5.46 and 221.2 ± 6.7 ml O_2/kg*km ($P < 0.05$) respectively in SG and MG.
Conclusions: The two groups have shown statistical differences in RE. Moreover, there is a relation between RE and performance. It's important to consider that the specialized group (selected athletes) presented different mean personal best. Therefore, this differences in term of performance could be the effect of a better RE, of an average weekly running volume of almost 4 times greater, but also of a higher $V'O_2$ max. The small dimension of the groups is a limit for this preliminary study and more athletes are needed to have better data. Moreover, this study lays the foundations to follow the growth of the athletes through the years and to evaluate the differences between the groups in the long term.

Combined weekly training program of high-intensity interval training and moderate intensity continuous training: effects on cardiorespiratory, metabolic and performance parameters in adolescents-trained rowers' athletes

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Purpose: In rowing, the moderate-intensity continuous training (MICT) and the high-intensity interval training (HIIT) are the most used endurance training modalities. However, in adolescent rowers, the effects induced by the combination of these training programs on performance are still unclear. Therefore, the aim of this study was to investigate, in adolescent trained rowers, the effects of a combined weekly training program of HIIT and MICT on cardiorespiratory and metabolic responses as well as on performance. The perception of effort was also a focus.
Methods: Twelve adolescent trained rowers (age: 15.75 ± 0.45 years; VO_2max: 59.68 ± 3.61 mL•min^{-1}•kg^{-1}; training volume: 7 sessions/wk) were divided into two groups: HIIT + MICT group (n = 6) and CONTROL group (n = 6). During the 7-wk training period, the HIIT + MICT group performed 3 MICT sessions/wk (80-100 min at 70% of Peak Power Output, PPO), 2 resistance training (RT) sessions/wk (3sets/6-10reps) and 2 HIIT sessions/wk (4 × 4 min at 85%PPO interspersed with 3 min at 50%PPO), while the CONTROL group performed 5 MICT sessions/wk (80-100 min at 70%PPO) and 2 RT sess/wk (3sets/6-10reps). Before and after the intervention period, an incremental step test until- exhaustion on a rowing ergometer was performed. Oxygen consumption (VO_2), Heart Rate (HR), Blood lactate concentration ($[La]^+$) Power at Lactate Threshold (PLT), PPO and mean weekly training volume were also assessed. The rating of perceived exertion (RPE), by the Borg's CR-10 scale, was used to assess the subjective level of fatigue experienced at the end of the exercise.
Results: Statistical analysis showed that, in the MICT + HIIT group the PLT was significantly higher ($p < 0.05$) and the mean weekly training volume (57.18 ± 1.26 km vs 72.11 ± 0.62 km) was significantly lower ($p < 0.001$) compared to the CONTROL group. An effect of TIME in both groups for VO_2max, HRmax and PPO values (p always < 0.001) with no effect of TIME x GROUP were shown. Finally, no difference in RPE was detected.
Conclusions: This study shows that the HIIT + MICT program is effective in promoting cardiorespiratory and performance responses similar to those reached by the traditional MICT training, despite a significantly lower mean weekly training volume performed. Our findings indicate that the combination of HIIT and MICT within the

weekly training program could be a valid training alternative in young adolescent rowers.

Jump performance of female volleyball players: a potential link with bioelectrical impedance analysis?

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Purpose: Bioelectrical impedance analysis (BIA) is commonly recognized as a valid method for exploring changes in body components in sports fields. Nonetheless, it is currently unknown if BIA parameters can provide useful information about jump performance in volleyball. The purpose of this study is: 1) to evaluate kinematic/kinetic parameters and reactive strength of recreational young female volleyball players during a vertical jump; 2) to explore the relationship between jump performance and BIA parameters.
Methods: 30 young female volleyball players (age 16.2 ± 1.9 years) were involved in a cross-sectional study at the beginning of their off-season phase. All the participants had three volleyball training sessions and two gym sessions a week. Bioelectrical resistance (R), reactance (Xc), and phase angle (PhA) were directly measured using a foot-to-hand bioimpedance technology at a 50 kHz frequency (BIA 101 BIVA®PRO). Bioelectric R and Xc were standardized for the participants' height and used to plot the bioimpedance vector in the R-Xc graph according to the BIA approach. Following a standardized warm up, participants were asked to perform 3 Squat Jumps (SJs), 3 Countermovement Jumps (CMJs) and 7 maximal hoppings (MHs) as high as possible, with minimal contact time, and with arms akimbo always. Maximal jump height in all the tests was measured with the Optojump Next photocell system (Microgate, Bolzano, Italy). The outcomes were also compared among the athletes grouped by CMJ and SQJ tertiles.
Results: As MH was used to assess reactive strength of lower limbs, a significant positive correlation ($p < 0.01$) was found between that attribute and both peak SQJ and CMJ. PhA differed ($p < 0.01$) among the athletes grouped by SQJmax and CMJmax tertiles, while athletes with a greater jump height showed a lower BMI and a higher PhA.
Conclusions: These preliminary results suggest that BIA and PhA evaluation could represent a valid support for assessing jump performance in young volleyball players, when more sophisticated methods are not available.

The influence of body dissatisfaction, eating disorder symptoms and self-efficacy: a path-analysis and the mediating role of stress in aspiring fashion models, professional models and athletes

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Purpose: It is widely recognized that body dissatisfaction is an important public health concern due to its association with symptoms of disordered eating and worse psychological well-being. Moreover, stress can play a substantial role within ill health. The purpose of the first study was to examine whether stress mediated the relationship between body dissatisfaction and eating disorders, in 112 aspiring fashion models aged between 15 and 24 years (M = 19.5, SD = 2.08) from 32 different countries of the world during an international contest, and 100 students (control group), aged between 16 and 22 years (M = 18.6, SD = 1.39). The purpose of the second study was to develop a path model of intrapersonal dimensions (self-efficacy and internal locus of control) as antecedents of perceived stress toward females' body dissatisfaction and eating attitude disorders. A total of 300 females, including 100 professional fashion models, 100 high-level athletes and 100 students (controls), between 15 and 24 years of age (M = 19.6, SD = 1.85) participated in the study.
Methods: Measures included the administration of psychological stress, self-efficacy and the locus of control dimensions, body (image) dissatisfaction, and eating attitude disorder indices.
Results: First, data indicated higher scores on body dissatisfaction, stress level, and eating attitudes disorder among the group of aspiring fashion models compared to the control. Mediational analyses showed that body dissatisfaction was partially mediated by stress level on eating disorders. In the second study, comparing the three subsamples, a path analysis showed better fit indexes in the two subgroups with elevated investment on their body image with respect the control group.
Conclusions: The presence of skilled health workers in the field of nutrition and psychology could be extremely important in the field of fashion and sport to maintain an adequate quality of life.

The role of socio-demographic characteristics and physical activity patterns in the adoption of health preventive measures and perception of quality in gym customers in Italy

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Purpose: The aim of this study was to assess the socio-demographic characteristics and physical activity and exercise patterns of gyms' customers, as well as their health related behaviours when attending the fitness facility. In addition, we aimed to evaluate the customers' perception of hygiene and safety of the different areas of the gyms, trying to understand if there were differences in the behaviours and perceptions according to several individual variables.
Methods: A self-administered online questionnaire was used to collect the data. Participants were recruited from gyms in Italy using a combination of convenience and snowball sampling approaches. Descriptive statistics were used to analyse the socio-demographic and behavioural characteristics of the sample, as well as their perception of gym quality. Bivariate analysis was initially conducted to examine associations between variables, and if statistically significant, two logistic regression models were performed using the perceived quality of the gym and the likelihood of adopting health preventive measures as the dependent variables.
Results: The sample consisted of 1321 individuals, 48.2% females and 50.9% males, with the majority falling into the 18–25 age range (59.9%). Most participants were single (70.7%) and had a high school education (57.7%). The majority of participants engaged in moderate to vigorous physical activity, primarily weight lifting and machine-oriented exercises, and exercised 3–5 times a week for 1–2 h mostly between 5 and 9 pm. Regarding the perceived quality of the gym, the

majority of respondents rated it positively, with 34.5% considering it "Good" and 39.2% rating it "Very good." Females had slightly lower ratings compared to males, and higher education levels were associated with slightly lower ratings. In terms of adopting health preventive measures and behaviours, approximately 41.3% of respondents showed a likelihood of adopting them. Males generally exhibited a higher likelihood compared to females. Lastly, we found that the perceived quality of the gym positively influenced individuals' likelihood of adopting health preventive measures.

Conclusions: The findings of the present study can contribute to a better understanding of exercise habits and preferences in the context of gym settings and help to establish management and preventive strategies.

What is the effect of a home-based combined training in obese adults?

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Purpose: Obesity is a growing public health problem affecting an increasing number of countries worldwide [1], compromising health and leading to significant long-term consequences, including the development of several chronic diseases [2]. The lifestyle habits are important risk factors that potentially can lead to the obesity condition thus the current study aims to assess the effect of a home-based combined training on body mass index (BMI), physical activity condition and sleep behavior in obese adults.

Methods: 20 participants (mean age 56.2 ± 10.8yrs), 4 males (20%) and 16 women (80%) were recruited at IRCCS Istituto Auxologico Italiano (Milan, Italy), and followed a home-based combined training lasting 12 weeks. They filled out the *International Physical Activity Questionnaire* (IPAQ), the *Balance Error Scoring System* (BESS), the *Total Faulty Breathing Scale* (TFBS), the *Five Times Sit To Stand* (5STS), the *Hand Grip Strength Test* (HST) and the *Mini Sleep Questionnaire* (MSQ), to assess, at baseline (PRE) and at the end of the 12 weeks (POST), physical activity levels, postural stability, breathing, strength of lower and upper limbs and sleep, respectively.

Results: Based on the scores of the IPAQ, the participants were classified as inactive (n = 9, 45%) and moderately active (n = 11, 55%). The comparison on the whole sample between the PRE and POST condition revealed significantly lower values of BMI (35.6 ± 5 *vs* 37.9 ± 5.2 kg/m^2, $p < 0.001$), BESS (5.65 ± 2.6 *vs* 9.25 ± 2.4 score, $p < 0.001$), TFBS (5.05 ± 0.22 *vs* 5.95 ± 0.22 score, $p < 0.001$), MSQ (22.4 ± 10.2 *vs* 27.7 ± 10.5 score, $p = 0.006$), and significantly higher values of physical activity levels (1324 ± 626 *vs* 766.6 ± 666.8 METs, $p < 0.001$), HST (27.9 ± 7.7 *vs* 26.2 ± 7.6 kg, $p < 0.001$) and 5STS (7.5 ± 2.6 *vs* 9.5 ± 3 s, $p < 0.001$) in POST condition.

Conclusions: The results show the importance of increasing physical activity practice aimed at maintaining an active lifestyle in order to reduce the onset of obesity. Multidisciplinary interventions including physical activity could be effective in improving the metabolic disorders.

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Physical activity moderates the association between chronotype and sleep quality in highly active italian university students

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Purpose: Active university students generally report better sleep quality than their inactive mates, as well as Morning- (MT) sleep better than Evening-types (ET) [1–3]. The current study investigates the differences in sleep quality (SQ) in highly active students and the potential moderation effect of physical activity (PA) on the relationship between SQ and chronotype.

Methods: 433 university students at the Sports Science School (University of Milan) (males = 70%; 19.7 ± 1.6yrs) filled in the *Godin-Shepard Leisure-Time Physical Activity Questionnaire* (GSL-TPAQ—LSI as measure unit), *Pittsburgh Sleep Quality Index*, and *Morningness-Eveningness Questionnaire*, to assess PA, SQ, and chronotype. All the participants were highly active and divided into tertiles based on GSL-TPAQ: *low* (LSI < 53), *medium* (LSI > 53 and < 72), and *high* (LSI > 72). A three-way ANOVA (sex, chronotype, and PA effects) and moderation analysis with PA, SQ, and chronotype as the moderator, independent and dependent factors were performed.

Results: 65% of the participants were good sleepers. The chronotype*physical activity interaction was significant ($p = 0.03$), with ET sleeping significantly worse than Neither-types (NT) considering either *low* (ET: 5.4 ± 2.2; NT: 4.5 ± 1.7; $p = 0.04$) or *medium* PA tertile (ET: 5.3 ± 2.1; NT: 4.4 ± 1.9; $p = 0.03$) and compared to MT in *high* PA tertile (ET: 5.7 ± 1.8; MT: 4.4 ± 2; $p = 0.02$). Considering the MT sample, the participants in the low PA tertile slept significantly worse than those in the *high* PA tertile (*low*: 5.6 ± 1.8; *high*: 4.3 ± 2; $p = 0.05$). The moderation analysis was significant ($\beta = 0.4$, $p = 0.02$) at the 50th and 84th percentile ($p < 0.001$, $p < 0.001$, respectively), explaining that, in the *medium–high* PA level, only MT improved the sleep quality while increasing the PA.

Conclusions: University students of Sports Science showed good sleep quality. Their active nature could predispose them to sleep better. MT, rather than ET, university students are those who benefit most from PA to improve their SQ. ET students have to deal with various factors affecting their SQ, and the PA alone is insufficient to smooth out the problems causing bad SQ.

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Accessibility and sustainable mobility: Preliminary results of a perceived quality study of the Rubicon Community House

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Purpose: The objective of this study is to analyze the preliminary results on perceived accessibility and mobility to/from one's place of care. The study is part of a larger project to assess the perceived quality by users of a Community Home (CdC).
Methods: 741 paper questionnaires were collected from users of the Rubicon CdC (Emilia-Romagna, Italy) of the "Azienda U.S.L. della Romagna". The questionnaire included both quantitative and qualitative multiple-choice sections. To investigate the factors contributing to low overall satisfaction with CdC services, a multiple logistic regression analysis was conducted. The results of the analyses were presented as Odds Ratios (ORs) with corresponding 95% confidence intervals (95% CIs). To analyse qualitative data from the two open ended questions, content area analysis was used.
Results: 70.5% of the participants lived more than 15 min away from it and 73.3% reached it by car. The multiple logistic regression analysis showed that "accessibility and reception" was the area with lowest perceived quality. This was due to high rates of dissatisfaction regarding the ease of reaching the CdC by public transportation (63.8%), and availability of parking (73.2%). Those living more than 15 min away were more likely to have a lower perceived quality of bus service than those living less than 15 min away (OR: 2.24; 95% C.I. 1.16–3.96). From the qualitative analysis, some participants pointed out the need for additional parking in the proximity of the hospital.
Conclusions: In conclusion, the study highlights users' demand for greater accessibility to the CdC and suggests the need to involve public administrations in implementing local polizie that offer more public mobility services to citizens, including infrastructures that incentivise the adoption of a helathy lifestyle, (e.g. bikepaths and footpaths).

The velasco model for the postural instability prevention among young athletes and non-athletes

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Purpose: Malalignment of a kinetic chain results in abnormal biomechanical stress that can lead to overuse injuries. Overuse injuries incidence in the volleyball play amounts to 0.6/1000 match hours, in particular among females. Average duration of a volley match is of 105 min. Here we present a pilot study (VELASCO) led on a sample of 15 girls aged 11 years, being volley players for at least 3 ys.
Methods: Girls underwent two postural assessments (visit and data analysis from posturometric/stabilometric platform*)* and other tests (vertical jump test through the OptoJump; imbalances test through the FMS) before and after a 7-weeks of pre-season training.
During the training (an hour two times per week), each girl was provided with a training plan consisting of: (a) a general section containing different exercises and indications about the number of repetitions/series and recovery time, (b) a section containing a set of exercises tailored on the athlete's postural state. Exercises aimed to improve coordination and proprioceptive skills, joint mobility, core strengthening and rotator cuff muscles rebalancing. If more specific muscle issues occurred (shortening of the psoas muscle, posterior tibialis muscle, etc.) ad hoc exercises were provided. All athletes participated in scheduled workouts.

According to the Regional Interdependence model stating that musculoskeletal changes result from a homeostasis disruption also involving other systems, athletes' parents were asked to fill a questionnaire to collect data on athletes' physical and psychological risk factors (injuries, visual and dental issues, personality, etc.) and dietary habits as a proxy of unbalanced nutritional intake.
Results: All athletes followed a balanced nutritional intake. The majority of girls presented abnormal STP receptors and/or paramorphic signs (cervical/lumbar arrows, scoliotic prominences, tilting). The FMS deep squat and active straight-leg raise tests showed worse results among girls exhibiting posterior chain stiffness, and the rotational stability test showed asymmetry in 22% of athletes with stiffness compared with 16.7% of the others. The second assessment showed a general slightly improved postural state and the VELASCO results allowed the athletes' parents to refer girls to appropriate rehab programs.
Conclusions: Although the limitations of a pilot study do not allow the validation of the VEALSCO model, our results could suggest a new systemic approach to the young people which should involve coaches and physical education teachers as the leverage of an innovative postural disorders screening, for bridging the gap due to the decline affecting School Medicine in the last decades.

Effectiveness of a telecoaching and exercise training combined program on physical performance in elderly people: preliminary outcomes from the "Walking Leaders" model

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Purpose: "Walking Leaders" model is a green exercise intervention for elderly people which includes physical activities for balance and walking through supervised and telecoaching exercises. Telecoaching provides the use of information technologies and digital communications to access training services remotely. Our purpose was to investigate the effectiveness of a telecoaching and exercise training (TET) combined program with the aim of enhancing physical performance and health among elderly people.
Methods: 52 elderly people (age: 72 ± 6.35 years, height: 1.59 ± 0.09 m, weight: 68.71 ± 15.61 kg, BMI: 27.28 ± 4.2; 29F, 23 M) were evaluated before (T0) and after 8 weeks (T1) of exercise training. TET combined program included a specific training volume (walking speed, sets, and repetitions of exercises) and 5 training sessions/week: 2 supervised training sessions (walking and balance circuit, 60–90 min), 2 self-managed training (strength exercises, 30 min) and 1 self-managed walking (40 min). Information technologies and digital communications were used to remember exercises and access training services remotely. Data were collected on the Tinetti Scale, Time up and Go (TUG), and short physical performance battery (SPPB). Paired T-Test was used to compare the results ($p < 0.05$).
Results: Paired T-test showed statistically significant changes in the instrumental evaluation after the intervention period ($p < 0.05$) with an improvement in all the analyzed variables. We showed a reduction in the risk of falling ($p < 0.001$), an improvement in static and dynamic balance ($p < 0.001$), as well as an improvement in physical performance. In particular, from baseline to post-test, we found a reduction in the Sit to Stand execution of 20.59%, and in the TUG execution a reduction of 10.22%.
Conclusions: According to the results of the present investigation, 8 weeks of a TET combined program could improve functional abilities and physical performance among older people. Moreover, telecoaching training sessions did not cause adverse events, resulting a safe and effective training method for this population.

Regular exercise prevents endothelial dysfunction by improving antioxidant activity in the cutaneous microcirculation of master athletes: a focus on epigenetic regulation

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Purpose: Aging is the basis for several unfavorable conditions, including cardiovascular diseases (CVDs). In this sense, regular physical activity (PA) has been proven to delay cellular aging and prevent endothelial dysfunction related to CVDs. Despite numerous studies involving human subjects, literature concerning master athletes is still lacking, particularly that related to cellular and molecular mechanisms of PA. The aim of the study was to evaluate long-term effects of physical activity on microcirculatory functions in a population of 36 elderly athletes compared to 36 age-matched sedentary controls.
Methods: Hand and foot baseline and stimulated skin blood flow (SBF) was measured by laser-Doppler flowmetry. Total Oxyradical Scavenging Capacity (TOSC) assay was used to determine plasma antioxidant capacity against peroxyl (ROO•) and hydroxyl radicals (OH•). Moreover, molecular/epigenetic mechanisms (nitric oxide, NO, PGC-1α, SIRT1 and miR29) were assessed too.
Results: PA significantly increased local blood flow in post-ischemia and post-heating conditions, as well as NO plasma concentrations, denoting a better endothelial function/microcirculatory efficiency. Moreover, athletes presented a greater plasma antioxidant and increased transcriptional levels of the metabolism regulator PGC-1α. Finally, PA enhanced plasma level of SIRT1 and miR29, suggested as epigenetic regulators of redox balance and cellular metabolism. In addition, stimulated local blood flow was directly related to plasma antioxidant capability, and SIRT1 and miR29 levels.
Conclusions: Regular exercise has been shown to prevent aging-related endothelial dysfunction by improving and preserving plasma antioxidant defenses and NO bioavailability in the cutaneous microcirculation. Overall, our data confirm the beneficial effects of PA on the cardiovascular profile even in elderly athletes and shed light on molecular/intracellular signals involved in the positive adaptations to exercise.

Relationship between affective response to exercise and physical activity practice in 144 cardiac patients: findings from an observational study

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Purpose: Literature has extensively shown how physical activity plays a crucial role in the management of individuals with cardiovascular diseases. However, the motivation and adherence to exercise-based secondary prevention program may differ significantly among patients. Assessing the affective response to physical exercise in this population can provide important insights into the factors influencing their engagement in physical activity.[1] Therefore, the aim of this study was to examine the relationship between affective response, physical activity volume, and functional parameters in cardiac patients.
Methods: The patients attending the secondary prevention program at the Study Center for Motor and Sports Sciences in Ferrara between December 2021 and May 2023 were recruited for the study. Each participant underwent a comprehensive assessment that included risk factors, demographic and anthropometric variables, diagnosis, and therapy. They were then evaluated using the following measures: (a) 1-km treadmill walk test (1 K-TWT) performed at a moderate intensity, (b) assessment of affective response to exercise using the AFFEX questionnaire, and (c) self-reported weekly physical activity using the Seven Day Physical Activity Recall.
Results: A total of 144 male participants, (mean age 72 ± 9 years, BMI 27.44 ± 3.87) were analyzed. The average speed achieved during the 1 K-TWT was 4.7 ± 1.1 km/h. Participants reported engaging in 12.5 ± 9.22 MET/h/week of physical activity. Significant correlations were observed between the amount of physical activity performed and various AFFEX domains, including "honor" ($r = 0.44$; $p < 0.001$), "attraction" ($r = 0.37$; $p < 0.001$), "calmness" ($r = 0.24$; $p = 0.004$), "competence" ($r = 0.25$; $p = 0.003$), "empower" ($r = 0.24$; $p = 0.004$), "energy" ($r = 0.25$; $p = 0.002$), "interest" ($r = 0.25$; $p = 0.002$), and "pleasure" ($r = 0.28$; $p = 0.001$). Furthermore, the study population was divided into tertiles based on the walking speed achieved during the 1 K-TWT. A

statistically significant difference was observed between the first and third tertiles for the "energy" (p = 0.013) domain.
Conclusions: These findings suggest that affective response plays a role in integrating physical exercise into the lifestyle of cardiac patients. Assessing affective response in a clinical setting can be a valuable tool, both for exercise specialist and sports physician, to understand the effectiveness of educational interventions aimed at promoting physical activity and improving functional parameters.

Stand up university, break sedentary behaviours: unifit study

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Purpose: Many studies show that sedentary behaviour is strongly associated with higher risk of cardiovascular and metabolic diseases in adults. The World Health Organisation (WHO) recommends limiting the amount of time spent in sedentary behaviour suggesting that every move counts for health. Active breaks (ABs), defined as short (2–10 min) bursts of physical activity (PA) incorporated in the working hours, were shown to be an effective strategy to improve physical and mental health. The aim of this study is to collect different perspectives from a group of employees of the University of Bologna (Italy) on incorporating ABs in the workplace and to demonstrate the feasibility of such interventions.
Methods: We conducted three focus groups (FGs). Participants were recruited on a voluntary basis: PhD student, research fellows, medical residents and administrative staff of University of Bologna (N = 18). The age of participants was between 27–64 years. After the focus groups, a questionnaire was administered to participants and it was subsequently analysed to determine the barriers and facilitators of implementing ABs in the workplace.
Results: 88, 8% of the participants responded that they had a sedentary lifestyle. 94, 4% showed interest in incorporating ABs in the workplace. The most common barriers identified were lack of time and a suitable space, along with social acceptability and need for appropriate clothing. However, time flexibility, different types of exercises and group activity are major facilitators in organising ABs in the workplace. Participants also felt that structuring ABs with an effective outcome was very important for facilitating the participation of workers.
Conclusions: This study highlights that ABs could be an acceptable intervention for breaking-up sedentary behaviours among university employees. FG is a valid technique to evaluate the barriers and facilitators of an ABs intervention in the workplace.

Barriers and facilitators in implementing active breaks interventions during work: a systematic review

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Purpose: Office workers have been found to be an extremely sedentary group, exhibiting high levels of inactivity during both work and non-work hours. Considering that individuals typically spend around one-third of their waking hours and more than 40 years of their lives at work, the work environment becomes an ideal setting to implement interventions targeting physical activity (PA) behaviour modification, combating sedentary habits, and promoting overall health. Active Breaks (ABs), defined as short periods of moderate to vigorous PA to reduce sedentary behaviour, could be a useful intervention. The aim of this systematic review is to analyse the existing scientific literature to identify barriers and facilitators of ABs interventions performed during working hours.
Methods: The following PICOS question was developed using the following search terms: (P) Workers aged 18 or more; (I) ABs intervention; (C) No intervention or different intervention from ABs to promote PA; (O) Barriers and facilitators toward the implementation of the ABs interventions; (S) Experimental or observational study. The literature search was performed by searching the following databases: MEDLINE (PubMed), Embase, Cochrane Central Register of Controlled Trials, CINAHL, PSYCINFO. The Social-Ecological Model (SEM) was adopted to analyse the results. The three levels of influence of SEM that guided the methodology of this study are: intrapersonal level; interpersonal level; program related reasons level.
Results: From a total of 980 articles, after various screenings, 6 were included. Regarding the intrapersonal level, common facilitators for ABs were: "physical and mental health benefits", "need to do more PA", and "providing positive feelings and promoting enjoyment". Common barriers for ABs were: "time constraints/lack of time" and "lack of interest and motivation". Regarding the interpersonal level, the most common facilitator for ABs was "supervisor or peer support", while the barriers identified were "lack of camaraderie" and "lack of supervisor or peer support". Regarding the program-related reasons level, the most common barrier for ABs was "workflow disruption".
Conclusions: This systematic review highlights the barriers and facilitators of ABs intervention during working hours. The identification of barriers and facilitators will provide the basis for improving the implementation of ABs interventions in the workplace such that they are successful and well-liked by employees.

Correlation between thyroid hormones, skeletal muscle mass and muscular fitness in overweight/obese individuals

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Purpose: The link between the hypothalamic-pituitary-thyroid axis and obesity includes several interactions. It is known that thyroid hormones are involved in key metabolic pathways such as lipid and glucose metabolism. Moreover, small changes in thyroid hormone levels have been reported to correlate with changes in body mass index (BMI) and body composition, regardless of thyroid dysfunction. Instead, little is known about the influence of thyroid hormones on skeletal muscle function, which is negatively affected by obesity and ageing. A preserved skeletal muscle mass (SMM) and function within a framework of excess body mass may directly influence thyroid

function. Furthermore, this association may differ according to gender. Therefore, this study aimed to investigate the association between thyroid hormone levels, SMM and muscular fitness components in overweight/obese male and female individuals.
Methods: Twenty-five males (mean age: 46.3 ± 14.5 years, BMI: 32.0 ± 4.3 kg/m^2, fat mass: 32.3 ± 7.4%) and thirty females (mean age: 39.5 ± 15.6 years, BMI: 32.3 ± 4.2 kg/m^2, fat mass: 43.3 ± 6.4%) in a euthyroid state were recruited. SMM was assessed using bioelectrical impedance analysis (BIA 101 Akern). Grip strength was evaluated on the dominant hand using the handgrip test (HG), while muscle strength of the lower body was assessed with the chair-stand test (CST). Thyroid hormones of interest were serum concentrations of free-triiodothyronine (FT3) and free-thyroxine (FT4).
Results: In males, a positive correlation between SMM and FT3 levels was found (r = 0.469, p = 0.018). In addition, SMM was positively correlated with FT4 levels (r = 0.517, p = 0.008), whereas a negative correlation between CST and FT4 levels was found (r =— 0.439, p = 0.028). In females, a positive correlation between FT3 levels and HG was observed (r = 0.392, p = 0.032).
Conclusions: A preserved SMM in the presence of excess of body mass and fat may stimulate thyroid function in males. The effect of thyroid function on muscular fitness components may differ between males and females. Whether thyroid hormone levels may be a parameter indicative of muscular functionality in overweight/obese individuals is still under investigation.
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Effect of physical activity on cognitive performance and motor fitness in primary school children

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Purpose: In recent years, there has been a growing focus on the importance of physical activity in promoting health and cognitive development in primary school children. Therefore, the aim of this study was to investigate the effect of physical activity level on cognitive performance and motor fitness in primary school children. The secondary aim was to test the possible association between cognitive performance and motor fitness.
Methods: Seventy middle-aged children (37 males: 10.4 ± 0.6 years; 33 females: 10.3 ± 0.5 years) were recruited to participate in the present study from an elementary school. They filled in the Physical Activity Questionnaire for Children (PAQ-C). Using cut-off points of previous studies, they were categorized as "sufficiently active" or "low-active" based on PAQ-C scores. They were tested on cognitive performance (inhibitory control by the Flanker task and attention by the visual search task), motor fitness (by the countermovement jump), agility (by the Modified agility t-test), speed (by the 10-m sprint), balance (by the Balance Error Scoring System) and reaction time (by the Clinical reaction time).
Results: For inhibition, although the group x flanker condition interaction was not significant, the main effects of flanker condition ($p < 0.001$) and group (p = 0.031) were significant. Of note, the post-hoc analysis revealed that sufficiently active children showed faster response time in the incongruent condition of the Flanker task than low active children (p = 0.05). For attention, the group x number of items interaction was not significant, as well as the main effect of group (p = 0.38), whereas the main effect of number of items was significant ($p < 0.001$).
There were significant associations between the congruent and incongruent conditions of the Flanker task and the motor fitness tests ($0.3 < r < 0.5$, $p < 0.05$), whereas performance in the Visual search task did not correlate with the motor fitness tests.
Conclusions: These findings suggest that physical activity level has an effect on inhibitory control and motor fitness, whereas it does not influence attention in primary school children. Therefore, physical activity seems to be associated to motor fitness and executive functions domain of cognition (inhibitory control), rather than to general domain of cognition (attention). This is further corroborated by the significant association between inhibitory control and motor fitness.

Hiking above the threshold to maximize post-exercise hypotension

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Purpose: The literature documents the influence of high-intensity exercise, especially above the ventilatory threshold (VT), on blood pressure (BP). The temporary decrease in BP, particularly systolic BP (sBP), following exercise is referred to as Post-Exercise Hypotension (PEH). Despite the benefits of exercise on BP, no study has yet investigated the impact of outdoor activities on PEH. Therefore, the study aimed to investigate the PEH response following hiking and its relationship with the duration spent above the VT (MIN ≥ VT).
Methods: The study included one female (F, age: 23 years; body mass: 65 kg; height: 167 cm; BMI 23.3 kg/m^2) and one male (M, age: 24 years; body mass: 72 kg; height: 180 cm; BMI: 22.2 kg/m^2). To identify the corresponding values of oxygen uptake (VO_2) and heart rate (HR) at VT, subjects underwent a submaximal incremental walking test. During the test, participants selected a speed that represented comfortable walking during the first 2-min stage at 0% treadmill grade. Subsequently, the grade was increased by 2% at each stage until 95% of the estimated maximum heart rate (HRmax) was achieved. VT was determined using the v-slope method. Following 24-h of rest, participants underwent a field session involving a selected hike (length ~ 3800 m). sBP was measured 15-min before (PRE) and 30-min after (POST) the hike. PEH was calculated as the difference between sBP PRE and POST. VO_2 and HR were continuously recorded throughout the hike to assess the internal load.
Results: The hike was completed in 45: 19 min (MIN ≥ VT = 14 min) by F, while M completed it in 42: 43 min (MIN ≥ VT = 0 min). The average HR for F was 133 ± 15 bpm, corresponding to 68%HRmax, and for M 120 ± 15 bpm corresponding to 62% of HRmax, indicating a light to moderate intensity. The average values of VO_2 were 20.2 ± 6.5 ml/kg/min for F (VO_2 MIN ≥ VT = 28.2 ± 2.3 ml/kg/min) and 14.5 ± 5.1 ml/kg/min for M. Both individuals exhibited lower sBP values during POST (F: 103 mmHg; M:

117 mmHg) compared to PRE (F: 128 mmHg; M: 130 mmHg), resulting in PEH of 25 mmHg for F and 13 mmHg for M.
Conclusions: Despite variations in sBP levels, PEH was observed in both participants. The MIN ≥ VT appeared to play a crucial role in enhancing PEH, particularly in the F participant. These results emphasize the importance of training at high-intensity levels, specifically above the VT, to maximize the sBP reduction following outdoor activities.

Effects of a single session of static and dynamic stretching on joint range of motion and single-leg stability

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Purpose: Static and dynamic stretching acutely increase joint range of motion (ROM), but there is also some evidence suggesting transient changes in single-leg stability[1]. The objective of this study is to assess the acute effects of a single session of static and dynamic stretching targeting various body areas on ROM and single-leg stability parameters.
Methods: Forty healthy volunteers were randomly assigned to either the static stretching group (SSG) or the dynamic stretching group (DSG). Four test days were conducted in a randomized order, with each participant being tested on a separate day for neck lateral inclination, knee extension, hip internal rotation, and ankle dorsiflexion. Additionally, the right and left single-leg stability test was performed during all test days. Joint ROM was assessed using 2D video analysis software (Kinovea, France), while single-leg stability was measured using a pressure platform (FreeMed, Sensor Medica, Italy). Ellipse area, sway path length, transversal (Δx) and sagittal (Δy) motion of the center of pressure (CoP) were collected for single-leg stability. During each test session, participants underwent baseline assessments for ROM and single-leg stability, followed by 1 stretching exercise, for the target body area, repeated 3 set × 30″ for each side right and left, either static or dynamic depending on the assigned group. After stretching, a post-intervention assessment was conducted. Data analysis involved a two-way ANOVA for the group × condition interaction, and Student's t-test was used to determine significant differences between pre and post stretching. The significance level was set at $P < 0.05$.
Results: Both SSG and DSG improved joint ROM for each area of the body between pre- and post-intervention assessments, except for the DSG in left hip internal rotation (33.4 ± 7.6° vs 34.6 ± 7.6°, p = 0.164) and left ankle dorsiflexion (18.1 ± 6.3° vs 17.4 ± 5.4°, p = 0.399). The SSG did not show any modifications in single-leg stability.While the DSG exhibited an increase in transversal motion (Δx) of the CoP for the left leg after neck stretching (20.7 ± 7.0 mm vs 23.5 ± 5.9 mm, p = 0.046). Moreover DSG, showed an increase in ellipse area for the left leg after hip external rotators stretching (497.9 ± 332.8 mm^2 vs 800.6 ± 414.3 mm^2, p = 0.014), and for the right leg after calf stretching (535.8 ± 294.6 mm^2 vs 717.5 ± 357.9 mm^2, p = 0.034).
Conclusions: Contrary to the common belief that static stretching may have negative effects before any type of physical activity, the findings of this study lead us to conclude that static stretching is actually safer than dynamic stretching in training conditions that prioritize balance and single-leg stability. This is particularly relevant for activities such as postural exercise, injury prevention, and adapted physical activities.
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Breath again, a pilot project for the validation of respiratory gymnastics protocol, based on yoga and feldenkrais, for healthcare professionals with post-COVID-19 conditions: follow up

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Purpose: The 'Breath again' project was created thanks to the Health Promotion Programme of the Department of Public Health of the Bologna AUSL. It consisted of six meetings lasting two hours each, from October to December 2021. The activity included sessions of Yoga and Feldenkrais (respiratory exercise protocol) and aimed at healthcare professionals who showed respiratory difficulties after SARS-CoV-2 infection. The results after the project were promising; therefore it was proposed to the participants to take part in follow-up after one year in order to confirm the long term positive effects.
Methods: Of the 16 participants, 14 joined the follow up through the administration of the EuroQol-5D-5L questionnaire (EQ-5D-5L) and the 1-min Sit-to-Stand test (1 m-STS). The 1 m-STS test was carried out by all participants. The questionnaire was completed by 13 out of 14 participants; 12 out 14 participants also replied to the VAS scale of 0 to 100 for the timely health assessment. The information collected was processed through Wilcoxon tests for common data, with significance established for p-value < 0, 05.
Results:
The data collection was carried out by taking as T0 the start of the course, as T1 the end of the activity (approximately 6 weeks from T0) and as T2 the follow-up to 1 year after the end of the project.

The values of the 1 m-STS test showed an average increase of 8, 36 (T0 = 31, 93 ± 10, 50; T2 = 40, 29 ± 13, 84; P = 0, 0017).

The synthetic index EQ-5D-5L showed an average increase of 0, 19 (T0 = 0, 65 ± 0, 38; T2 = 0, 84 ± 0, 26; P = 0, 0234). The largest differences were found in 'usual activities' (work, study, household work, family or leisure activities) and 'pain or discomfort'. In addition, the quantitative health assessment at the time of completing the questionnaire, coded using the VAS scale, showed an average increase of 9, 67 (T0 = 73, 67 ± 19, 70; T2 = 83, 33 ± 10, 52; P = 0, 0391).
Conclusions:

A behavioral intervention for the adoption of a healthier lifestyle in people with diabetes mellitus

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Purpose: The study aims to evaluate the physical activity (PA) and sedentary time (SET) levels of the participants, their state of health, their nutritional habits, and their level of muscle strength. Moreover will study the barriers (intrinsic/extrinsic) to starting PA and will evaluate the willingness of the participants to practice PA.
Methods: From October 2023 to December 2023, 60 volunteer adults related to the Diabetes Clinics of Perugia Hospital, will be involved in this study. The inclusion criteria will be: diagnosis of diabetes; 25–80 years old at screening; ability to walk independently; BMI > 27 kg/m^2 and < 40 kg/m^2. The exclusion criteria will be: the clinical evidence of serious cardiovascular, central nervous system, and musculoskeletal diseases that may limit or contraindicate PA. Several groups will be set up: in addition to the group that refuses to participate in the project (standard care), one group will be involved in standard care + theoretical counseling sessions, and another group will be involved in standard care + theoretical counseling sessions + practical counseling sessions, supervised by specialized kinesiologists. The study was approved by the University Committee of Bioethics of the University of Perugia.
Results: With this study, we expect to enrich the intervention of structured therapeutic education in Diabetology through the contribution of undergraduates and master's graduates in Sciences and Techniques of Sport and Preventive and Adapted PA. Among the expected results, we hypothesize obtaining improvements in the level of PA practiced and the reduction of the sedentary behavior of the participants, increasing the patient's awareness of these health determinants, with consequent positive effects from the metabolic outcomes and benefits that can be maintained in the long term, thanks to the support of a multidisciplinary team, which includes specialized kinesiologists who deal with adapted physical exercise.
Conclusions: It is known that in people with diabetes adherence to regular PA and exercise is generally difficult to achieve, also due to individual/environmental barriers. For this reason, it is of interest to promote a study of a behavioral intervention to evaluate the levels of PA and SET of patients with diabetes, to understand whether standard care is comparable to theoretical and/or practical information sessions on PA and its benefits.

Physical activity, sitting time and motivation-to-change: an Italian survey

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Purpose: This work aims to study the physical activity levels (PAL), sitting time (SIT), and motivation to change (MTC) in a group of volunteer adults participating in an online survey.
Methods: From December 2022 to March 2023, 127 adults (65 men and 62 women, mean age = 40.17 ± 14.83 years), volunteers, were involved in this study, using convenience/availability, sampling. Participants were invited to adhere to an online survey. General information (as health, marital and working status), anthropometric, and self-report questionnaire measures were collected. Data were studied for active/inactive (subjects who referred to practice/do not practice physical activity regularly) and gender subgroups. Finally, the PAL and SIT categories were linked to motivational data.
Results: 54.8% of the participants did not report particular pathologies. 38.2% were single, 35% were married, 65% have a job, and 20.3% were students. 52.8% of participants replied that they regularly exercised. 44.4% play physical activity alone (48.6 men vs. 39.3% women), while 27.0% with friends (31.4 men vs. 21.4% women), and 23.8% with a personal trainer or kinesiologist (20.0% men vs. 28.6% women). Differences were observed both in the energy expenditure due to vigorous PA (men 17.7 ± 30.8 MET-h vs. women 9.8 ± 20.4 MET-h) and in total energy expenditure (53.6 ± 50.2 MET-h for men and 35.5 ± 33.9.00 MET-h for women). Regarding SIT, during weekdays (4.4 ± 2.7) and weekends (4.1 ± 2.5), results did not show a difference between gender. Finally, we observe that all the sample presented a high percentage in contemplation status (56.3 ± 28.2), but were observed medium scores also in preparation (53.8 ± 30.3) and maintenance (50.1 ± 38.1) status. A statistically significant difference was observed in the contemplation state (that was more relevant in women, 62 ± 25.7 than in men, 51 ± 29.5). On motivational factors, we find higher average values in men regarding self-efficacy (70.8 ± 20.5 vs. 59.2 ± 23.4), and readiness to change (72.8 ± 22.1 vs. 63.9 ± 24.4).
Conclusions: Given the high levels of inactivity and sedentary lifestyle in the general population and the resistance/barriers (including motivational ones) to the practice of regular physical activity, it is necessary to plan campaigns to raise awareness and monitor the lifestyles of the population from the first decades of adulthood, promoting healthy lifestyle education initiatives to control the risk of non-communicable diseases.

Age-It: ageing well in an aging society. a novel public–private alliance to generate socioeconomic, biomedical and technological solutions for an inclusive Italian Ageing Society

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Purpose: Population ageing is a major twenty-first century phenomenon. The Age-It programme follows the view of the World Health Organization, which promotes the adoption of policies and strategies based on the "active and healthy ageing" framework concept[1]. Age-It is a research programme that aims at generating a quantum leap, making Italy the leading scientific hub in research on ageing, and a state-of-the-art "empirical laboratory" regarding the ageing process. Italy will become a benchmark for other, also non-European, rapidly ageing societies.
Methods: The Age-It Project is funded by the National Research Plan (NRP) 2021–2027. Ten spokes have been created in order to generate a proactive research infrastructure and ten different Universities and national agencies were involved in the project network to develop the different spokes, workpackages and tasks. The University of Eastern Piedmont is in charge of the development of a new integrated pathway that can enable elders (both healthy and at-risk) to better access evidence-based prevention and health promotion interventions. In order to comply with this main goal we started a systematic review (SR) focused on preventive pathways for healthy ageing.
Results: The SR was registered in Prospero (ID: CRD420234310459); a total of N = 9998 titles were retrieved from databases (i.e., Pubmed, Cochrane, Embase, Psychinfo, Cinhal) and screened by a team of reviewers. A total of N = 261 abstarct were screened and N = 66 full text passed in the final screening phase. The results from the last SR step will help the design a new model, defined as Age-It Preventive Pathway. This Age-It preventive pathway is focused on creating different evidence based strategies to improve the healthy status and lifestyles of older people. The substantial framework of this new pathway is the behavioral change model and the concept of "what am i willing to do to improve my health".
Conclusions: This new Age-It Preventive Pathway, based on the SR results, will be fundamental for the definition of specific methods and tools to be implemented in an integrated complex intervention able to close the existing gaps in information, autonomy, adherence, and compliance of older people when accessing preventive and health promotion programs.
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Acknoweledge: This research is supported by by the AGING PROJECT Department of Excellence Università del Piemonte Orientale.

Correlation between visual reaction time and functional mobility in older adults

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Purpose: Falls in older adults are a serious concern which may lead to loss of autonomy and the needs of long-term care. Timed Up and Go test (TUG) is widely used to assess lower limb function, mobility and fall risk. Scientific evidence shows that balance is mainly influenced by the visual system, as a consequence, a reduced visuospatial ability may enhance the risk of fall. Therefore, the aim of this study was to evaluate the correlation between Functional Mobility (FM) and Visuomotor Reaction Time (VRT) in older adults.
Methods: Twenty-three males (age: 67.2 ± 7.0 years, mass: 80.1 ± 12.6 kg, height: 1.68 ± 0.06 m, BMI: 28.3 ± 3.6 kg/m^2) and nineteen females (age 68.7 ± 5.6 years, mass: 65.2 ± 8.7 kg, height 1.51 ± 0.04 m, BMI 28.4 ± 3.7 (kg/m^2) volunteered to participate in this study. FM evaluation was carried out by using the Timed up and go Test (TUG). VRT was assessed with the fitlight trainer system. The VRT test consisted of four sensors spaced 0.30 m apart (total sensor distance 1.20 m) lighting up in random order creating two blocks of thirty stimuli. Spearman's Rho was used to verify the correlation between the FM and VMRT. The correlation analysis was carried out on the whole sample and separately for each gender.
Results: VRT was significantly correlated to a shorter time to perform TUG test (Rho: 0.524; $p < 0.01$) in the whole sample. Moreover, this correlation was significant when the statistical analysis was carried out separately for each gender. A larger correlation coefficient was observed in women (Rho: 0.658; $p = 0.002$) compared to men (Rho: 0.447; $p = 0.033$).
Conclusion: Participants who had lower VRT showed better TUG performance irrespectively of gender. TUG is a simple evaluation consisting of an everyday motor task which relies on orientation in space and time. Future studies should investigate whether the TUG may be used as a tool to estimate VRT thereby assessing fall risk in older adults.
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Comparison of the hr-ve relation during indoor and outdoor cycling

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Purpose: Heart rate frequency (HR) is a parameter widely measured in exercise physiology literature due to its ease of collection and interpretation. In addition, HR provides indirect information about respiratory data, as it is well-correlated with minute ventilation (VE). Typically, this HR-VE relationship has been investigated in highly controlled settings. However, in real life scenario (e.g., cycling to work), HR-VE association needs to be investigated due to the possible influence of external factors that are not typically present in laboratory tests (e.g., exposure to particulate matter). Thus, our aim was to verify and compare the HR-VE relationship in two different testing conditions: indoor cycling (IC) and outdoor cycling (OC).
Methods: In 20 subjects (21.8 ± 2.26 yo), in both first dorsal interosseous (FDI) and tibialis anterior (TA), the envelope of EMG (eEMG) and the force signal (F) were detected. For FF the signal driving the motor control system was the F while the trailing signal was the eEMG. The opposite for NF. Each of the consecutive UGR and DGR lasted 7.5 s. The vertices of the effort triangles were 50% and 100% of F (FF) or eEMG (NF) measured during individual maximal voluntary activity. Each subject performed four different tasks for each muscle: FF50, FF100, NF50, and NF100. The areas beneath the F and eEMG signals were computed for UGR and DGR. Electro-mechanical coupling efficiency (EMCE) was calculated as the ratio between the F/eEMG area ratio during both UGR and DGR. Data from the different tasks were compared using a linear mixed model with Kenward-Roger's methods for post hoc analysis.
Results: For the OC test, the mean VE was 29.68 ± 12.96 L/min, 43.85 ± 20.48 L/min, and 53.61 ± 20.08 L/min for the 60, 70, 80%

HR_{max}, respectively. For the IC test, the VE values were 31.59 ± 14.66 L/min, 41.92 ± 17.21 L/min, and 55.31 ± 24.26 L/min, respectively. In both conditions there was a linear relationship between HR and VE (ANCOVA test; $R^2_{road} = 0.224$, $p = 0.001$; $R^2_{lab} = 0.228$, $p < 0.001$), but without any statistical difference between the two conditions ($p = 0.91$).

Conclusions: The HR-VE relationship did not differ between the two conditions studied. Therefore, the relationship collected in IC could be used in real life scenario to predict VE from HR data.

Heart rate and daily physical activity monitoring in healthy middle-aged and older adults

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Purpose: Low levels of physical activity have been consistently associated with the risk of developing chronic diseases, such as type 2 diabetes, cardiovascular diseases and certain cancers. Moreover, the increase in the total level of daily activity was inversely associated with the risk of developing chronic diseases. Thus, it becomes essential in any community to quantitatively assess the level of physical activity performed by its members and then identify intervention strategies promoting the performance of physical activity with the ultimate goal of ensuring "successful aging" for each individual. Aim of the present study was to assess the level of daily routine physical activity in healthy middle-aged and older adults.

Methods: Adherence to the evaluation protocol was considered as outcome variable. Movement velocity (V, km/h) and heart rate (HR, bpm) of 45 healthy participants (age: range 50–80 y, mean 61.1 ± 7.4 y), from Tigullio area in the Liguria Region, were monitored using a sensor armband (Scosche Rhythm24) which was connected to the MyWellness Technogym app on a mobile phone. Measures were acquired for 2 h between 10 and 12am (morning acquisitions: AM) and between 3 and 5 pm (afternoon acquisitions: PM), every day for 8 weeks.

Results: Mean adherence to the monitoring protocol was quite low and variable: 28 ± 27% (AM: 30 ± 28%, PM: 26 ± 28%). In addition, mean V and HR values of AM and PM acquisitions were 3.63 ± 1.10 km/h (AM: 3.55 ± 1.23 km/h, PM: 3.80 ± 1.18 km/h) and 83.94 ± 9.05 bpm (AM: 83.05 ± 9.43 bpm, PM: 85.67 ± 9.22 bpm), respectively. In PM acquisitions, HR reached higher values compared with AM ($p = 0.03$), whilst no significant differences were found in adherence and V. Furthermore, no significant correlations were found between V and HR, whereas a significant positive correlation was detected between AM and PM velocity ($R = 0.61$; $p < 0.0001$). Finally, a significant linear relationship was found between AM and PM hearth rate ($R = 0.74$; $p < 0.0001$).

Conclusions: Our findings demonstrated that participants enrolled in this study had a low adherence to the monitoring protocol and a low physical activity in their daily routine. HR was higher than expected on the basis of the measured physical activity and the age of the participants. This pilot study describes a sedentary middle-aged and older population with low education in using new technologies to monitor physical activity. Intervention strategies promoting daily physical activity are highly encouraged.

Actlife: is active lifestyle enough for health and wellbeing?

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Purpose: Sedentary lifestyle is considered the main cause of non-communicable chronic disease. This condition is now defined as the most prevalent disease of the XXI century, responsible for 3.2 million death per year. Making people being active when they have never been, is quite difficult. However, finding feasible strategies to make people being active enough to obtain health-related benefit is mandatory. Thus, the aim of this study is to evaluate the health-related effect of an intervention focused on increasing spontaneous physical activity (SPA) compared to a traditional exercise program (TEP) based on exercise guidelines of American College of Sport Medicine.

Methods: Thirty-three healthy elderly (68 ± 7 years) were included in the study and randomly assigned to a SPA group (n = 17) or to TEP group (n = 16). Subjects were involved in the study for 6 months and all of them received wearable commercial devices to monitor their daily activity, steps count and energy expenditure. SPA group was simply asked to increase its spontaneous physical activity and their receive suggestions and feedback by a member of the research staff. TEP group underwent an exercise program three times a week based on exercise guidelines for healthy elderly individuals. Before and after the 6 months intervention subjects were evaluated for maximal aerobic capacity (VO_2max) and vascular function by means of Flow-Mediated Dilation (FMD) and single-Passive Leg Movement (sPLM). A two-way ANOVA (time x group) was used to test statistical differences within and between groups.

Results: Only the SPA group increase significantly their weekly active time (15%, $p = 0.048$), daily steps count (36%, $p = 0.042$) and daily energy expenditure (12%, $p = 0.043$). Both groups, increased their VO_2max (17% and 13% SPA, $p = 0.043$; and TEP, $p = 0.007$ respectively), FMD% (25%, $p = 0.029$, 21%, $p = 0.003$) and hyperemic response during sPLM (14%, $p = 0.022$; 25%, $p = 0.015$). No between groups differences were found for any measured parameters.

Conclusions: Results of this study show that in elderly individuals, the two different strategies proposed lead to similar improvements in aerobic capacity and vascular function supporting the idea that successfully increasing spontaneous physical activity leads to significant health-related benefits.

Acknowledgments: This work was supported by PRIN 2017 (2017RS5M44).

Promoting health and well-being in a maritime community of older adults: a pilot study on the adherence and efficacy of dry-land and water exercise interventions

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Purpose: *It is known that people living in rural or isolated communities spent more time in sedentary activities than those of urban ones.[1] The aim is to examine the impact of specific exercise modalities on physical, physiological, and psychological health outcomes in older adults living in maritime community.*
Methods: *A physical activity promotion project was developed in remote maritime area of the north-east Adriatic coast (Delta del Po region, Emilia Romagna, Italy). Forty-seven (47) older adults were involved in a dry-Land and water exercise intervention promoted by a "Palestra della Salute" recognized by the Emilia Romagna Region and CONI.*
Individuals were evaluated for anthropometric (weight, waist circumference, BMI) and functional ($VO2_{peak}$, and lower limb fluids accumulation) variables. The adherence to the projects were assessed through the rate of participation at the activities proposed.
Results: The sample is constituted by 37 women and 10 men, the 29.6% normal weight, the 55.5% overweight and the 14.8% was obese. The adherence to the program was recorded in 70% (n = 17 exercise sessions). The walking test assessed an average value of estimated $VO2_{peak}$ ranged from good to very good (23.8 ± 3.5 to 26.4 ± 3.7 ml/kg/min, P = 0.009). Weight reduction from 66.4 ± 9.9 to 65.7 ± 3.9 (P = 0.006). Finally, lower limb fluids accumulation significantly decreased from the baseline to 8-week (mean value right and left leg: ranged from 2402 ± 423 to 2348 ± 392 ml $p < 0.0001$).
Conclusions: A physical activity program combining both dry-land and water exercise sessions was effective in promoting active lifestyle even in remote maritime communities more subjected to sedentary behaviors. Cardiovascular fitness improvement and fluids accumulation reduction are potentially related to the transition from sedentary to active lifestyle, even in healthy subjects.
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How Athletic pursuits shape body image in young adults

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Purpose: Mental health is an important component of overall health, although concerns about body's appearance could affect mental health. Body image (BI) is a multidimensional construct focused on how subjects see, feel, think and behave regarding their bodies. Negative BI is predictors of health-related problems such as depression, weight control and eating disorders. Given the positive impact of sport practice, in particular team sport, on health, this study aimed to evaluate the effect of team sport practice on individual's BI.
Methods: Forty young adults (17 males, 23 females) were allocated in two groups: Team Sport Group (TSG = 20 team sport athletes) and Sedentary Group (SG = 20 sedentary individuals). To assess the subjective and emotional dimensions of BI, subjects were asked to complete the BI Dimensional Assessment (BIDA) questionnaire. BIDA is a neutral silhouette-based scale, ranging from 1.8 to 5.2. Participants had to indicate their perceived and ideal body shape, the most appropriate body shape for their peers and the most appreciated body shape by the opposite sex. Three direct indexes were then calculated: Body Dissatisfaction (BD), Sexual Body Dissatisfaction (SxBD), Comparative Body Dissatisfaction (CBD). The scores can range between − 100% and 100%. Positive values indicate that subjects currently rate their BI higher than idealized levels. To verify differences ($p < 0.05$) in BD, SxBD, CBD in team sport athletes compared to sedentary individuals a multivariate analysis of variance (MANOVA) was applied.
Results: TSG showed significant ($p < 0.05$) lower values for BD (3.5 ± 9.3%), SxBD (-1.3 ± 9.4%) and CBD (-10.8 ± 8.5%) with respect to SG (BD: 12.7 ± 17.1%; SxBD: 10.7 ± 18.3%; CBD: 4.3 ± 24.7%).
Conclusions: Findings confirm the relevant role of sport participation in determining psychological benefits, such as a person's perceptions of body. The TSG reported better perceived BI than sedentary counterparts. Scores of BD and SxBD were higher (positive) in SG than TSG, indicating that perceived body shape of athletes is similar to the ideal and the most appreciated body shape by the opposite sex. Conversely, scores of CBD were lower (negative) in TSG than SG, indicating that perceived body shape is different than the most appropriate body shape for their peers. This difference could be due to athletes tending to resemble the aesthetic ideal of a healthy and appealing physique, which is not achieved by their peers.

Physical performance in masters' students in sport sciences related to the learning approach

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Purpose: Minimum levels of physical activity (PA) prescribed by the World Health Organization are achieved through a variety of modalities. Some are characterized by a cognitive approach, which aims to improve physical skills through a reproductive style, while others are characterized by an ecological-dynamic approach, which optimizes heuristic learning through a productive style. Currently, kinesiologists do not give due importance to the effects on practice levels of different teaching–learning methodology in the two different teaching methods: prescriptive teaching and heuristic learning. The objective is to measure levels of physical performance in the category of future sports kinesiologists and to test whether significant relationships exist between the effects of exercise and the type of approach to learning following individual PA.
Methods: Sample consists of 51 students attending the Master's degree course in Sports Science at the University of Salerno to whom a question was preliminarily administered to divide them into two groups: cognitive (CG) and ecological dynamic (EDG) based on the approach used in PA practice. A battery of quantitative tests was then administered: squat jump (SJ), counter movement jump (CMJ), free arms counter movement jump free arms (FA-CMJ), stiffness test (ST). Finally, a questionnaire was administered with Google Forms containing questions on the following topics: movement mode from one place to another, weekly PA practice and continuous PA practice. Subsequently, the collected data were processed using SPSS software with Chi-square and Student's t-tests for independent samples to verify relationships between variables and differences between performance levels.
Results: 100% (n = 38/38) of the respondents used a motorized vehicle every day; 37% of CG and 26% of EDG used motorized vehicles at least once a week (P < , 05; Cramer V, 591); Bicycle use is very low in both groups and there is no association between group membership and bicycle use (P > , 05); only 5% of CG and 26% of EDG walked for the entire week (P = < 0.05; Cramer V = 0.609); 100% of CG and 79% of EDG practiced PA continuously (P < 0.05;

Cramer V = 0.343); CG performed better in FA-CMJ (21%) and ST (71%) ($P < 0.05$).
Conclusions: The two approaches differ in their impact on daily, structured physical activity and their effects on performance. Therefore, the different learning methodologies provide their important contributions to the promotion of PA.
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Effects of a six-month functional and postural training protocol on physical fitness in a group of middle-aged adults on the workplace

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Purpose: The "Ateneo in Salute e in Movimento" project was designed to provide students, professors and employees of University of L'Aquila the opportunity to exercise within the workplace, at lunch break to reduce physical inactivity and to promote psycho-physical wellness. The aim of the study was to investigate the effects of a multicomponent physical exercise protocol on Physical Fitness on the workplace.
Methods: Thirteen middle-aged adults were recruited (mean age 56.6 ± 6.2 years). Body composition and Physical Fitness were assessed using an impedance balance and the Senior Fitness Test battery (SFT), respectively, at three different times: before the beginning of the intervention (T0), after 9 weeks (T1) and after the 6-month intervention (T2). SFT includes: 30'' Chair-Stand, 30'' Arm-Curl, 2' Step-Test, Sit & Reach, Back-Scratch and 8-Foot Up & Go to assess upper and lower body strength, cardiorespiratory efficiency, upper and lower body flexibility and dynamic balance, respectively. Training program was carried out three times/week and consisted in exercises to improve core strength, balance, proprioceptive system activation, muscle power, cardiorespiratory system and flexibility, especially during postural classes. Functional Training was administered with a Training Lab Italia® Protocol (CTLIP) consisting in a circuit interval training with ratio 30''work: 30″rest.
Results: ANOVA revealed that 2' Step Test was significantly different between T0 and T1 ($p = 0.03$) and after the intervention (T2 vs T0, $p = 0.01$), while no significant differences were found for the other variables ($p > 0.05$).
Conclusions: Results suggest that in middle-aged adults of both genders, a multicomponent training protocol on the workplace was effective on Physical Fitness, specifically, on cardiorespiratory fitness.
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A 3-month exercise program performed in a green–blue space: preliminary results from the "Parco Del Mare" study

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Purpose: A growing number of studies suggests that access and exposure to natural outdoor environments, in particular green–blue spaces, have beneficial impacts on health. However, evidence is limited regarding the evaluation of the effectiveness and the efficacy of physical activity interventions carried out in this type of settings involving healthy population. Therefore, the aim of the "Parco del Mare" pilot study is to evaluate the feasibility and the effects of a moderate-intensity exercise program carried out in a green–blue setting, on health outcomes (assessed through validated tests and questionnaires).
Methods: Healthy adults with no contraindication to practice physical activity were recruited and divided into two groups: the experimental group (EG) involved in the exercise sessions performed twice-a-week for 3-months in the Parco del Mare setting and the control group (CG) receiving no intervention. Physical performance was evaluated using the Six Minutes Walking Test (6MWT) at baseline (T0) and follow-up (T1).
Results: Preliminary results conducted on a sample of 26 subjects (EG = 16; CG = 10; mean age 47.64 ± 1.9 years; 18 females) show that after 3 months of intervention the EG significantly improve physical performance compared to the CG (total distance in meter 535.33 ± 19.75 vs 460.0 ± 17.32 respectively, $p < 0.05$).
Conclusions: Preliminary results are confirming the hypothesis: the intervention carried out in the Parco del Mare setting is expected to be feasible and effective in improving direct and indirect health parameters, quality of life and physical performance in healthy adults.

Active breaks in the context of a systemic and ecological approach to promote physical activity in the school setting: the whole active health promoting schools project (WAHPS)

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Purpose: The WAHPS project is based on a whole approach to increase levels of children's physical activity in the primary school setting, funded by Italian Minister of Health in 2019. It involves four Italian Regions (Abruzzo, Emilia-Romagna, Lombardia, Marche) in a multicenter collaboration. In 2022, after the pandemic, a total of 23 schools were enrolled and three interventions were proposed to each school: Active Breaks (ABs), Walking Buses (WBs) and Playgrounds Marking (PM). The aim of the present study is to evaluate the implementation level and the impact in terms of teachers' confidence and classroom climate of the solely ABs intervention and in a subsample of 9 schools.

Methods: The ABs consisted in timed interruptions of classroom academic activities with breaks took from 3 to 8 or more minutes and classified as: Active Breaks properly so called (i.e. jumps, march or jogging on place, legs and arms movements, etc.); Brain Boosters (physical or non-physical games aimed at stimulating concentration before an academic task); Brain Breaks (loosening-up and relaxing activities to calm after a tough academic task). We conducted a continuous assessment to monitor AB implementation, based on a weekly log filled in by teachers by means of online forms.
Results: 175 teachers and 100 classes of primary school (from 1st to 5th grade) took part in the study from March (9th week of the year) to early June 2023 (23rd). The compliance at the monitoring task wasn't homogeneous within the sample: in total, 474 weeks were monitored (average of 4.7 weeks per class) but only 6 classes have been monitored for 8 weeks or more. In the 43.8% of monitored weeks, teachers implemented ABs for at least one time every day; in the 49.4%, the breaks took more than 8 min and, for the 90.7% of weeks, classes spent a total of 10 min or more a day in ABs. The most relevant impact of ABs implementation resulted in the children's liking (teachers agreed 'much' or 'completely' this item in 87.1% of weeks) followed by feasibility (53.7%), social climate (50.1%) and utility for academic tasks (40.2%).
Conclusions: In more than half of monitored weeks, ABs appeared very feasible, appreciated by the target and positive for the class climate. They make children active for at least 10 min for more than 90% of observed weeks. The study highlighted the importance and challenges of continuous monitoring activity in evaluating interventions based on a comprehensive approach.
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Improvement of health-related quality of life variables in elders living in residential care facilities: the role of a physical activity program

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Purpose: Epidemiological data show that people are living longer. This change carries opportunities for people, but also the increased need for residential care facilities (RCFs) for elders who require care that cannot be taken at home [1]. The entry into RCFs is a delicate moment, in which maintaining autonomy is essential, promoting physical and mental health [2]. The aim of this work was to evaluate the perceived quality of life (QoL)-related variables in RCFs residents at baseline and after a 6-weeks of physical activity (PA) intervention, to explore its possible role in improving the older adults' perceived QoL.
Methods: Overall, 108 residents belonging to seven Italian RCFs were enrolled. The Short-Form 12 (SF-12) questionnaire was used to assess the Physical Component Score (PCS) and Mental Component Score (MCS). To evaluate the residents' attendance at PA, questions about the weekly frequency of PA performed were included, analyzing data also considering the presence of a kinesiologist as a member of the RCF team. After baseline assessments, a 6-weeks PA intervention conducted by a kinesiologist was implemented in 2 RCFs once or twice per week, then the same variables considered at baseline were re-evaluated.
Results: As expected, the residents' PCS resulted inversely related to their age. The individual PA attendance and the MCS were greater in the residents living in RCFs where a kinesiologist was present. Moreover, the higher adherence at individual and group PA was related to higher MCS. After the 6-weeks PA intervention, a greater RCFs residents' attendance at individual PA and a high frequency in group activities were shown. Furthermore, the attendance at kinesiologist sessions once per week improved residents' MCS (mean value pre: 43.4 ± 10.2; mean value post: 49.5 ± 6.7; $p < 0.05$). Interestingly, the proposal of two sessions per week with the kinesiologist during the intervention period significantly improved both PCS and MCS in older adults; the mean PCS value increased from 44.3 ± 10.1 to 49.4 ± 5.5 ($p < 0.05$), whereas the mean MCS value improved from 47.8 ± 4.6 to 52.7 ± 3.4 ($p < 0.01$).
Conclusions: Data suggest the strong impact of PA, structured by an expert, in increasing the health-related variables in RCFs' older residents, especially the mental sphere of the perceived QoL. These beneficial effects were shown particularly with the twice-a-week program [3].
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Effects of long-term structured exercise training programme (sext) in chronic obstructive lung disease (COPD): a case-series study

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Purpose: In COPD patients SExT program is important for maintaining quality of life and long-term function. The long-term effects (> 12 months) of physical activity programs in real life setting remain unknown (1). Few experiences, no studies in COPD on the outcomes of programs lasting many years. The aim of the study was to analyze subjects with COPD who attended a long SExT program.
Methods: We presented COPD patient who regularly attend a SExT. The program consisted of baseline T0 and regularly evaluation of exercise capacity to set exercise training sessions. This case-series study assessed the evolution in the outcomes [spirometry FEV1, 6-min walking distance (6MWD), Gait Speed (10-m), Timed Up and Go (TUG), Sit to Stand (STS), Berg Balance Scale (BBS), N° supervised Exercise session performed, pneumology -cardiology consultation, hospitalization, pharmacological treatment. Based on the results of exercise capacity evaluation, an individualized program was built considering symptom burden, as well as comorbidities. Tailored supervised sessions (2 sessions per week) incorporate progressive programs of aerobic exercise, muscle strengthening, balance (attends to falls) postural retraining, and chest expansion exercises. These supervised sessions took place in a gym with 5 individuals at the time and duration of each session was 60 min. The proposed

exercises were individualized and adjusted over time based on exercise capacity, symptoms and any changes in the clinical condition.
Results: We present 4 subjects with COPD that have attended to a gym "Esercizio Vita Kinesiology Center" in the decade between 2013 and 2023 for a mean of 2678 ± 614 days. All subject with experienced movement-related dyspnea. Half of the participants were women, at the start (T0) the mean age was 62 ± 2 years, BMI 27 ± 10, FEV1% 40 ± 17 and 75% had a diagnosis of severe or very severe COPD. They have completed a mean of 615 ± 317 supervision training session. COPD exacerbations were fewer than in the no-exercise training period. Comorbidities also did not prevent long-term adherence to SEXT. At the end of the program, there was a maintenance of exercise capacity 6MWT (from 233 ± 84 to 236 ± 83) TUG (from 9, 6 ± 1, 8 to 9, 2 ± 1, 35) STS (from 16, 1 ± 3, 7 to 15, 7 ± 2, 0) BBS (from 54, 0 ± 1, 4 to 53, 0 ± 2, 4) however, 10-m it has gotten slightly worse (from 10, 2 ± 1,2 to11, 6 ± 1,2).
Conclusions: SExT it is important for successful ageing in COPD patients. Limit: lack of control group, and of patients dropping out of the gym (probably for health reasons), but as long as you can attend, your functional level does not worsen.
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Single and combined effects of classroom-based active breaks and standing desk on health-related fitness in adolescents

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Purpose: Schools are ideal settings for promoting health-related behaviors where adolescents spend much of their daily time. Unfortunately, schools have often neglected such behaviors, including physical activity, due to their focus on academic achievement. Decreased physical activity, however, might mitigate scholar purposes of academic accomplishments. A potential solution could be to promote time-efficient physical activity interventions, such as breaking up prolonged sedentary times with light-intensity physical activity or using standing desks. Whether such interventions, singularly or in combination, affect parameters of health and fitness, however, is still debated. Hence, this study examined the single and combined effects of classroom-based active breaks and using standing desks on adolescents' health-related fitness.
Methods: Participants were 100 secondary school students (78% females, age range from 15 to 17 yr). Four classes were randomly assigned to the following groups: control (CT, n = 20), active breaks (ACT, n = 26), standing desks (STD, n = 26), and active breaks and standing desks combined (ACT + STD, n = 28). In both ACT and ACT + STD groups, participants completed 3 × 8-min active breaks per weekday for 12 weeks. In the STD and ACT + STD groups, otherwise, participants completed 3 × 8-min using standing desks. Finally, in the ACT + STD group, both interventions were alternate. Measures of health-related fitness, including muscle strength/power/endurance, aerobic endurance, flexibility, blood pressure, and anthropometry, were assessed at baseline and post-intervention. ANCOVA tests using baseline values as covariates were used, with a *P*-value set as 0.05.
Results: The adherence to the interventions was > 80%. There were significant changes in muscular and aerobic endurance, flexibility, and systolic blood pressure ($P < 0.01$), primarily in the ACT group. Similar non-significant trends were observed for muscle strength ($P = 0.06$) and diastolic blood pressure ($P = 0.06$). However, no between-group differences were evident for muscle power and all anthropometric parameters ($P > 0.05$).
Conclusions: These results suggest that classroom-based physical activity interventions positively impact health-related fitness in secondary school students. Such effects are more noticeable when breaking up prolonged sedentary times with light-intensity physical activity.

Lifestyle educational intervention on supervised walking groups: two years experience in ferrara

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Purpose: The aim of this project was to promote increased physical activity levels in healthy individuals and people with chronic diseases by organizing walking groups under the supervision of a kinesiologist.
Methods: The project collaborated with local institutions to disseminate information on healthy lifestyles, including nutrition and physical activity levels. Participants were divided into groups based on a 1 km treadmill test (1): group A (walking speed WS: 4.8—5.4 km/h) and group B (WS: above 5.5—6.5 km/h). Baseline data on body mass index (BMI), and cardiovascular function index (CFI) were collected. Each group engaged in kinesiologist-supervised walking sessions of at least 70 min, which included warm-up, brisk walking, and cool-down. Both groups were invited to participate, prior to the walk, in the first of three events discussing evidence of the benefits of walking in preventive medicine, organized in collaboration with the University of Ferrara. Following the event, the subjects were asked to fill out a satisfaction questionnaire.
Results: From 05/2022 to 09/2023, a total of 310 participants (62 ± 10 years, BMI 26 ± 4 kg/m2, CFI: 90 ± 7, WS: 5 ± 0.5) were included in the study. In 2022, 99 were interested 74 participated (62 ± 9 years old, BMI 26 ± 4 kg/m2, CFI: 95 ± 10, WS: 5 ± 0.4) joined the project by attending lifestyle change awareness seminars organized by the 'O. Vergani' high school, aimed at different age groups. In 2023, 211 people joined the project. Among them, 11 did not start due to work commitments or unfitness and 120 also participated in the event at the University of Ferrara of which 45 participants completed a short questionnaire. 80 participants with an average age of 60 ± 12 years, BMI of 25 ± 3 kg/m2, CFI: 93 ± 9.Group A consisted of 48 subjects (12 males, age 63 ± 10, BMI: 25 ± 4, CFI: 88 ± 7, WS: 5 ± 0.2 km/h) and group B of 32 subjects (10 males, age 57.6 ± 12, BMI: 23.6 ± 3.3 kg/m2, CFI: 97.7 ± 8.8, WS: 5.8 ± 0.4 km/h). The project will end on 28 September 2023 and the results of the activities from April to September 2023 will be presented at the congress.
Conclusions: The increase in the number of participants from 2022 to 2023 suggests that walking groups are a valuable tool for raising awareness. Social interaction and/or the presence of a kinesiologist could improve the physical and mental well-being of participants.

Territorial cooperation with various organizations provides valuable support for the promotion of lifestyle changes.

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Active breaks in high school: students' perspectives

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Purpose: School-based physical activity (PA) interventions may counteract the physical activity (PA) decrease in adolescents (11–18 years old) (1) and promote teenagers' mental health (2). Research has proven active breaks (ABs); 10/15 min of PA in school hours) an effective strategy to address the phenomenon in primary schools (3)(4). Would ABs be beneficial in secondary school too? How should ABs be adjusted according to the different educational settings and individual needs in adolescence?

Methods: Based on the Social-Ecological Model (5), 20 adolescents from a secondary school in Rimini (Italy) were involved in a Focus Group (FG) in March 2023. Qualitative data were collected through pre-developed themes investigating the students' previous experiences of PA in school, their opinions about the potential benefits and risks of AB, and facilitators and barriers. The last part of the FG explored their hopes, expectations and objectives. Data analysis and interpretation were conducted using the Taguette software platform.

Results: The preliminary coding resulted in 18 categories, further reduced to 13, and grouped into 3 macro-themes: *opinions about PA at school, facilitators and barriers of ABs, and how to implement ABs.* Each theme contained many codes. The findings highlight that students perceive a 5/10 min AB as a resource of mental (from long hours of frontal lectures) and physical (from long-time sitting) restoration. Students described teachers as a barrier as they might fear losing control of the class because of the ABs; however, the most prominent facilitator was the student's ability to ensure a safe and pleasant experience for everybody. Taking turns, each student would guide the class, potentially including stretching exercises and team games with a ball.

Conclusions: Teenagers express the need to activate body and mind and ABs could be the strategy. Also, ABs could promote adolescents' personal (e.g., self-management and decision-making) and social (e.g., empathy and cooperation) skills, both with classmates and teachers.

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Effects of benzodiazepine use on physical performance in healthy participants in sport: a systematic review

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Purpose: Athletes hunt for any sort of way to improve even marginally their performance to achieve success. Particularly, the use and misuse of pharmacological drugs is increasingly observed in sport with a novel debate arising about the possible ergogenic effect of Benzodiazepine (BZD), which is not prohibited in sport. Indeed, BZD represent a "suitable" drug class against insomnia in athletes triggered by increased daytime fatigue and altered sleep patterns due to travel and scheduling requirements (Zandonai et al. 2018). Nevertheless, the real effect of BZD use in sport remains unclear. To this, the present review aims to summarize findings from literature about the effect of BZD administration on physical performance.

Methods: A systematic literature search was performed in Pubmed, Scopus and Psycinfo online databases up to April 2023 using terms as "benzodiazepine" (and generic drug names), "sport", "performance", "strength", "endurance" and "athlete". Single case studies reporting use of BZD in professional athletes were described.

Results: Ten primary studies were included in the systematic review and 2 single case studies on professional athletes were described. No positive or negative effect emerged on physical performance using BZD in healthy participants both considering acute doses administration and long-term effects. Single case studies of BZD use by professional athletes indicated that the use of lormetazepam to counteract insomnia and faster the physical recovering easily transform in addiction cases without any benefits on physical performance.

Conclusions: Literature showed that BZD use in healthy participants does not seem to have an ergogenic or ergolytic effect on physical performance, but these results should be taken with caution since the few studies exploring this topic. In addition, two clinical cases about BZD use by professional athletes revealed a high risk for addiction and hospitalization suggesting the need for a regulation of its use within sport (Zandonai et al. 2022). Sports medicine physicians should suggest treatments with BZD for specific clinical situations and for short-term use only and future studies with larger samples should be clarify the complex relationship between BZD and physical performance.

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Exploring Parkour's impact on trials cycling skill development

Purpose: The aim of this paper is to analyse the potential, inherent in participating in a different sport from one's main sport, in enriching an athlete's motor skills and how these skills can be successfully transferred to their own sport. Drawing on the ecological dynamics approach.

and the athletic skills model, this contribution explores how the sport of parkour can be used as a donor sport for trials cycling.
Methods: Through a theoretical and technical excursus, different suggestions are proposed to consolidate the hypothesis that practising parkour as a donor sport can contribute to the long-term improvement of athletes' performance, reduce the risks of early specialization, and. promote greater longevity in sports practice. Also are offered some practical examples of parkour exercises that can be transferred to trials cycling and some educational applications for teachers are suggested.
Results: By practising Parkour, athletes can acquire skills such as jumping, overcoming obstacles, evaluating distances, and performing movements with precision, which can be transferred to trials.
Conclusions: The affordance landscape shared between parkour and trials offers ample opportunities for the acquisition and transfer of these skills, without the negative consequences of early specialization.
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Innovative exercise approach for promoting sports inclusion in youth: expanding emotional and evolutionary intelligence through physical activity

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Purpose: The world of sports is a communication tool that unites the child with high-functioning autism spectrum disorder (ASD-HF) with a gifted normal. For the study, an operational motor protocol was implemented through the administration of the circuit on Dexterity Harre (HDC) in the presence and online on a Zoom platform to a sample of children ages 8 to 12 years old, aimed at increasing their attention and motor skills in a climate of shared intentions, which creates adaptations and modification of stereotypes.
Methods: The circuit on Harre dexterity (HDC) was used to improve the general motor skills of the analyzed sample, with the use of mats, a ball, three obstacles 50 cm high, a stopwatch and a decameter. The study lasted 7 months twice a week of training for a total of 14 sessions of 1h30 each. Adapted physical activity (APA) programs were conducted simultaneously online and in the presence of 28 children. The in-presence group consisted of 10 normal children (AB-P) and 4 ASD-HF children (ASD-P) and the online group consisted of 10 normal children (AB-O) and 4 children with ASD-HF (ASD-O). They were administered the IPAQ questionnaire to see if there is an increase in physical activity in the past 7 days.
Results: At the end of 7 months of the motor protocol administration, measurements were taken with Anova to see if there were any differences between the division of the two groups, "Group 1 (FG)" and "Group 2" (OP). Tukey HSD test showed the differences between the specific groups, ASD-P vs ASD-O $p < 0.001$, ASD-O vs AB-O $p < 0.001$, ASD-O vs AB-P $p < 0.001$, ASD-O vs AB -P $p = 0.136$, ASD-P vs AB-P $p < 0.001$, AB-P vs AB-O $p = 0.003$. For IPAQ questionnaire administration, it is found that there is a statistical difference between before and after 7 months of physical activity administered to all groups with $p = 0.0002$, but no difference between groups, $p = 0.848$, or both interactions, $p = 0.993$.
Conclusions: Sports expresses an important factor in physical and mental growth, as the spirit of teamwork aims for everyone to achieve the same result. Participants were taught to act independently without discrimination during the 7-month monitoring period. Achieving an increasing improvement in the practice of sports activities was also a tool for parent–child bonding and fun. Demonstrating that the link between sports and education are two vehicles of social and human relationships needed to cope with life's difficulties.

Does better gross-motor development promote learning sport- specific skills?

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Purpose: To achieve greater motor competence, it is necessary to expand personal motor baggage through diversified experiences of movement. According to scientific literature, a wide range of FMS (Fundamental Movement Skills) in the developmental age allows the overcoming of the *proficiency barrier* (Seefeldt, 1980) useful for the acquisition of specific sports skills. In line with the principle of trainability of LTAD (Long Term Athlete Development) model that identifies specific windows of optimal trainability for each motor skill, the aim of this study is understanding whether a wider motor baggage provides a better predisposition to learning and acquisition of a specific sport skill.
Methods: Through a descriptive and correlational analysis, the study compares the performance level of gross motor development and specific sports skills performed by a convenience sample of 323 children aged between 3 and 10 years, ($M = 7.32 + 1.78$), 130 males and 193 females. The non-probabilistic sampling technique involved the selection of two groups (children who play sport in the extracurricular setting and children who do not partecipate in extracurricular sports activities). The following survey tools were used: information questionnaire, TGMD-3 gross motor skills test, technical tests of evaluation of specific sports skills.
Results: From the data collected it was possible to detect a clear difference in the levels of gross motor development between the two groups (school context / sports context). Correlational analysis between gross motor development and performance levels of specific sports skills shows a positive correlation.
Conclusions: The analysis of specific sport skills performance led the conclusion that a properly designed practice opportunity significantly raises performance level during one's own sport's tests and promotes an enlargement of one's own basic motor background, which in turn lays fertile foundations for learning new and more complex motor skills.

Exploring the dynamic dimensions of physical literacy: definitions, assessments, and educational interventions

Physical Literacy (PL) is a multidimensional concept that requires a holistic understanding of the relationship between the individual and the learning environment. The ecological and nonlinear perspective emphasizes the importance of emerging constraints and dynamic interactions between the individual and the surrounding environment. The aim of this study is to provide clear and specific definitions of Physical Literacy, highlighting its complexity and fundamental dimensions. Furthermore, the discussion emphasizes the significance

of viewing Physical Literacy as a dynamic and complex process, where person, environment, and task are interconnected. Subsequently, various assessment methodologies applicable to Physical Literacy are explored, emphasizing the need to adopt ecological and nonlinear approaches to evaluation that consider the contextualized and dynamic interaction between the individual and the environment. National and international projects are also referenced while examining educational interventions aimed at promoting Physical Literacy. The article underscores the importance of considering Physical Literacy as an educational process that requires careful design, considering constraint manipulation, practice variability, and co-design of activities. In conclusion, this article offers a specific perspective on Physical Literacy in terms of its definition, evaluation, and interventions, within an ecological and nonlinear framework. It highlights the importance of Physical Literacy as a fundamental element in physical education, essential in developing a physically literate population.

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UNESCO: baku outcome document and fit for life alliance and status pe of quality of policies and practices

Purpose: The quality of Physical Education (PE) is fundamental for the well-being of the present and future generations according to physical, social, emotional land academic benefits for all the students and positive community development and part of UNESCO's FIT FOR LIFE ALLIANCE presented at the BAKU MINEPS VII (2023). The UNESCO's Quality PE 2021–2022 (QPE) Survey aim is to measure the state of PE.

worldwide and close the policy-practice gap based on the evidence and scientific data.

The survey is at international and global levels and provides to evaluate and enhance QPE policy and provision in the local UNESCO member states. The Survey was undertaken as a contribution to the Quality of education according to UNESCO (Hardman, 2008–2014).
Methods: The survey collected data from 117 countries, and 2, 088 PE teachers at the school level. Data was collected by the International Federation of Physical Education and Sport (FIEPS) and supported by the WHO and the QPE Steering Committee of 20 international experts.
Results: Key findings: lack of funding budget for PE (57% of countries less than 2%); lack of inclusivity (1in 4 students with disabilities do have not access to PE), lack of time (only 9.1% upper secondary schools, 16.3% of lower secondary school declared standard 180 min per week PE, and 42.7% of primary schools announced 120 min per week), lack of training (only 43% of primary teachers have formation in PE subject).
Conclusions: The QPE enhancement worldwide needs human and financial investments to guarantee a generation of healthy, resilient, and socially responsible citizens for all the students and support the decision–makers to prioritize the improve PE teaching practices with school-based and evidence/data-based policies.
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A description of the perceived well-being related to regular physical activity practice in preservice primary school teachers population

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Purpose: The importance of physical activity in improving health is widely acknowledged. Nevertheless, physical activity (PA) rates are decreasing in more industrialized countries (Brownson et al., 2005). In response to this trend, institutions and organizations have implemented physical activity promotion projects in primary schools to raise children's awareness and engagement in physical activity (Smedegaard et al., 2016). However, adequate physical activity engagement strictly depends on the teacher's feelings and motivation in PA.
Thus, this study aimed to describe the influence of regular physical activity practice on the perceived well-being of a population of preservice primary school teachers.
Methods: Perceived well-being was assessed using the WHO-5 Well-Being Index (Topp et al., 2015). Participation was voluntary, and students could fill out the questionnaire simply by clicking on a specific link received by email.
Results:
The final sample size was 525 preservice teachers (71% female and 29% male). Analyzing the regular practice of physical activity, 26% of the participants declared not to practice any sport or be engaged in any physical activity.

Conversely, 74% were involved in some form of physical activity. In addition, results show a significant difference in the well-being index in favor of those who practiced and type of PA ($p < 0.001$).
Conclusions: Primary teaching students show a higher rate of well-being perception if they practice any sport or PA.

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MOBAK-3 for the assessment of basic motor competencies in primary school children: results from Italy

Purpose: Fundamental Motor Skills (FMS) are the equivalent of the ABCs in the world of physical activity, divided in locomotor skills and object control skills. The first class of movement involve moving the body through space and include skills such as running, galloping, skipping, hopping, sliding, and leaping; the second one consists of manipulating and projecting objects and include skills such as throwing, catching, bouncing, kicking, striking, and rolling. These skills represent the basis for future movement and physical activity. The aim of the present study is to assess motor competence levels in primary school children according to gender and BMI.
Methods: The sample consists of 284 primary school children, including 134 boys (Age = 9.04 ± 0.53; Height = 1.35 ± 0.07; Weight = 35.97 ± 7.88; BMI = 19.45 ± 3.62) and 150 girls (Age = 9.12 ± 0.50; Height = 1.35 ± 0.07; Weight = 33.73 ± 7.97; BMI = 18.17 ± 3.24). Children recruited from the 3th grade of two primary schools in Apulia Region, Italy, participated in MOBAK Erasmus +—Basic Motor Competencies in Europe Project—aimed at studying the motor development of the child. Students were evaluated during PE lessons according to MOBAK 3–4 protocol, after a brief description and one demonstration, as required by testing procedure. In addition to descriptive statistics (mean ± standard deviation), ANOVA was carried out to assess differences according to gender, and chi-square test was used to determine quartile variations.
Results: The sample consists of 284 primary school children, including 134 boys (Age = 9.04 ± 0.53; Height = 1.35 ± 0.07; Weight = 35.97 ± 7.88; BMI = 19.45 ± 3.62) and 150 girls (Age = 9.12 ± 0.50; Height = 1.35 ± 0.07; Weight = 33.73 ± 7.97; BMI = 18.17 ± 3.24). Children recruited from the 3th grade of two primary schools in Apulia Region, Italy, participated in MOBAK Erasmus +—Basic Motor Competencies in Europe Project—aimed at studying the motor development of the child. Students were evaluated during PE lessons according to MOBAK 3–4 protocol, after a brief description and one demonstration, as required by testing procedure. In addition to descriptive statistics (mean ± standard deviation), ANOVA was carried out to assess differences according to gender, and chi-square test was used to determine quartile variations.
Statistical analysis showed better basic motor competence in boys than in girls, especially for the object control skills ($p < 0.05$). However, quartile analysis highlighted that –only a small percentage of boys and girls got positive scores (> third quartile) in all MOBAK assessment test.
Conclusions: The preliminary results of the MOBAK Erasmus +—Basic Motor Competencies in Europe Project highlighted the need to improve and enhance the learning of fundamental movement skills in primary schoolchildren, and they are even more worrying when compared with those of other European countries. Future political and didactic interventions should aim to structure projects and initiatives aimed at (1) revise the physical education curricula in primary school, (b) structure PE teachers' training aligned with the international recommendations and guidelines, and (c) increase the opportunities to learn and experience motor basic skills.

The physical snack project: enhance high-intensity physical activity levels in adolescents

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Purpose: In the field of physical education, multicomponent interventions have been widely used for the promotion of active lifestyles and healthy behaviors in children and adolescents. In this context, the proposal of Active Breaks during the school day represents an opportunity to enhance the daily levels of physical activity (PA) with short breaks of PA in opposition to the too many sedentary times spent in school. The current study describes the preliminary results of the "Physical Snack" Project" (a.y. 2021–2022), aimed at enhancing and extending the opportunity of the daily practice of physical activity in secondary school. The intervention protocol was carried out from March to June 2022 and provided for the alternation of active breaks, physically active lessons, and active breaks before and after school.
Methods: In addition to anthropometric measures (gender, age, weight, height and BMI), physical self-perception, enjoyment and daily levels of physical activity were assessed with three validated questionnaires. The sample involved a total of 540 children attending secondary school in Foggia (Apulia province) in t_0 (M = 271, age = 12, 30 ± 1, 05 years, weight = 51, 10 ± 13, 84 kg, height = 1, 56 ± 0, 11 m, and BMI = 20, 64 ± 4, 10; F = 269, age = 12, 35 ± 1, 10 years, weight = 46, 56 ± 10, 40 kg, height = 1, 55 ± 0, 08 m, and BMI = 19, 26 ± 3, 63) and 279 in t_1 (M = 120, age = 12, 14 ± 0, 95, weight = 47, 31 ± 12, 30 kg, height = 1, 55 ± 0, 09 m, and BMI = 19, 29 ± 3, 81; F = 159, age = 12, 33 ± 1, 14 years, weight = 48, 86 ± 12, 09 kg, height = 1, 56 ± 0, 88 m, and BMI = 19, 76 ± 3, 93). Descriptive statistic was carried out to present the results as Means ± Standard deviation (SD) and paired sample t-test was performed to compared variables pre- and post-intervention. Moreover, the percentage of adolescents classified as low, moderate, or high levels of physical activity was reported. Data analysis was conducted with SPSS ver.25. All significance levels were set at $p < 0.05$.
Results: Statistical analysis showed a significant increase in the levels of physical activity in boys, and higher enjoyment during PA for girls. In addition, the data analysis revealed a significant increase in the percentage of boys and girls who practiced high-intensity physical activity.
Conclusions: The preliminary results of the "Physical Snack" project highlighted that active breaks represent a valid strategy to improve the daily levels of PA (especially high intensity PA) and the related factors, and, due to the positive association between high-intensity PA and health benefits, promote general health status in adolescents.

Motor performance and self-perception in children: results of SBAM project in Apulia

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Purpose: The progressive increase of overweight and obesity in children is linked to increased physical inactivity and reduced

opportunities for physical activity expenditure. Promotion of children's health through physical education, physical activity and sport is an educational purpose that requires interinstitutional and multicomponent interventions. The aim of the present study is to describe the preliminary results of the SBAM Program (a.y. 2019/2020), highlighting differences in motor performances (strength, endurance and speed) and self-perception according to gender and BMI in a sample of primary schoolchildren.

Methods: The study involved 600 primary schoolchildren (M = 300, F = 300, mean age = 9, 18 ± 0, 38). After collecting anthropometric data (height and weight), children were equally distributed according to BMI Cutoff in Normalweight (M = 100, F = 100), Overweight (M = 100, F = 100) and Obese (M = 100, F = 100) groups. Motor assessment was conducted during curricular physical education lessons, as follows: standing long jump (SLJ) and medicine ball throw (MBT) to evaluate strength of the lower and upper limbs, shuttle run 10 × 4 (10 × 4) and 6 min walk test (6 minWT) to assess speed and endurance. Physical self-perception was assessed with the" Physical Self Efficacy Scale for Children" a 6-items Likert-scale questionnaires. In addition to the descriptive statistics (M ± SD), analysis of the variance ANOVA 3 (group, normal-weight vs overweight vs obese) × 2 (gender) was performed, to highlight significant differences in relation to the dependent variables consi- dered. Pearson's correlation coefficient was also used to highlight significant relation between BMI, components of physical fitness and self-perception. The significance index was set at $p < 0.05$.

Results: The results showed better motor performance and levles self-perception ($p < 0.05$) for the Nw group compared to Ow and Ob in both genders. Overweight and obese children showed lower values in all motor tests, except 1 kg medicine ball throw, compared to those of normal weight, and the correlation analysis confirmed that BMI negatively influenced lower limb strength, endurance, and speed performance.

Conclusions: The present study highlight the needs for evidence-based interventions aimed at increasing the opportunity to be physically active, reduce sedentary behaviors and promote quality physical education programs.

Implementation of developmental motor/artistic teaching practices from a praxeological and grapho-motor perspective

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Purpose: The period in which children improve the different forms of movement and learn to combine them (Meinel, 1976) corresponds to the primary school period, an age in which there is a significant improvement in the child's forms of movement, on condition that they are stimulated and structured in environments suitable for this type of learning (Pesce, 2015). The possible use of batteries of motor assessment tests in educational contexts allows to obtain information on the level of initial motor maturation of children, as well as to acquire objective data on circumstances relevant to the possible identification of developmental levels (Meinel, 1984), which guide to the planning of appropriate educational activities. The aim is to investigate the study of basic motor and grapho-motor skills, focusing on movement/dance didactics in a praxeological key in a motor-inclusive field.

Methods: The present descriptive survey was conducted on a convenience sample of 200 children between the ages of 8 and 9, (M = 96; F = 104), selected by means of non-probabilistic sampling. The survey instruments used are: MOBAK 3–4, a test aimed at assessing the learning and development of basic motor skills; BHK, a scale for assessing grapho-motor performance; motor-artistic workshop activities with an experiential approach. From the data collected it was possible, through the descriptive statistics of these tests, to quantify in terms of mean values and standard deviations the differences of the variables, through the analysis with comparisons by gender, age and sports practice, both on the whole sample and with comparisons between groups.

Results: Especially in the surveys in release, a decrease in graphic difficulties emerged, an increase in graphic production in terms of writing speed and an improvement in the competence area of "Moving" in the experimental group (p-value = < . 005).

Conclusions: Finally, the results provide encouraging data, suggesting that the trial should be extended to a larger sample and over a longer period of time, so as to increase the workshop proposals. In this scenario, it is important for research to study and promote the results of educational practices that enhance the role of corporeity, starting from a renewed conception of physical education at school.

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The role of physical activity and sport modality in shaping psychosocial skills: a study on fair play, self-esteem, and self-efficacy in children

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Purpose: Engaging in physical activity and sports is essential for the psychosocial development of children, as it fosters moral development, social integration, and character building based on ethical principles, such as fair play(1,2). This study analyzed the relationship between physical activity behavior, sport modality, and higher-order psychosocial skills, such as moral decision-making, fair play, self-esteem, and self-efficacy, in a sample of children from two primary schools. Our hypothesis posited variations in psychosocial outcomes based on children's physical activity levels and sport participation (individual vs. team, open skill vs. closed skill).

Methods: One hundred twenty-nine primary school children (59 females, M_{age} = 8.13, SD = 0.81 y.o.) participated in the study. Each participant completed the following questionnaire: the Fair Play in Physical Education, the Attitudes Moral Decision-Making in Youth Sport, the Rosenberg Self-Esteem, the Physical Self-Efficacy, and the Physical Activity questionnaires.

Results: The results demonstrated that physical activity and gender exerted a general effect on fair play, whereas sport type did not exhibit a significant association with any of the studied constructs. However, sex and physical activity level, as well as sport type, were identified as significant predictors of sports self-efficacy.

Conclusions: Overall, our study highlights the complex and multifaceted nature of these constructs and the importance of considering multiple factors in elucidating their relationships. Our study has important implications for trainers and teachers who aim to promote fair play and sportsmanship in their programs. To promote ethical

behavior in youth sports, character education programs that emphasize values such as fairness, respect, and responsibility can be helpful. Coaches and parents can also serve as positive role models to promote these values and create a culture of fair play and respect in youth sports programs. By emphasizing these values, such programs can contribute to positive psychosocial development in young athletes.

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Differences in gross motor skills between children with and without symptoms of attention deficit hyperactivity disorder

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Purpose: Gross motor skills are crucial for child development, encompassing goal-directed movements like locomotion and object control. These skills are fundamental for daily activities and engaging in physical exercise. Proficiency in gross motor skills is necessary for sport-specific abilities and successful participation in physical activities. Children with movement difficulties are less likely to be physically active and more inclined toward sedentary behavior, which can hinder their motor skill development, social interaction, and overall health. Attention deficit hyperactivity disorder (ADHD) is widely acknowledged as the prevailing developmental disorder affecting children. A significant number of children with ADHD exhibit motor impairments in their everyday activities, potentially influencing their developmental trajectory. Children with ADHD who encounter motor deficiencies often struggle with tasks that involve movement. The objective of the study was to examine and compare the gross motor skills between Italian children with and without symptoms of ADHD.

Methods: Using a cross-sectional design, data were collected in a large sample of Italian primary school children (N = 2942; mean age = 8.57 years, SD = 1.49 years). The Gross Motor Development-3 (TGMD-3) assessment tool was utilized to measure the gross motor skills of the participants. The TGMD-3 evaluates fundamental gross motor skills across two categories: locomotor skills and ball skills. Additionally, the study involved administering the ADHD Rating Scale for Teachers to all teachers, which consists of 18 items divided into two subscales: inattentiveness and impulsivity-hyperactivity (> 14 was the cutoff for each subscale). Each item is rated on a scale of 0 to 3 based on the frequency of observed behaviors, ranging from never to always. ANOVA (p-value set at 0.05) was used to compare the TGMD-3 scores between children with and without symptoms of ADHD. Gender and age were used as covariate.

Results: The results showed significant differences between groups only on the inattentiveness subscale for: TGMD-3 total score ($p = 0.0001$), locomotor ($p = 0.0001$) and object control subscales ($p = 0.01$). The results showed differences in gross motor skills between children with and without symptoms of ADHD.

Conclusions: While these findings need to be confirmed in the longitudinal study, our results have significant implications in educational settings where it is important to consider the possible impact of ADHD symptoms during motor development.

Effects of physical exercise intervention in motor competence in active and inactive Portuguese adolescents

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Purpose: Childhood and adolescence are critical moments for the development of Motor Competence (MC), that as already noted is a key factor in promoting active lifestyles and health for the rest of a people's life. This study conducted in Portugal aimed to analyse the effects of a physical exercise program in adolescents MC and whether compliance with the physical activity (PA) guidelines can intervene in MC variation.

Methods: The study involved 218 students from a secondary school, divided into intervention group (IG) and a control group (CG). Based on the PA Index Questionnaire that the participants filled in, all subjects were divided into active and inactive, with 113 active subjects (53.1% girls; 46.9% boys) and 105 inactive subjects (70.5% girls; 29.5% boys). For the IG we have 53 valid subjects (29 active, IGa;24 inactive, IGi), and for the CG 37 valid subjects (21 active, CGa;16 inactive, CGi). For 9 weeks the IG followed the Family in Move Program (FMP), which is a multi-lateral approach designed to encourage PA with their families and application of exercise battery to promote MC during a Physical Education (PE) class. To assess the level of MC, it was used the MC Assessment (MCA), an evaluation system divided into six tests that estimate locomotor skills, manipulative skills, and balance skills. After the training period, the MCA tests were administered again to both the IG and the CG. The statistical analysis was conducted using the Statistical Package for Social Science (SPSS).

Results: The results showed that adolescents in the IGa exhibited greater improvements in lateral jump (ΔIGa 21, 99 ± 2, 64), lateral transposition (ΔIGa 11, 82 ± 3, 74), kick speed (ΔIGa 2, 48 ± 2, 16), horizontal jump (ΔIG 2, 44 ± 1, 61) and launch speed (ΔIGa 1, 72 ± 1, 74) compared to the CGa. However, the intervention was not as effective for agility (ΔIGa -0, 61 ± 0, 81). Comparing data with the Pairwise method we found a statistically significant variation in the horizontal jump ($z = 4, 261$; $p < 0, 05$) between IGa and IGi, proving that a greater level of PA can lead to greater improvements in this exercise. In the CG there were no significant differences.

Conclusions: The intervention was effective for horizontal jump, which explain that PA can improve the benefits of the FMP intervention programme carried out in PE classrooms.

Epidemiological analysis of pain and discomfort among Italian Recreational Cyclists

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Purpose: The aim of this epidemiological analysis was to investigate the pain, discomfort and overuse injuries frequencies in recreational cyclists. The goal of the study was to relate the use of bicycles and the experience of pain, discomfort and injuries and define which procedure could be beneficial to avoid these problems.
Methods: During a period of time of 8 years (2015–2023), 2000 cyclists (90% man—10% woman / Average 35–55 years old—Average 3–5 years of experience as recreational cyclist—2 training session a week in average—70, 3% don't compete in any cycling competition—63, 2% practiced regularly another sport -99% reporting to be in good health) filled a questionnaire before doing a bike fitting procedure in a Bikeitalia LAB, cycling labs in Italy, specialized in Bike fitting.
The questionnaire was composed of 75 questions about expertise, training, pain and injuries.
Results: 89, 7% of the subjects who filled the questionnaire experienced pain, discomfort or an overuse injury on some occasion during cycling.
The most common injuries were:

Hand numbness (47, 8%)—Saddle soreness (44, 3%)—Back Pain (36, 9%)—Knee pain (34, 5%).

In a scale from 1–5 the pain intensity was 58, 2% at level 2 and 32% at level 3.

In the most common case (44, 3%) the pain was appearing soon during the training session, just between 1 and 3 h of activity.

Most of the subjects (67, 4%) experienced pain or discomfort only during the cycling training session and not in other moments of their life, reporting that the pain was strictly related to the cycling activity.
Conclusions: Cycling is a closed skill sport, where the athlete can vary the intensity or the cadence but cannot modify the gesture per se. On average a cyclist repeats the same sport gesture 90–100 times per minute. This specificity can lead cyclists to experience pain and overuse injuries in some point of their cycling career. This situation can be experienced by both recreational and competitive cyclists, independent of expertise, mileage or age. Due to the fact that 78% of the cyclists who filled the questionnaire have never got a bike fit before, it could be beneficial for cyclists looking for a professional bike fit to adapt the measure of the bike to their body and their fitness capabilities. A future development of a professional bike fit procedure should be investigate.

The influence of anthropometric parameters in track & field curve sprint

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Purpose: The 200 m and 400 m are two sprint competition of athletic, with athletes that must run more than 58% of the competition in a curve. Despite numerous investigations have been conducted regarding straight sprints poor information is available regarding curve sprint. Therefore, the aim of this study was to explore the relationship between anthropometric and strength parameters during curves sprints performed directly on an athletic track to assess of the different anthropometric and strength factors could lead to a better understanding of the technique for running faster on curved paths during sprint events.
Methods: This was an observational crossover open-label pilot study. A total of 14 athletes (8 men and 6 women) were screened and enrolled in the study (age: 20.5 ± 2.3 years, height; 1.73 ± 0.06 m; body mass: 60.5 ± 6.2 kg). Participants underwent randomly two experimental sessions carried out on two different days and interspersed with 48 h of recovery. Demographic characteristics, anthropometric variables, jump test by squat jump (SJ) and triple hop distance (THD), and performance during the 20 m curve sprint were collected during the first day. During the second day 1 repetition maximum (1RM) for the right and left limbs, respectively, during the Bulgarian split squat (BSS) was evaluated. The unpaired t test and Pearson's correlation were used for data analysis.
Results: No statistical differences for anthropometric and strength parametric parameters between right and left lower limbs were observed. Twenty-meter curve sprints were negatively associated with body mass ($P = 0.0059$, $R = -0.7$) and BMI ($P = 0.032$, $R = 0.6$). Moreover, a negative association was observed with SJ height ($P = 0.0025$, $R = -0.7$), speed ($P = 0.0028$; $R = -0.7$), strength ($P = 0.009$, $R = -0.7$) and power ($P = 0.009$, $R = -0.7$). Finally, 20 m curve sprint negatively correlated with right ($P = 0.0021$, $R = -0.7$) and left ($P < 0.0001$, $R = -0.9$) THD and 1 RM right ($P = 0.025$, $R = -0.6$;) and left ($P = 0.0049$, $R = -0.7$) BSS, respectively.
Conclusions: This pilot study demonstrated that the 20 m curve sprint was negatively associated with body mass, BMI, vertical jump performance, THD and 1RM BSS. As a practical application, this pilot study enabled collection of information that could be useful to better understand the anthropometric and strength parameters associated with curve sprint.

Rhythmic gymnastics and aesthetic group gymnastics

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Purpose: The paper presented here is an analysis of two technical-combination sports, Rhythmic Gymnastics and Aesthetic Group Gymnastics, which are both athletic activities belonging to the gymnastics sphere. The comparison between the two comes through an examination of their respective codes of points (published by the Federations), a consideration of the term "aesthetic" from a philosophic point of view and a study of the mechanisms of observation by the competition judges. There is also a paragraph regarding the conditional and coordination skills involved in the two sports.
Methods: The data included in the thesis is the result of a comparison of scientific research articles found through such browsers as Google Scholar and Pubmed. The key terms utilized were "Rhythmic Gymnastics", "Aesthetic Group Gymnastics", "technical-combination sports" and "competition judging". The Code of Points for Rhythmic Gymnastics and Aesthetic Group Gymnastics were used and supplied by the International Gymnastics Federation and the International Federation of Aesthetic Group Gymnastics.
Results: The work done by the judges is to contemplate and interpret the different performances of the gymnasts. Aesthetic beauty unites Rhythmic Gymnastics and Aesthetic Group Gymnastics. The analysis of Score Codes underlines the substantial differences in the composition of the competition exercises: body difficulties, small tools, gender and number of team members and types of competition. The jury is divided into equal panels, but the judging criteria are different.

Conclusions: In conclusion, it can be confirmed that both Rhythmic Gymnastics and Aesthetic Group Gymnastics, even though they belong to different Federations, are disciplines that seek to achieve aesthetic beauty and perfection of movement. The juries of both sports are asked to observe the performances in the most correct manner possible and to maintain a high level of concentration, keeping in mind the phenomenon of distractors.
The substantial differences are to be found within the structures of the Codes of Points.

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"The role of the hormonal profile of constitutional biotypes in the training process"

Purpose: The effect of a training session against resistance -10% m/s of the 1RM and at exhaustion on hormone concentrations in the constitutional biotypes, Endomorphic (-10% m/s) and Mesomorphic (Exhaustion) was evaluated. Ten subjects participated in the present study. Anthropometric measurements, % fat and lean mass, and salivary concentrations of Cortisol, Testosterone and DHT were assessed at 4 times during the test day.
Methods: The research project involved 10 male subjects, aged between 18 and 30 years, who as background had at least 2 years' experience in free weight training. Body composition was measured by means of AKERN bioelectrical impedance and by means of "ISAK " plicometry, the 3 somatic type categories were determined using the Heath-Carter method. All subjects underwent an incremental 1RM protocol on the back squat exercise to create individual load-speed profiles and then underwent the -10% m/s or exhaustion protocol using a VITRUVE linear transducer. Salivary samples were taken pre, post, post 15 min and post 30 min of the test. The salivary sample was used for the measurement of Testosterone, DHT and Cortisol; afterwards the salivary sample was centrifuged and stored in a freezer at -40° until the day of analysis. On the following days, salivary levels of the hormones were measured by the ELISA method.
Results: Following correction for fat mass and lean mass of the hormone results, knowing that the Mesomorph subjects present high levels of lean mass and have an "aggressive" character inclination [1][2], we found higher values of Testosterone, Cortisol and lower values of DHT than the Endomorph group, who, knowing that they present a high fat mass and have a character inclination tending towards low reactivity and sedentariness [3][4], we found high values of DHT at all times, linear values of Cortisol and lower values of Testosterone compared with the Mesomorph group.
Conclusions: The survey provides results on the constitutional characteristics, physical performance and hormone concentrations of trained subjects. On the basis of the data obtained, it can be assumed that following the administration of a stressful stimulus such as training, constitutional biotypes respond in different forms. Therefore, investigating the theory of biotypes and their hormonal responses in training is a topic that could lead to important changes in the individualised administration and management of training parameters.

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Evaluations of biva in body builders

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Purpose: Bodybuilders are athletes characterized by high muscle mass. During competitions, the evaluation is performed based on aesthetic parameters. The study aims to provide normative references of body composition with the vector bioimpedance methodology (BIVA). A second aim is to compare BIVA assessments performed on both sides and the upper and lower body.
Methods: A group of 68 elite bodybuilders (41 males aged 30.1 ± 9.2 years and 27 females aged 32.1 ± 8.0 years) was enrolled. A BIVA assessment was performed the day before the 2021 World Natural Bodybuilding Federation Italian Championships.
Results: As a result, male and female bodybuilders ranked to the left in the BIVA ellipse relative to the general population. Furthermore, unlike females, males also ranked lower than the general athletic population. In addition, in the symmetry assessment, males show a significantly greater upper body than the lower, right, and left parts, while in women, this is observed for the lower part of the body.
Conclusions: The differences in the results obtained between males and females can be attributed to the different patterns of endocrine production between the sexes and the different criteria used by the juries to attribute the final score during the competitions. Therefore, BIVA references in bodybuilders could help adjust the training and nutritional program during the peak week before a competition.

Left heart adaptations in male and female judo elite athletes

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Purpose: Cardiac remodeling can occur in two ways: physiological o pathological. Pathological cardiac remodeling is the consequence of adverse factors that lead to structural and functional changes in the left ventricle (LV) in response to internal o external damage [1]. Judo is an intermittent combat sport that requires high levels of intramuscular force. Therefore, our research aims to examine cardiac muscle adaptations and remodeling in elite judo athletes and to evaluate differences between male and female judoka.
Methods: The study included 19 elite judokas divided into two subgroups: the first from 10 male athletes (25.50 ± 3.17) and the second from 9 female judokas (23.56 ± 3.16). All participants underwent surface ECG recording. The following parameters were measured: RWT—Relative wall thickness; LVM—Left ventricular mass; LVMI—Left ventricular mass index. An independent sample t-test was used for values between the two groups. The level of statistical significance was set at $p < 0.05$.
Results: In terms of left ventricular mass (LVM) and left ventricular mass index (LVMI), significant differences were found between male and female judokas (233.44 ± 68.75 g vs. 164.11 ± 16.59 g, $p = 0.009$), (105.16 ± 24.89 vs. 84.66 ± 15.06, $p = 0.044$), respectively.
Conclusions: Gender comparison showed higher LVM and LVMI in male athletes than in female athletes. The presence of physiological cardiac enlargement in high-level judokas seems to be a common occurrence. In addition, it can be argued that there is an important influence of gender as a factor.
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High velocity during large sided games in professional soccer players

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Purpose: High-intensity running attracts the attention of research and technical staff to prepare the player to meet the demands of the performance model (Haycraft et al., 2017). The technical staff use GPS to quantify specific sport exercises and to evaluate the high intensity training load (Guitart et al., 2022). Large Sided Games (LSG) are these sport-specific exercises carried out with a ball, on fields where each player exploits from 270 to 325 square meters (Sannicandro et al., 2021). This study aims to describe, analyse and compare the high speed deriving from LSG exercises during the 4vs4 and 5vs5 formats, with goalkeepers (GK).
Methods: 26 professional soccer players (age: 24.28 ± 2.12 years, weight: 75.8 ± 6.5 kg; height: 182.6 ± 6.7 cm). During the two LSG exercises, the players were monitored using GPS tool at 18.18 Hz (GPEXE®SYSTEM, EXELIO, Udine, Italy). The external load variables detected and examined are: peak speed (km/h), distance traveled per minute (m/s^2), distance traveled at high speed (19.8–25.2 km/h) and in sprint (> 25.2 km/h). The LSG were carried out on a natural grass playing field. The 4vs4 + 2GK format were performed on a field 60×54 m ($324 m^2$/player) while the 5vs5 + 2 GK on 65×60 m ($325 m^2$/player). After the warm-up, players began with LSG exercises: 4 sets of 5 min each (2 min passive recovery).
Results: The speed peak ($p < 0.05$) and the sprint distance ($p < 0.005$) are greater and significant during 5vs5. The distance traveled per minute and the distance traveled in high speed is also higher in the 5vs5 although not significant.
Conclusions: From the analysis of the data, it appears that the format of 5vs5, although at the same density compared to 4vs4, allows it to be able to achieve higher values and high velocity peaks than 4vs4.
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Menstrual cycle & performance: the effects of an integrated health intervention strategy combining counseling, nutritional education and preventive-adapted physical activity on performance among competitive university students during their period.

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Purpose: Menstrual cycle and the ingestion of oral contraceptives affect women everyday life through a wide range of physical and psychological symptoms. Despite of several previous studies on this topic, coming up with guidelines describing the best health protocol to enhance women's sports and daily performance remains a challenging task. Moreover, stress effects on life, cycle and performance need to be taken into consideration. This pilot study aims to carry out an integrated health intervention strategy to boost sport and psychosocial performance among competitive university students.
Methods: 12 university students playing volleyball (aged 19–26) were enrolled in an Experimental Group (EG) and in a Control Group (CG). Only 7 people (EG n = 4; CG n = 3) completed the study. The EG was trained for 6 weeks (aerobic and strength specific training program). After each training session they were required to perform a stretching regimen. They were also required to practice at least 30' of hormonal yoga per week for 3 months and to follow online nutritional education sessions (30' per week for 3 months) and individual sport counseling sessions (15' per month for 3 months). Outcomes were obtained through: "Menstrual Distress Questionnaire MEDI-Q", physical tests (squat test, push up test, Ruffier-Dickson test, CR-10 effort evaluation), anthropometric measurements and vital signs in three different stages of the menstrual cycle (early follicular phase, late follicular phase, mid-luteal phase) every 3 months (baseline T0, end of the intervention T1, follow-up T2).
Results:

1. Resting Heart Rate decreased in the EG.
2. The number of squats performed by the EG increased more ($p < 0, 005$).

3. CR10 perceived effort after Ruffier-Dickson test decreased in the EG, along with an increase of the number of squats performed.
4. The MEDI-Q Total Score and the Menstrual Symptoms index decreased from T0 to T1 ($p < 0, 005$) in the EG.
5. The ingestion of Oral Contraceptives does not seem to influence results.

Conclusions: This integrated health intervention strategy can enhance physical recovery and lower body power, along with decreasing menstrual cycle symptoms, distress and overall perceived effort.
Despite these results, the number of people recruited is too small to generalize and improved studies need to follow.

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Examining the association between speed and myoelectric activity: time-based differences and muscle group balance

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Purpose: This study aimed to investigate the association between the speed of soccer players and their myoelectrical activities during an incremental shuttle running test over a distance of 25 m. The gluteus, hamstrings, and quadriceps muscles were specifically examined. GPS tracking and wearable electromyography (EMG) devices were utilized to collect relevant data.
Methods: Twelve male young soccer players ($n = 12$) aged 18 ± 1.2 years, with an average body mass of 68.4 ± 5.8 kg and average body height of 1.72 ± 0.08 m, from a professional Italian youth team (Italian "Primavera"), volunteered as participants for this study. Goalkeepers were excluded from this study. The speed of each player during the incremental shuttle running test was measured using GPS technology, sampling at 50 Hz. Myoelectrical activities of the gluteus, hamstrings, and quadriceps muscles were recorded through wearable sEMG devices, sampled at 100 Hz. To ensure alignment of the sampling frequencies, the sEMG data was resampled to 50 Hz, matching the GPS data sampling rate. This allowed for direct comparison and analysis of the data obtained from both measurement systems. The collected data were analyzed to determine the relationship between the investigated variables, the variations overtime and any potential differences associated with different sides of the body.
Results: The results have revealed significant differences over time in myoelectrical activity in relation to the increase in running speed (Repeated Measures ANOVA) and a robust correlation ($r^2 \approx 0.97$) between the speed of the participants ($m \cdot s^{-1}$) and their myoelectrical activity (μV) during the incremental shuttle running test. Interestingly, no significant differences were found between the sides of the analyzed muscles ($p > 0.05$), indicating consistency in the relationship between speed and myoelectrical activity across muscle groups. The interpolation lines generated by the association of Speed and sEMG exhibit very similar angular coefficients (0.9 to 0.12) in all six measurements obtained from electromyography of the three investigated muscle groups on each side of the body.
Conclusions: The study highlights the concurrent validity of the employed tools (GPS and sEMG). These findings indicate that both technologies can be effectively utilized to evaluate the correlation between speed and myoelectrical activity in soccer players during incremental shuttle running. This assessment offers valuable insights into both external and internal loads. The concurrent validity of the employed tools further supports their usefulness in future research and practical applications related to soccer training and performance evaluation.
Acknowledgments: the authors would like to thank all study participants.

Infrared thermography is representative of real-time muscle electrical activity during single-joint exercise to failure

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Purpose: Monitoring muscle fatigue is important in exercise and clinical settings. Surface electromyography (sEMG) registers muscle activity by means of electrodes applied on the skin and provides real-time information about muscle performance and fatigue. However, sEMG requires skin preparation, and the conductive gel on the electrodes may cause skin irritation, discomfort, and it can dry out, especially during long measurements, providing noisy signals. Infrared thermography (IRT) is a non-invasive method that measures skin temperature. Although some studies tried to predict EMG activity using IRT after exercise, there are no data about the possible correlation between EMG and IRT during exercise to monitor change in muscle performance and fatigue. The present study investigated the correlation between sEMG and IRT during a single joint exercise to muscle exhaustion.
Methods: Eight healthy participants (age = 25 ± 4; male = 4, female = 4) performed 3 series of supine triceps brachii extension exercise using dumbbells, at ~50%RM until failure, with 2 min of rest between series. sEMG was recorded using Encephalan Mini AP-10 system, and electrodes were placed on the long head of triceps brachii, using the middle point between the lateral aspect of the acromion and the olecranon as reference. IRT was acquired using a thermal infrared camera (FLIR SC660) placed in front of the subject, so that the entire surface of triceps brachii was visible. The number of repetitions performed in each series, and rate of perceived exertion (RPE) were recorded immediately at the end of each series. sEMG and IRT data were acquired simultaneously during the exercise task.
Results: Repeated measure ANOVA showed that the number of repetitions significantly decrease ($P = 0.009$, $\eta^2 = 0.488$), while RPE

increased from series 1 to 3 (P = 0.007, η^2 = 0.629). Similarly, integrated EMG significantly decrease with muscle fatigue from series 1 to 3 (P = 0.022, η^2 = 0.421). Interestingly, the delta of temperature measured by IRT showed significant correlations with integrated EMG (r = 0.531, P = 0.008), waveform length (r = 0.484, P = 0.017), and maximum fractal length (r = 0.433, P = 0.035) measured by sEMG.

Conclusions: Our study indicates that IRT features correlate with sEMG activity during single-joint exercise to failure. These preliminary results suggest that IRT can be a useful, non-invasive tool for the evaluation of muscle fatigue during exercise, since it can overcome the limitations related to sEMG (e.g., skin irritation, discomfort, noisy signals during long exercise tasks), resulting appealing in exercise performance evaluation, and clinical settings. Further studies including higher sample size are required.

Reliability of load-velocity profiling using the sprint resister in front crawl swimming

Purpose: Strength training in swimming is crucial for enhancing performance, preventing injuries, optimizing efficiency, and increasing endurance. Therefore, it is essential for swimmers to incorporate strength exercises into their training programs. Load-velocity profiling can be employed to evaluate the swimming-specific strength and velocity capacities related to sprint front crawl performance. The aim of this study was to establish the test–retest reliability in calculating load-velocity profiles in front crawl with the use of the Sprint Resister, and to determine if the obtained results were consistent with the methodologies considered as the goal-standard in literature that utilize more expensive equipment.

Methods: Fourteen male swimmers (18.2 ± 1.6y) at the regional or national level participated in the study. The participants performed a 25 m semi-tethered swim with maximal effort using five progressive loads (1, 3, 5, 7, and 9 kg). Additionally, they completed a 50 m front crawl at maximum effort. The average velocity during the middle five meters (10-15 m) of the pool was calculated. The relationship between load and velocity was expressed through a linear regression line for each swimmer. The intercepts between the graph's axes and the established regression line were defined as the theoretical maximum velocity and load (L0). Furthermore, L0 was also expressed as a percentage of body mass. The coefficient of determination and the slope of the linear load-velocity relationship were calculated. Test–retest reliability of each parameter was assessed using intra-class correlation, coefficient of variation (CV) and typical error (TE).

Results: The intra class correlation coefficient showed a good agreement (always > 0.8, with $p < 0.001$) for all variables. CV was $\leq 5.37\%$ and TE was rated as "good" in all variables. A difference was found between test and retest in 50 m front crawl time ($p < 0.01$). No difference was found between the load-velocity profile outcomes variables between test and retest.

Conclusions: In conclusion, the load-velocity profile for front crawl swimming can be calculated reliably using the Sprint Resister. These methods can be used to monitor swimmers' speed and strength capabilities, allowing for personalized training prescription to enhance performance.

Field test batteries to assess physical fitness in Italian school-aged children prior and post COVID-19

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Purpose: The COVID-19 pandemic impacted human lifestyles across the world changing the daily and sports activities in younger and increasing sedentary habits with a detrimental effect on physical fitness (PF). Muscular strength and speed-agility PF components play a crucial role in children's musculoskeletal development and bone health. The aim of the study is to investigate the impact of COVID-19 restrictions on PF in Italian school-aged children.

Methods: 286 elementary school children of both sexes aged 6-11y were tested through an internationally validated battery test, which evaluates muscular strength and speed-agility. The evaluation tests included the standing broad jump (SBJ), the 7-m Hop One Foot and the 7-m Hop Two Feet, the 1-kg Medicine Ball Throw (MBT), the Tennis Ball Throw (TBT), the 20-m linear and the 10 × 5-m test. To assess the differences before and after the COVID-19 restrictions of all the PF tests was used the parametric independent samples t-test.

Results: After COVID-19 lockdown children lower limb strength decreased, in particular SBJ in boys mean difference (MD) -0.42 m and SBJ in girls MD = – 0.20 m; $P < 0.05$. A reduction also in speed-agility ability (10 × 5 m in boys MD = 14.1 s; 10 × 5 m in girls MD = 11.2 s; $P < 0.05$) was observed. Instead the upper limb strength remained steady before and after the restrictions, only a slight reduction was found in TBT (11.49 ± 4.01 m vs. 11.29 ± 4.51 m, P value > 0.05).

Conclusions: COVID-19 restrictions negatively impacted PF in Italian children, specifically the lower limb strength and speed-agility decreased. Since PF is a marker of health in children, sport specialists have to implement programs to help children to become more active and healthier during their lifespan.

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Biomechanics and bioenergetics of maximum intensity crawl in swimmers with down syndrome

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Purpose: Individuals with Down syndrome have known deficits in muscle strength and reduced cardiovascular adaptation to physical exertion, which limit their athletic performance. In swimming, this may lead to early coordination impairment and cardiovascular fatigue even during short-distance races. We compared in a maximal intensity 50 m crawl test a group of competitive male swimmers with Down syndrome (SDS; n = 11; 26.5 ± 5.5 years) and a control group of able-bodied male competitive water polo and/or triathlon athletes (CNT; n = 11; 27.1 ± 3.9 years) of similar weekly training volume (> 3 h/week), in terms of biomechanics and bioenergetics.

Methods: Athletes from both groups performed a 50 m crawl test in a 25 m pool, starting in the water and with a free-choice turn. Throughout the test, wearable sternal sensors were used to measure heart rate (from 250 Hz ECG) and 3D (100 Hz) accelerometric data. 60 Hz underwater videos were used to calculate the angle of inclination of the body's major axis to the water plane. Indexes of regularity (Sample Entropy, SampEn) and symmetry were calculated offline on the accelerometric signal.

Results: Total times (SDS: 65.2 ± 22.3 s; CNT: 32.7 ± 4.1 s) and stroke counts (SDS: 66.1 ± 9.6; CNT 51.4 ± 7.4 s) were significantly higher in the SDS athlete group ($P < 0.01$). However, heart rates were reduced during immediate recovery (30-s recovery, SDS: 104 ± 23 bpm; CNT: 145 ± 21 bpm) and delayed recovery (60-s recovery, SDS: 79 ± 27 bpm; CNT: 114 ± 27 bpm) after the 50 m test in SDS subjects compared to the CNT group ($P < 0.05$). Nevertheless, the regularity (SampEn) and symmetry of the sternal acceleration signal in the direction of motion did not show significant differences in the SDS compared to the CNT group and between the first and the second pool. Horizontal body position in water was found to be strongly correlated with performance in SDS swimmers ($r = +0.79$, $p < 0.01$), but only during the first 25 m.

Conclusions: High-intensity crawl performance differed between SDS and CNT athletes in terms of time and biomechanical characteristics, as well as reduced internal load adaptation. These differences suggest adaptations in training loads to enhance swimming efficiency in athletes with Down syndrome.

EVALUATION OF METABOLIC AND MECHANICAL PARAMETERS IN DIFFERENT PHASES OF THE MENSTRUAL CYCLE IN YOUNG FEMALE CYCLIST. A PILOT STUDY

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Purpose: the aim of this study was to evaluate the potential effects of the menstrual cycle (MC) phases on the performance on young cyclists woman. To this aim, metabolic and neuromuscular parameters were investigated during two phases of the menstrual cycle, the "early follicular" (EF) and the "mid luteal" (ML) characterised by different hormones concentration.

Methods: seven young female cyclist (13–16 years old) with regular MC (21–35 day) were analysed in three different days. Before they attended the study protocol they completed a specific calendar to monitor their menstrual cycle phases. During the first session an incremental test till the maximum were performed on a cycle ergometer to obtain the peak power output (PPO). Then the cyclists were tested during both the menstrual cycle phases (EF, ML) in a time to exhaustion test (TTE) at 80% of the PPO, a Wingate test and jump tests (SJ, CMJ). Data of oxygen consumption (VO2), ventilation (VE, Rf), heart rate (HR), body temperature (BT), rate of perceived exertion (RPE), height of the jump (HJ), peak, mean power, pedalling rate (RPM) from Wingate test and the TTE time were collected.

Results: Higher HR data were found during EF than ML phases from the 50% to the end of TTE test ($\Delta = 5$ bmp, $P < 0.01$) and at the end of TTE test (($\Delta = 8$ bmp, $P < 0.05$). According to MBI (magnitude based inference) analysis, other data show higher values during the EF phase for the Rf ($\Delta = 7$ b/m) and the RPE ($\Delta = 10$ points of Borg 0–100) with a probability of 85 and 88% respectively. No statistically significant differences were shown in VE, VO2 and BT, even though a difference of 3 °C was found. None of the parameters related to the jump tests and Wingate tests showed significant differences between the phases.

Conclusions: in this study an impact of the MC phases was seen on the endurance performance but not on the neuromuscular and on very short but intense efforts. Specifically, the observed differences were significant from the 50% of the TTE test, when the exercise intensity surpassed the second ventilatory threshold (87% of VO2 and 91% of HR). For this reasons it seems that the MC affects the endurance performance especially at high intensity. In addition it can affects more the long trials because of the higher RPE. From a practical point of view this study suggest that MC phases should be considered in the prescription and monitoring of training loads, especially at intensities above the anaerobic threshold.

Statistical survey of service characteristics in modern tennis among top 10 and 90–100 atp singles players

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Purpose: Through a statistical survey, this study aims to investigate the components of ATP tennis[1,2], primarily focusing on service stroke in correlation with players' ranking.

Methods: Professional matches played from June 25, 2018, to June 26, 2023, were analyzed[3, 4]. Walkovers or matches with insufficient data available were excluded. 12 k matches played in 441 tournaments in the men's circuit (Grand Slams, Master 1000, ATP 250 & 500, Davis Cup, and ATP Finals) were considered, totaling around 23 k hours of play. 25 players were included in the elite group, having been in the Top 10 ATP for at least 6 months in the past 5 years. Their match statistics from when they were in the Top 10 were compared with those 165 players who had rankings between 90 to 100 ATP in the same period. The t-test for independent samples assessed the differences between the two groups.

Results: Elite tennis players have a more effective first serve, which leads them to win 74.08 ± 6.06% of the points against 69.59 ± 9.33% in the second group (Δ 4.5% $p < 0.01$). Others components were analyzed as the consistency (% of serve IN) of the first service (Δ 1.4% $p = 0.20$), the consistency (Δ 0.5% $p = 0.62$) and effectiveness (Δ 1.96% $p = 0.24$) of the second serve, even if they were not statistically significant. Elite players also stand out in conceding fewer breakpoints to their opponents (1 in every 2.17 service games) than the second group (1 in every 1.68 service games) ($p < 0.01$). Top 10 players serve more in the wide section from the right side of the court, with an average frequency of 49.00 ± 4.79% vs. 43.30 ± 10.92% (Δ 5.69% $p < 0.05$). From the left side, the Top 10 serve more in the T Sect. (47.48 ± 6.76% vs. 39.52 ± 9.84%, Δ 7.95% $p < 0.01$), while other group on average prefer to play more on the wide Sect. (49.99 ± 7.96% vs. 45.03 ± 5.94%, Δ 4.95% $p < 0.05$). No statistically significant differences were found in the middle section ($p = 0.22$) and the placement of the second serve in any sections in both groups.
Conclusions: This study revealed significant differences among elite players in the Top 10, and those ranked 90 to 100 ATP. The first serve was shown to be the shot that most differentiated these two groups in placement and effectiveness. In addition, the Top 10 players concede fewer breakpoints to their opponents on average. Although the results obtained from this survey are already remarkable, it may be interesting to add the study of service speeds in the future.
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Cardiac biomarker alterations in response to rapid weight loss and high-intensity training in judo athletes

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Purpose: This pilot study investigated the effects of rapid weight loss (RWL) combined with high-intensity-sport-specific training (HISST) on heart rate, blood pressure, cardiac biomarkers, and left ventricular systolic function in elite male judokas.
Methods: Nine elite male judokas participated in a crossover investigation. Baseline assessments were performed, followed by two test protocols. The first phase involved RWL and HISST, while the second phase, after a 7-day interval, focused on HISST alone. After each phase, the athletes underwent electrocardiogram, biomarker, and transthoracic echocardiogram assessments.
Results: Comparing baseline parameters to the first phase (RWL and HISST), heart rate significantly increased (58.11 ± 7.78 vs. 79 ± 9.25, $p = 0.001$), as well as cardiac biomarkers: lactate dehydrogenase isoenzyme (175.33 ± 31.22 vs. 238.56 ± 56, $p = 0.003$), aspartate aminotransferase (16.56 ± 4.61 vs. 29 ± 9.96, $p = 0.027$), creatine kinase-MB isoenzyme (13 ± 11.5;24 vs. 29.11 ± 10.05, $p = 0.004$), and high sensitivity cardiac troponin (10 ± 0 vs. 14.49 ± 6.4, $p = 0.045$). In the second phase (HISST only), there was a significant increase in alanine aminotransferase isoenzyme (37.78 ± 11.22 vs. 26 ± 8.03, $p = 0.024$) and creatine kinase (472 ± 185;654 vs. 166.88 ± 56.57, $p = 0.01$) compared to the initial measurement. However, no significant differences were observed in left ventricular systolic function between baseline values and the two test protocols.
Conclusions: RWL combined with HISST led to significant alterations in cardiac biomarkers without impairing left ventricular systolic function. HISST alone caused changes in biomarkers primarily attributed to muscular damage. These findings emphasize the importance of closely monitoring cardiac health during intense training regimens in elite athletes.

Horizontally versus vertically oriented exercises for the lower body performance and muscle architecture: a training study

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Purpose: The aim of the present investigation was to compare a horizontal-based resistance training program to a vertical-based program on a 6-week training period.
Methods: Twenty resistance trained individuals (16 men and 4 women) were randomly assigned to a horizontal-based (HT; n = 10; age = 25.1 ± 4.0y; body mass = 70.6 ± 10.7 kg; height = 173.8 ± 6.2 cm) or to a vertical-based group (VT: n = 10; age = 27.1 ± 4.2; body mass = 75.6.3 ± 10.7 kg; height = 174.2.0 ± 5.8 cm). Participants in both groups trained 4 days a week for 6 weeks and performed the same upper body exercises. The difference between the groups consisted in the lower body exercises (Hip thrust, reverse hyperextension and standing long jumps in HT, and parallel squat, stepup, and vertical jumps in VT). Both training programs included the same number of repetitions and the same progression from volume to intensity through the 6 training weeks provided. Maximal strength (hip thrust and parallel squat 1RM), explosive strength (standing long jump and vertical jump), 20-m sprint, and muscle architecture measurements (muscle thickness-MT and echo intensityEI of vastus medialis, vastus lateralis, gluteus) were collected, prior to and post the training period.
Results: A significantly greater increase in hip thrust 1RM was detected in HT while greater increases in squat 1RM were noted in VT. A significantly greater increase in vastus medialis MT was detected in VT compared to HT. Similar increases in gluteus MT and EI were registered in both groups ($p < 0.05$). A greater improvement in standing long jump was detected in HT compared to VT, while both groups significantly improved vertical jump performance ($p \leq 0.05$). No other significant changes were detected. Combining both groups, strong correlations were detected between gluteus EI and sprint ($r = 0.86$; $p < 0.001$), while gluteus MT was significantly correlated with both squat ($r = 0.62$; $p = 0.008$) and hip thrust 1RM ($r = 0.74$; $p < 0.001$) only.
Conclusions: : Results of this study indicate that both HT and VT induced similar changes in muscle architecture of the gluteus, while VT only promoted an increase in vastus medialis MT. HT was more effective than VT for horizontal jumps while neither program were able to improve sprint performance. Interestingly, strong relationships

were detected between gluteus EI and sprint while, MT was correlated with maximal strength only.

Analysis of short and long intermittent training during a small-sided-game in U17 women football players

Purpose: Football is a problem-solving sport[1] involving intermittent short high intensity actions followed by short recovery phases[2]. This study aimed at using an ecological approach to evaluate which type of training structure supports technical-tactical efficacy in a context of high intensity demands in women football.
Methods: Eight athletes participating in the U17 Italian women's football national championship, were analysed during a small sided game format (SSG = 4v4 + goalkeepers) comparing two different intermittent work-recovery ratio. SSGs were performed in a 160m^2 area per player[3], with limited touches in the defensive half field and free touches in offensive half field. SSGs were organized as follows: *Long Intermittent* (LI) = 3 sets of 4 min of work and 2′30 s of recovery; *Short Intermittent* (SI) = 4 repetitions of 1 min of work and 20 s of rest, and 60 s of recovery between sets. Both structures were characterized by with the same amount of volume (17 min).
Quantitative and qualitative parameters were analysed: GPS data included average Metabolic Power(avgMP), Energy Expenditure > 29w (EE29w), and Total Distance (TD); Heart Rate (HR), Ratings of Perceived Exertion (RPE) using CR10 scale, and ball tracking (video analysis using a tactical app). 40 m sprint test was performed every day after warm-up to evaluate athlete's readiness by peak speed data (PS).
Results: Repeated measures analyses of variance, showed significant differences for most of the parameters: $avgMP_{SI}$ vs $avgMP_{LI}$ (11.5 ± 1.5 vs 9.8 ± 1.7 respectively, with $p = 0.002$, $\eta p^2 = 0.76$); $EE29w_{SI}$ vs $EE29w_{LI}$ (4118 ± 1223 vs 3104 ± 1086 respectively, with $p = 0.004$, $\eta p^2 = 0.71$); TD_{SI} vs TD_{LI} (1628 ± 172 vs 1374 ± 168 respectively, with $p = 0.001$, $\eta p^2 = 0.79$); HR_{SI} vs HR_{LI} ($p = 0.009$; $\eta p^2 = 0.65$). There were no significant differences for RPE ($p = 0.451$) and PS ($p = 0.072$). Finally, technical-tactical behaviour analysis showed advantages for SI, with 40% more scores, 10% more time spent in offensive field, and less lost balls in defensive zone (-66%).
Conclusions: The "time constraint" characterizing SI may positively influence players' practice leading to less mistakes and similar RPE compare to LI. Accordingly, SI could be an optimal training organization that coaches should prefer if their goals are skills acquisition, game efficiency and athletic development in their athletes.
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Static and dynamic baropodometric tests in high-level professional soccer players. A pilot study

Purpose: In sports and specifically in football, the number of competitions and therefore the number of seasonal matches is increasing. Also for this reason it is advisable to quantify the training and recovery loads. As reported by the scientific literature, communication, and sharing is of great importance in reducing the risk of Injuries. The main purpose of this research was to demonstrate how numerous professional football teams can collaborate and integrate professionally. The proposal of this study was to study high-level professional footballers in pre-season and in-season with static and dynamic baropodometric tests. After the matches can change the muscle/joint structure? This was a hypothesis of research.
Methods: 27 footballers were tested in the preparation period (T0) and in the post-match (T1). Each player in 5' carried out tests of support time on the treadmill with and without shoes and subsequently with a gait pattern while walking and running.Inclusion/exclusion parameters were considered such as: playing time during the match, and recovery time (e.g. sleep quality).
Results: The results are being processed. Parametric tests were used for the data analyses. The video slow analysis allowed us to analyze each player in detail in parameters such as; stance, times of ground pressure, and pelvic rotation.
Conclusions: The easy reproducibility allows these tests to be performed even with limited times. The easy reading of the data allows a staff a quick report. A follow-up is foreseen throughout the competitive season. This study is to be considered a pilot study.
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Performance analysis of barracuda techniques in artistic swimming

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Purpose: Artistic Swimming (AS), an Olympic discipline since 1984 for female athletes (with male athletes joining in 2015 in world and continent tournaments), combines swimming, dance, and gymnastics, resembling water ballet. Synchronization is vital in AS routines, including duets, and eight-member teams. Barracuda is one of the AS techniques in which the inferior part of the body requires vertical push-ups over the water of the lower body (limbs and trunk). Barracuda vertical trust deviations have point deductions (15–30 degrees: 0.2, 30–45 degrees: 0.5, over 45 degrees: 1). This study aims to analyse the Barracuda vertical trust technique by examining leg-hip-track angles (LHT) and head-water surface distance.
Methods: A Female and a male artistic swimmer (14.5 ± 1.5 years, 8 ± 2 years' experience, 162 ± 1 cm height) participated in the study. Three GoPro cameras, with 240 Hz, were used to record the actions. A camera is positioned underwater to capture Barracuda preparation, another on the pool edge to observe limb positions and body deviation, and the third is placed behind the participants to observe the deviation angle. Videos were analyzed using BioMovie software [1], examining LHT and head-water surface distance. After a warm-up, swimmers performed two sets with three repetitions each of Barracuda.
Results: The player with an average LHT of 40 ± 3 degrees and a head-to-water distance of 30 ± 8 cm achieved a successful push-up until the back, earning a score of 8.5 points without any deviation

fault. Otherwise, the other athlete with an LHT of 48 ± 2 degrees and a head-water distance of 60 + 10 cm from the water exhibited a deviation fault of 15 > &30 < degrees in half of the sets, and rose above the hip level, resulting in a score of 7.5 (-0.2) points.
Conclusions: This study suggests the potential benefits of holding the legs and body track closer and positioning the head near the water surface before initiating the push-up. The findings will contribute to understanding and enhancing this technique in AS to offer probable insights to enhance this technique. Future studies with similar technical methods can focus on investigating these factors and on other variables such as applied force and angular velocity in other AS techniques.
Acknowledgements: We would like to express our sincere gratitude to FINPLUS-Polo Natatorio Foro Italico, G Sport, and Aurelia Nuoto's artistic swimming teams that collaborated with us during this research.
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Development and validation of a new anthropometric predictive equation for estimating fat mass in elite male soccer players

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Purpose: The present study aimed i) to develop and validate an anthropometric soccer-specific equation for predicting fat mass (FM) using dual energy X-ray absorptiometry (DXA) as a reference method; ii) to assess the performance of existing soccer-specific predictive equations.
Methods: Eighty male soccer players (aged 24.4 ± 5.4 years, BMI 23.7 ± 1.2 kg/m^2) underwent anthropometric measurements and DXA scan during the in-season period. The participants were divided into development and validation groups. The validation group returned for a second assessment three months later and was included in an analysis of longitudinal validity.
Results: The best developed model was: FM (kg) = − 9.905 + (sum of triceps, iliac crest, abdominal, and front thigh skinfolds (mm) × 0.175) + (thigh circumference (cm) × 0.258)—(ethnicity × 1.577)—(age (years) × 0.068), R^2 = 0.73, standard error of estimation (SEE) = 1.01 kg, where ethnicity is 1 for black and 0 for white. Cross-sectional validation showed r^2 values ranging from 0.71 to 0.72 with SEE equal to 0.80 kg and 0.86 kg for the baseline and the second assessments, respectively. Concordance correlation coefficients (CCC) were 0.84 at baseline and 0.86 at the second visit. The agreement analysis showed no mean bias at any time ($p > 0.05$) and lower 95% limits of agreement (LoA) ranging from -1.5 kg to 1.8 kg. Longitudinal validation demonstrated a high accuracy at both group (r^2 = 0.80, SEE = 0.37 kg, CCC = 0.90) and individual (mean bias = 0.04 kg, 95%LoA = − 0.7 kg to 0.8 kg, r = 0.117) levels. In contrast, the FM estimated from existing predictive equations differed from DXA for all the cross-sectional and longitudinal assessments, showing less accuracy compared to the new equation.
Conclusions: This study presents a new soccer-specific predictive equation based on four skinfolds and a circumference, allowing for a valid and sport-specific assessment of FM across the competitive season.

The impact of visual occlusion during small-sided games on youth players

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Purpose: This study aimed to investigate the effects of playing with visual occlusion (OCC) during small-sided games (SSG) performed under different pitch sizes on youth players' physical and technical performance. The purpose was to understand how visual occlusion may influence players' behavior and performance in game-based scenarios.
Methods: Twelve youth football players from a U14 football academy participated in the study. The design involved a repeated-measures approach, with players exposed to different experimental conditions: a) normal situation (NOR) without OCC; b) OCC with an eye patch on the dominant foot's corresponding eye. The SSGs were performed on both small and large pitch sizes. Time-motion variables were computed using positional data, and technical analysis was based on video footage. A repeated-measures analysis of variance was conducted to identify differences in the considered variables between the conditions.
Results: Although no significant effects were found in technical performance between NOR and OCC conditions, suggesting adaptability to OCC constraints, some trends were observed. Increasing pitch size in the NOR scenario led to higher physical demands and more touches with the dominant foot, while smaller pitches led to an increase in the number of passes. Larger pitches with OCC increased physical demands. Players tended to use their non-dominant foot more in smaller pitches with OCC. Furthermore, OCC in larger pitches significantly reduced the game pace, movements, and dribbling frequency, allowing more time for decision-making based on environmental information.
Conclusions: Playing with visual occlusion may impact players' behaviour and performance, leading to adjustments in the use of dominant and non-dominant feet. Coaches can consider adjusting pitch sizes to increase physical demands. Additionally, smaller pitches can be used to emphasize passing and encourage players to use their non-dominant foot effectively during OCC scenarios.
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A preliminary study on double peak in muscle activation in upper limb musculature during right cross punch execution in advance and novice boxers

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Purpose: This study explores Double Peak Muscle Activation in advanced (ADV) and novice boxers (NOV) during a right cross punch. Surface electromyographic (sEMG) activity in upper limb muscles is analyzed throughout different punch phases, providing valuable insights into muscle excitation in boxing techniques. Comparing Double Peak Muscle Activation between ADV and NOV boxers offers a preliminary understanding of the link between muscle excitation patterns and boxing expertise.
Methods: Participants: Eight male participants (age 23.63 ± 2.97, body mass 70.38 ± 7.23 kg, stature 179.5 ± 3.74 cm) were included in the study. They were divided into two groups: ADV (n = 4) and NOV (n = 4) boxers.The participants completed three tasks involving right cross punches: Voluntary task (VT), Reaction Time task (RT), Go/noGo task (GNG). sEMG signals were recorded from eight upper limb muscles on the dominant side: pectoralis major (PM), latissimus dorsi (LD), anterior serratus (AS), biceps brachii (BB), triceps brachii (TB), brachioradialis (BR), anterior deltoid (AD), upper trapezius muscles (UT).The impact forces were measured using a force plate. Data collected with the rectified EMG and impact forces were normalized to the MVC of the muscle involved and the boxer's weight, respectively.
Results: Preliminary data that VT indicated that ADV generated higher impact force during the task (14.580 ± 2.35 N), compared to NOV (13.546 ± 6.23 N). ADV had similar muscle impulse compare to NOV (ADV 0.252 ± 0.038 Ns; NOV 0.262 ± 0.058 Ns). In RT, during the latency phase, the AS muscle showed higher excitation in ADV (19.66% ± 10.82) compared to NOV (5.02% ± 2.71). In the impact phase of RT, the UT muscle had an higher excitation in NOV (72.2% ± 47.7) compared to ADV (47.3% ± 7.4. The BB muscle demonstrated variability during the latency phase of GNG task, with NOV (20.7% ± 30.7) and ADV (7.9 ± 4.4). In the GNG task's impact phase, the BB muscle showed higher excitation in ADV (99.9% ± 58.6), compared to NOV (47.8% ± 39.5). The TB muscle demonstrated higher excitation in ADV (85.5% ± 39.1) compared to NOV (40.37 ± 36.3) during the same phase.
Conclusions: This preliminary study explored the muscle excitation in ADV and NOV boxers during a right cross punch. Despite the limited sample size and lack of statistical significance, the findings provide valuable insights into muscle excitation patterns in boxing techniques. The comparison between ADV and NOV boxers offers initial understanding of the link between muscle excitation level and boxing expertise, paving the way for future research on Double Peak Muscle Activation in boxing performance.

Effects of learning approaches on improving explosive-elastic strength

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Purpose: Countermovement jumping (CMJ) and free-arm countermovement jumping (FA-CMJ) express explosive-elastic strength through a vertical jump after an eccentric phase of the lower limbs. A free-arm swing movement is provided in the FA-CMJ. The FA-CMJ is typical of performance contexts where adaptability to the environment is required, while the CMJ is applicable in testing because of the few possibilities for variation. Methods for their improvement are based on two approaches: cognitive, which aims to improve motor programs, and dynamic ecological, which aims at autonomous production of functional solutions to environmental problems. The effectiveness of the two approaches on improving CMJ and FA-CMJ is not fully known. The aim is to test the effects of training protocols based on the two approaches on the improvement of CMJ.
Methods: 36 subjects with an average age of 26 years were selected and divided into two groups of 18 subjects: experimental (EDG) and control (CG). The two groups underwent differentiated protocols for the duration of 12 weeks with a frequency of 3 weekly one-hour sessions. EDG performed a protocol based on a dynamic ecological approach aimed at stimulating the autonomous production of functional responses to stimuli: circle time and focus groups were used. CG followed an instructor-led training protocol: plyometric and contrast methods were used. Incoming and outgoing flight heights were collected by CMJ and FA-CMJ tests with Optojump instrumentation. Student's t tests for dependent and independent samples were used to test for pre and post differences within and between groups, respectively. The alpha level was set at 0.05.
Results: Improvements in the two gestures were recorded in both groups: in CG there was an improvement in jump height in CMJ of 12.2% and in FA-CMJ of 7.8%; in EDG itself there was an improvement in jump height in CMJ of 10.2% and in FA-CMJ of 19.5%; between the two groups there were no statistically significant ($P > 0.05$) differences in the improvement of CMJ, while there were statistically significant ($P < 0.05$) differences in the improvement of FA-CMJ.
Conclusions: The two protocols were both effective in improving the two gestures, but in the improvement of FA-CMJ, EDG was more successful. This finding can be imputed to the nature of the two gestures: FA-CMJ, being less influenced by constraints, was able to benefit more from an approach tending to stimulate spontaneous solutions through a productive style.
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The relationship between vertical jump and anaerobic performance in cross-country cyclists

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Purpose: Cross country biking is an endurance sport in which both aerobic and anaerobic energy systems are highly stressed. In fact, in this sport, aerobic and anaerobic training programs are scheduled by coach and, therefore, periodic aerobic and anaerobic tests are performed. Knowing potential differences and overlaps between different lower limb power assessment tests could help to maximize resources [1,2]. Hence, the purpose of this study was to investigate the relationship between vertical jump and anaerobic tests in young competitive cyclists.

Methods: Young cyclists aged between 13 and 16 years (Italian categories: ES1, ES2, AL1, AL2) were recruited. Participants underwent two tests, one 48 h apart from the other. In the first session, participants were asked to warm up by performing free jumps and then to perform three trials of maximal vertical jump recorded with a video camera placed in the sagittal plane. Through video analysis, performed with Kinovea, the flight time of each jump was measured. By using the Dal Monte et al. formula, jump height was calculated (jump height = flight time × 1.226). In the second session, participants were asked to warm up on their bikes, installed in a specific bike roller (MagneticDays), with a self-selected pedaling intensity and cadence. Subsequently, an incremental test was performed, starting with a power of 3 W per kg of cyclist's weight and increased with increments of 20 $W \cdot min^{-1}$, until the participant was exhausted. The maximum peak power reached was considered for statistical analysis.
Results: Fifteen young cross-country cyclists (11 m, 4f; height: 160.3 ± 9.5 cm, weight: 52.8 ± 10.8 kg) were enrolled. Pearson's coefficient revealed a significant positive correlation between maximum vertical jump height and maximum peak power ($r = 0.716$, $p = 0.003$).
Conclusions: Although the two tests detect different expressions of power, a correlation between the two measures was found. Therefore, to carry out periodic assessments of power in cyclists, the vertical jump and incremental tests could be overlapped.
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Perceptions of internal stakeholders on competitions organized by the Italian federation of dancesport and Italian coordination of dancesport

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Purpose The Italian Coordination of Dancesport (CIDS) is a project designed to develop a collaboration among dancesport teachers who work with both Sports Promotion Bodies (EPS) and the Italian Federation of Dancesport (FIDS). The decision in 2017 to separate the careers of sports judges and teachers, to avoid conflict of interest in competition, caused a very strong reaction in the federal world, leading teachers to move away from FIDS, approaching EPS for less rigidity. From 2021/2022, CIDS is organizing championships alongside the FIDS. The aim of the study was to measure the impact of CIDS and FIDS events toward the perceptions of dancesport teachers and competitors.
Methods Convenience sampling was performed to recruit dancesport teachers and competitors of different levels, who were administered an ad hoc questionnaire, including demographic data, data on perceptions toward CIDS and FIDS events, and data on sports results. Data were processed through Chi Square analysis, followed by a post hoc, the magnitude of which was measured using Cramer's V.
Results The results showed differences in perceptions between teachers and competitors about CIDS and FIDS events ($p < 0.05$). Teachers did not express particular preferences between the two types of events, unlike competitors, whose preferences depended on personal beliefs and ambitions.
Conclusions The study emphasized the importance of a coordination project to promote recreational and competitive sports with more flexible rules, as opposed to federal competitions, which were necessary for those acting solely for performance purposes.
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Rankings in youth cycling: are they a reliable indicator of a future entry into élite status?

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Purpose: Early sports specialization in recent decades has been associated with numerous negative effects such as the onset of injuries, limited relationships with peers, psychophysical growth problems, burnout. The aim of this research work was to determine whether the results obtained by cyclists in the youth categories could be used as an indicator of a future achievement of professional status in road cycling or a future TOP 10 in the élite Italian championships of Olympic cross-country (XCO).
Methods: : Sports career of 2492 athletes (1950 male and 542 female) between 13 and 16-years-old was examined. The selection criteria used were: year of birth; at least one placement in the annual youth rankings in the top 100 for road male and top 50 for road female; at least one placement in the TOP 25 at the youth XCO Italian championships for XCO. The athletes were divided into the different PRO and NON PRO experimental groups according to whether or not they signed a professional contract in road cycling.
Results: Athletes of the PRO group reach a better position in the standings than the athletes of the NON-PRO group both for male and female. For 16-year-old athletes, the average position is the lowest for every type of contract signed. Within the PRO group, a contract in professional teams was signed by 19% of male and 34% of female. Most of the athletes signed contracts in Continental Tour teams (67% male and 84% female). The highest transition rate was found in 16-year-old athletes (26% male and 42% female), while the lowest was found in 13-year-old athletes (17% male and 38% female). At 13-yaers-old 19% of the athletes not classified have reached Continental Tour teams some years later. For XCO at 16-years-old the transition rate is about 7% for male and 12% for female while at 13-years-old is respectively about 3% and 11%.
Conclusions: From 16-years-old, the results achieved in road competitions could be used as an indicator of the probability of becoming a professional cyclist. To forecast a future result in XCO, it's not recommended to use the position in a single competition as an indicator of a future Top 10 in the elite category.
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Can the recovery type induce different adaptations? a randomized trial (RT) with 8 weeks of active or passive recovery high-intensity interval training (HIIT) on Italian University students

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Purpose: HIIT has been among the most debated methods in sports and exercise [1]. Running and cycling-based HIIT is effective in inducing metabolic and neuromuscular adaptations [2]. Several variables need to be considered in programming a HIIT bout or plan, such as the work intensity and duration, the recovery intensity and duration, etc. [1]. The recovery type (active (AR) or passive (PR)) among each series has received great interest, and the low-intensity AR appeared more effective in decreasing the blood lactate concentration [3, 4]. Differently, a PR could increase the time to exhaustion [5]. In addition, during single training trials, the AR seemed to enhance the Peak Power and the total work achieved, while the PR met a lower fatigue rate [6]. Despite the well-known acute responses, if the recovery type could induce different long-term adaptations is unclear. So, this study compares the effects of 8-week HIIT with active or passive recovery.

Methods: 18 participants (10 ♀, 8 ♂; 22.6 ± 2.1 years) completed an RT with 8 weeks of HIIT. Nine participants were allocated to the AR (170.6 ± 11.5 cm; 68.8 ± 12.5 kg) and nine to the PR (163.7 ± 9.9 cm; 69 ± 14.7 kg) groups. Two training per week of 50 min were performed. The heart rate (HR) average, the Rating of Perceived Exertion (RPE), the number of repetitions (REP) and the training duration were collected and used to monitor the weekly training load (TL) progression. The Body fat (%BF), Fat-mass (FM) and Fat Free-Mass (FFM), Lean Soft Tissue (LST), and limb areas were estimated[7–9]. The $VO_{2\text{-peak}}$ was estimated through the Bruce test [10]. The grip strength with handgrip (HGS), jumping power (CMJ) and speed in 40 m shuttle test (4 × 10) were collected. The post–pre (Δ) difference was calculated for each variable. Distribution, homogeneity and sphericity assumptions were met to compute the 1-way ANOVA between PR and AR. The Hedge's g was computed to estimate the effect size. The p-value was settled at 5%.

Results: The TL and REP weekly increment were similar for PR (+ 3.39%/w, + 4.97%/w) and AR (+ 3.52%/w, + 5.19%/w). The HR weekly average was ∼ 78% for PR and ∼ 77% for AR. Wider changes in body composition were observed in PR (%BF: g = – 0.86 [-1.77; 0.08]; FM: g = – 0.92 [-1.84; 0.03]; upper limb mass area: g = – 0.89 [-1.81; 0.05]), except for lower limbs where the AR induced better adaptations (muscle area: g = – 0.67 [-1.57; 0.25]). Also, the PR induced greater improvements in $VO_{2\text{-peak}}$ (g = 0.47 [-0.41; 1.38]), and CMJ (g = 0.98 [0.02; 1.90]), whereas AR enhanced upper limbs strength (HGS right: g = – 0.70 [-1.60; 0.22]; HGS left: g = – 0.63 [-1.53; 0.29]) and the average speed (g = – 0.53 [-1.42; 0.38]).

Conclusions: Assessing different recovery types could enhance specific adaptations and their selection should be accounted for modelling HIIT for specific goals. Although more than two training days could induce better benefits, our results provide interesting information in the training field.

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The influence of obesity on cardiac and muscular inflammatory biomarkers after prolonged aerobic exercise

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Purpose: Endurance running increases blood biomarkers responsible for acute cardiac and muscular inflammatory responses. Previous studies have shown conflicting results on the impact of obesity on the increase in markers of cardiac and muscle damage immediately after a long run. Therefore, the aim of our study was to investigate the changes in cardiac and muscle inflammatory markers induced by strenuous exercise in a group of trained obese men. We aimed to determine whether body composition, cardiopulmonary fitness, and relative exercise intensity were associated with the increase of cardiac and muscular blood markers after a long-distance run.

Methods: Seventeen men with obesity (mean age 40 ± 6. y; mean body mass index [BMI] 31.3 ± 2.8 $kg \bullet m^{-2}$, mean maximal oxygen uptake [$V'O_2max$] 41.5 ± 5.6 ml kg^{-1} min^{-1}) were enrolled in this study. Participants trained for 24 weeks to prepare for a half marathon (21.097 km), 30 km, or a marathon (42.195 km), depending on their physical condition. The biomarkers as troponin I (cTnI), n-terminal pro b-type natriuretic peptide (NT-proBNP), lactate dehydrogenase (LDH), creatine kinase (CK), and myoglobin (MIO) were determined

before (T0), immediately after (T1) and three days after the race (T2). Heart rate was measured continuously during the race.

Results: The concentrations of cTnI, LDH, and MIO were significantly increased after the race ($P < 0.001$). All of the above parameters returned to baseline three days after the race. No changes were observed in the serum levels of CK at T1 ($P = 0.167$). No correlation was observed between the above parameters and body composition parameters. Correlation analyses showed a positive correlation between Δ cTnI (%) (i.e., [(post-race value − pre-race value)/pre-race value] *100) and $V'O_2max$ (l min^{-1}) ($R = -0.570$, $P = 0.030$) and ΔcTnI (%) and oxygen uptake at the gas exchange threshold ($V'O_{2GET}$) ($R = -0.610$, $P = 0.018$). In addition, Δ cTnI (%) correlated with percentage of respiratory compensation point (%vRCP) at marathon pace ($R = 0.611$; $P = 0.018$), and percentage of $V'O_2max$ at marathon pace ($R = 0.602$, $P = 0.020$), whereas ΔMIO (%) was positively correlated with HRmean measured during the race ($R = 0.582$; $P = 0.016$).

Conclusions: In summary, prolonged moderate-intensity race results in comparable increases in cardiac and muscular inflammatory markers in trained men with obesity, consistent with previous studies in lean counterparts. However, it no correlation was observed between the magnitude of the increase in cTnI, LDH, and MIO after exercise and the extent of obesity. Instead, the magnitude of the cTnI increase correlated with mean exercise speed, whereas MIO correlated with mean HR during competition.

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Acute effects of a dynamic stretching and core stability exercise protocol on physical performance in a group of u-16 volleyball players

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Purpose: Stretching exercise are frequently used during warm-up and training sessions in different sports to increase flexibility to develop higher power and agility and reduce injury risks. In acute, dynamic stretching seems to be more effective than static stretching for improving physical performance (1,2). Moreover, sports characterized by explosive athletic movement involving the upper or lower limbs, such as wall jumping or dunking and serving in volleyball, require also good *core stability* (3). Therefore, the aim of present study was to evaluate the acute effects of an intervention protocol with exercises which include together dynamic stretching and stimulation of core stability on physical performance in a group of U-16 volleyball players.

Methods: 18 young volleyball players (9 boys and 9 girls; age: 15.4 ± 0.7 yrs; BMI: 22.1 ± 2.2 kg/m^2) participating in the regional championship were recruited by Italian Volleyball Federation (FIPAV)—Campania Committee. The intervention protocol consisted in eight exercises, performed with ball, combining both dynamic stretching and *core stability* stimulating the main muscles group involved in volleyball such as the ischio-crural, hip flexors, shoulder muscles as well as the *core* muscles. Before (T0) and after exercise protocol (T1), participants' agility T-test, Counter Movement Jump (CMJ), Vertec (V) test, normalized anterior (nA), posteromedial (nPM), posterolateral (nPL) distances, and composite score (COMP) of modified SEBT (mSEBT) performances were assessed.

Results: At T1 compared to T0, there were significant differences ($p < 0.05$) in agility T-test (10.48 ± 10.18 s *vs*10.70 ± 10.56 s), jump height (31.8 ± 5.4 cm *vs* 29.8 ± 5.7 cm), peak power (3560.4 ± 718 W *vs* 3211.8 ± 570.6), and for left nA (71.3 ± 7.6 *vs* 66.8 ± 7.2), left nPM (105.6 ± 8.8 *vs* 98.3 ± 12.8), left nPL (106.1 ± 13.0 vs 98.5 ± 9.6), right nPL (103.9 ± 10.6 *vs* 98.1 ± 12.1), left (94.4 ± 6.6 *vs* 87.9 ± 9.9) and right (92.8 ± 7.0 *vs* 88.5 ± 10.2) COMP of mSEBT. No differences were observed in the V test in T1 compared to T0.

Conclusions: The present study shows that acute intervention with combined exercises of dynamic stretching and core stability improve the agility of lateral movements and the lower limb muscular power and dynamic stability in U-16 volleyball players.

Acknowledgments: we would to thank to staff of FIPAV—Campania Committee for volleyball players recruitment and helping to conduct the assessment during the study.

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The role of acute and chronic load on professional soccer players' recovery: a longitudinal study on the first and second round of the competitive season

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Purpose: Professional soccer is characterized by an increasing number of seasonal matches and continuous weekly changes to the game schedule, which lead to reconsider the seasonal periodization, especially the load-recovery management. The study aimed (a) to monitor training loads in the first and second rounds of the season and their influence on players' recovery status, and (b) to evaluate the recovery before and after the weekly conditioning session, characterized by the highest load volume in the week.

Methods: Saliva samples were collected from 24 professional soccer players (Ternana FC—BKT Italian League) during two equivalent "target" conditioning sessions, one in the first and one in the second round, respectively. Acute (7 days) and chronic (28 days) training loads, as well as their ratio, preceding each session, were evaluated and correlated with pre-training salivary data. To test the effect of the training session and the season round on the dependent variables (salivary testosterone, cortisol, t/c ratio), a linear mixed-effects model

was used, with time (pre, post and 24 h post-training), round (first or second) and their interactions as fixed effects.
Results: A significant effect of the round was found on all the dependent variables ($p < 0.01$), except cortisol ($p = 0.056$), with higher testosterone, T/C ratio, and lower cortisol values in the first round, at all timepoints. Regarding testosterone, a significant effect of time was reported ($p < 0.001$), showing a reduction at 24-h post training both in the first and in the second round. Cortisol showed a different trend in the two rounds (time × round: $p = 0.007$): in the first round, it significantly increased in the post-training compared to the basal value, while in the second round, cortisol showed high levels already in the pre-training, and then decreased in the post training. Significant correlations were detected between testosterone and acute/chronic distance ran at high intensity in the first round ($r = 0.58$), and T/C ratio and total training distance in the previous 28 days in the second round ($r = -0.49$).
Conclusions: In the second round of the season, the data show how the players were characterized by an increased level of stress already before the weekly conditioning training, compared to the first round, suggesting a greater difficulty for the athletes to fully recover from training and games. Acute and chronic training loads only partially explained the differences in the players' recovery status.

Ball possession analysis of paralympic water polo matches

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Purpose: Paralympic water polo is an aquatic team sport promoted by the Italian Para Swimming Federation (FINP). It is played by two mixed (both men and women) teams of six players (5 outfield and 1 goalkeeper) with physical disabilities, on a 20 m x 12 m field. A match is divided into four 7-min periods, with a time limit of 45 s for ball possession. The aim of this study was to provide an analysis of ball possessions in elite paralympic water polo matches.
Methods: A total of 387 offensive phases were obtained from four teams during five matches of the 2022 edition of Italy Cup (semifinals and finals) and Super Cup (final), to analyse time of ball possession (BPT), quality and number of passes (NOP) and number of players involved (NPI) in each action. Moreover, NOP was divided in passes on the water (POW) and passes on the hand (POH), while how each team gained and concluded each action of possession was also assessed. The BPT was calculated by monitoring the time from the official time of the match.
Results: The analysis with pooled data showed that 24.8% (n = 96) of the offensive phases occurred in the first period, while the 25.3% (n = 98), 23.8% (n = 92) and 26.1% (n = 101) in the second, third and fourth ones, respectively. A total of 340 actions registered passes between players, with an average of 3 ± 2 passes per ball possession. Regarding NOP, 210 actions (62%) were performed with ≤ 3 passes, 110 (32%) with 4–6 passes and 20 actions (6%) with ≥ 7 passes per action. Moreover, a total of 824 POW (3 ± 1 per action) and 271 POH (1.5 ± 1) were registered. The NPI registered an average of 3 ± 1 NPI per action, while the BPT showed a duration of 23 ± 10 s per offensive phase performed with passes. The one-way ANOVA showed significant differences between teams for NPI ($p < 0.001$), NOP ($p < 0.001$), POW ($p < 0.001$) and POH ($p = 0.031$), while the Pearson correlation showed a strong correlation between NPI and NOP ($r = 0.801$) and between NPI and POW ($r = 0.674$).
Conclusions: The analysis of passes shows a players' general difficulty in ball circulation, with a low NPI value per ball possession. However, these athletes cope this aspect with a higher number of POW compared to POH, which requires a different playing strategy. These results provide for the first-time useful information on this inclusive discipline for coaches to design specific training programs and for Federations to adapt the official rules and lead paralympic water polo to a more fluid game.

Analysis and comparison of the goalkeeper's role in past and modern soccer: a pilot study

Purpose: The purpose of the pilot study is to compare the technical and tactical performance of some elite goalkeepers, in two time periods and in different championships.
Methods: Such comparison has been performed through a scientific analysis of the data collected to verify if there have been any significant changes on the tactical function of today's goalkeepers compared to the past. Data was collected both from the match and analysis the interactive online football video library. Therefore, it was possible to carry out a careful observation and evaluation of the matches and specific technical actions of the goalkeepers.
Results: The information was collected concerning six professional goalkeepers: four Italians and four foreigners. The goalkeepers have been chosen, analysed and evaluated on six matches played from each of them, detecting the data related to ball management and the position of goalkeepers in the court in 540 min of match. **Conclusions:** In modern soccer the goalkeeper has a fundamental tactical role which requires, in additional to the protection of his own goal area, also the coverage of a much wider field area.
Training, Performance and Testing.

Influence of physiological factors determining physical performance in team sports: a review

Purpose: The purpose of this review is identify important determinants of team-sport physical performance that may be improved with following benefits for team-sport performance.
Methods: The determinants are described as factors that improve sprint performance or the ability to recover from maximal or sub-maximal efforts. There are many physiological qualities that are important for team-sport performance and which could be improved with specific methods.
Results: In the team-sport as basketball, football, handball, rugby, ecc… athletes engaged are required to repeatedly produce motor skills and maximal or sub-maximal efforts (eg, accelerations, changes in pace and direction, sprints and jumps), interspersed with brief recovery (rest or low-intensity activity). Performance in most team sports is dominated by technical and tactical proficiencies; while successful team-sport athletes must also have developed, physical capacities and specific.
Conclusions: Research is needed to verify adaptations induced in team sport athletes after methods of working on some physiological determinants.

Haematological and fitness analysis in professional soccer athletes before and after the strength and conditioning period

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Purpose: Athletes assessment in the pre-season period is needed to both understand individual response to training and the readiness for the forthcoming competition period. In addition to fitness performance tests, several blood markers could be strong indicators of exercise-induced stress, such as inflammation and muscle damage. The aim of this study was therefore to assess the physical and haematological response to the pre-season training in professional soccer athletes in order to manage their fitness and health status at the beginning of the competition season.

Methods: Twenty-one professional athletes competing in BKT Italian league and belonging to Ternana Football Club (age = 23.08 $\pm$ 1.29 yrs, BMI = 27.94 $\pm$ 4.83 kg/m^2) participated in the study. Fitness (Countermovement jump, 10 m sprint, Repeated Sprint Ability, and Yo-Yo IR2) and haematological (Lactate dehydrogenase, Creatine kinase, Haematocrit, C-reactive Protein, Interleukin-6 and Interleukin-10) data were collected at the beginning (T0) and at the end of the strength and conditioning period (T1—1 month later).

Results: In T1 vs T0 analysis, paired student T-test showed improvement in Repeated Sprint ability fatigue index ((i.e., percent reduction of sprint time from the fastest sprint; p value = 0.042) and Yo-Yo IR2 performance ($p < 0.001$) whereas athletes worsened their scores in 10 m sprint time ($p < 0.001$), Repeated Sprint ability total ($p < 0.001$) and change of direction time ($p < 0$, 001). Furthermore, haematological measurements showed significant increases in Lactate dehydrogenase ($p < 0$, 001), Creatine kinase ($p = 0.017$) and Interleukin-6 ($p < 0.001$) while no significant changes have been found in the other markers.

Conclusions: At the end of the pre-season, athletes improved their aerobic capacity and fatigue resistance despite a decrease in movement speed. These results, in addition to the increase of muscle damage markers (Lactate dehydrogenase and Creatine kinase) and pro-inflammatory cytokines (Interleukin-6) could reflect athletes' immune response to training and a state of exercise-induced muscular growth. The aforementioned parameters should be taken into account in order to identify individual athlete's optimal training-load, avoiding excessive exercise-induced stressors and thus decreasing the injury risk.

Effects of instructions on propulsive power and jump height during countermovement jumps in football players

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Purpose: There is evidence that vertical jump performance can be affected by instructions[1], velocity, and depth of the countermovement[2]. However, no previous study has examined the combined effect of the instructions on power output and jump height performance in highly trained athletes[3]. This study wanted to examine such effects in a group of professional football players.

Methods: Nineteen male professional football players, competing at the Major League Soccer Next Pro, were enrolled. They were asked to perform 2 sets of 3 countermovement vertical jumps (vCMJ) without arm swing and no extra load, in a counterbalanced order, during a single session. A specific instruction was provided for each set before vCMJ: (a) "*jump for maximum height"* (JMH), (b) "*jump for maximum speed of movement*" (JMS; i.e., performing fast unweighting, braking, and propulsive phases), without time and position constraints during the execution. An inertial measurement unit (IMU) with a triaxial accelerometer, a triaxial gyroscope, and a magnetometer with a wireless connection and 100 Hz sampling frequency was used. Outcome measures collected were mean power of the propulsive phase divided by body mass (MPP/bm), and jump height (JH), processed with a customized MATLAB script. Statistical analysis was performed with JAMOVI software 2.3 version.

Results: Paired Samples T-Test showed significant differences for MPP/bm_{JMS} vs MPP/bm_{JMH} (23.8 $\pm$ 3.4 W/kg vs 17.4 $\pm$ 3.3 W/kg respectively, with $p < 0.001$, $d = 1.9$); JH_{JMH} vs JH_{JMS} (0.438 $\pm$ 0.040 m vs 0.377 $\pm$ 0.049 m respectively, with $p < 0.001$, $d = 1.37$. Regression analysis showed a significant positive correlation between MPP/bm and JH only for the JMH instruction ($R^2 = 0.445$, $p = 0.002$), while a non-significative trend for the JMS instruction ($R^2 = 0.113$, $p = 0.159$).

Conclusions: The results showed that instructions had a significant influence on the outcomes analyzed. Despite MPP/bm being higher in the JMS condition, it proved to be a better predictor of jump height on JMH compared to the JMS instruction. Therefore, higher MPP/bm does not directly imply better jump performance.

Finally, instructions need to be taken into consideration when assessing or training highly trained athletes.

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To sync or not? Exploring the effects of different sensory cues on stride frequency control in running

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Purpose: Pace regulation during running activity is crucial for reducing lower limb load, avoiding injuries and improves running economy. One of the optimal strategies to allow this is to reduce stride length while increasing stride frequency. Variability in running frequency has been identified as one of the factors related to injury risk, and in this context, various studies have proposed the use of acoustic metronomes to enhance pace regulation during running. Recently, haptic cues delivered through mechanical vibrations have also been proposed to regulate the pace during walking. The aim of this study is to compare different specific sensory cues for pace regulation during running, determining the most effective ones in regulating stride frequency to provide specific recommendations for these types of training.
Methods: Thirteen participants (6 F) completed this study. The experiment consisted of three sessions: Haptic Metronome at the ankle (HMA), Haptic Metronome at the wrist (HMW) and Acoustic Metronome (AM). The HM was a prototype equipped with two vibrotactile interfaces (four vibrating sensors connected to an elastic band) positioned on the participants' dominant limbs. The AM was a mobile application and participants listened to the sound through earphones. During each session, the participants were required to complete a 400-m running task three times at four different target frequencies (100, 86, 75, 67 steps/minute). The main outcome used to assess the ability to synchronize with the metronome was the 'percentage of alignment', computed as the percentage of times the participants maintained the imposed frequency in relation to the total time.
Results: The frequency of 100 steps/minute was found to have a lower alignment percentage than those with 86, 75, 67 steps/minute. No significant differences were found among the sessions. Notably, no significant differences were observed comparing 100 steps/min to 75, 67 steps/min in AM and 100 steps/min to 75 steps/min in HMW.
Conclusions: These results suggest that there are no differences among the effect that different sensory stimuli have on pacing in running, but that the frequency to be followed is the most important factor to set when prescribing these types of training. Future studies should investigate the difference in sensory-motor integration during running between different types of stimuli, using rate like the spontaneous frequencies of the participants are warranted.

Association between anthropometric parameters and race time in sprint distance triathlon: the importance of regional body composition assessment

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Purpose: This study aims to analyze the influence of anthropometric and body composition variables, as well as previous experience and hours of training, on the Sprint distance triathlon performance. For this purpose, both the overall race time and the race time divided by the triathlon's disciplines were considered.
Methods: 17 triathletes, both amateur and elite, were evaluated the week before the competition. Anthropometric variables (height, weight, sitting height, arm circumferences and thigh circumferences, and handgrip strength) were collected using classical anthropometric methods. Total body composition parameters and regional muscular mass were collected using Bioelectrical Impedance Analysis (BIA, Akern). Other variables of interest were years of experience and hours/week of training.
Results: Total race time resulted significantly negatively correlated with hours/week of training (Spearman's R = – 0.75), muscle mass of the upper limbs (Spearman's R = – 0.57), and the lower limbs (Spearman's R = – 0.45). On the contrary, muscle mass of the trunk resulted positively correlated with race time (both overall and divided by disciplines) (Spearman's R = + 0.51). None of the considered variables were significantly associated with swimming time, whereas cycling performance was significantly correlated with hours/week of training (Spearman's R = – 0.74), handgrip strength (Spearman's R = – 0.49), total body fat percentage (Spearman's R = 0.50), and upper (Spearman's R = – 0.54) and lower limbs muscle mass (Spearman's R = – 0.49).
Conclusions: In this pilot study we examined for the first time the association between regional body composition parameters and triathlon performance. Contrary to the literature, in our study years of experience did not influence race time, but muscle mass of the upper and the lower limbs seem to play an important positive role in the final results. Conversely, trunk muscle mass was negatively correlated with performance. These preliminary results underline the importance of regional body composition evaluation to tailor specific training programs adapted for each triathlete.
References: Puccinelli et al. "Previous experience, aerobic capacity and body composition are the best predictors for Olympic distance triathlon performance: Predictors in amateur triathlon." *Physiology & Behavior* 225 (2020): 113, 110.

Effects of a six-month in-season daily undulating periodized resistance training program on performance and body composition in elite field hockey players: a sex comparison

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Purpose: The aim of the study was to compare the effects of a six-month in-season daily undulating periodized (DUP) resistance training program in male and female high level Field Hockey players of the Italian National Team.
Methods: Twenty-eight male (M: Age: 24.3 ± 3.6 years; body mass: 75.1 ± 8.5 kg; height: 176.8 ± 7.0 cm) and twenty-four female (F: Age: 26.3 ± 4.2 years; body mass: 60.7 ± 8.0 kg; height: 164.4 ± 4.9 cm) Elite Field Hockey Players were tested for body composition (lean body mass-LBM, and fat mass), bench press 1RM (BP 1RM), bench press peak power (BP power), and VO2max (estimated by YoYo Intermittent Recovery test) in March 2022 and following a 6-months daily undulating periodized resistance training program. Three resistance training sessions, each with a different focus (hypertrophy, maximal strength or power), were included in the training program. Players also participated in regular Field Hockey training 3 times per week and played 1 game per week with their club. Field Hockey training sessions also included additional individualized repeated sprint training and prolonged running exercises.
Results: A significant ($p \leq 0.05$) main effect of time was detected for 30 m sprint, BP power, estimated VO2max and LBM. Significant group x time interactions were registered for BP 1RM (–4.4% and + 10.1% in M and F, respectively), and estimated VO2max (+ 2.9% and + 1.2% in M and F, respectively). No other significant interactions were detected.

Conclusions: Results indicate that a DUP resistance training program was able to increase LBM and to improve maximum upper body power in both M and F Elite Field Hockey Players during a six-month competitive season. DUP training program, was more effective in F compared to M in improving upper body maximum strength.

Concurrent systematic physical interventions in Parkinson's disease: a pilot study

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Purpose: This study aims to verify the effects of two concurrent physical exercise interventions (in the gym and at-home training) in a neurodegenerative condition to improve the subject's quality of life increasing the workload and, at the same time, reducing the logistical discomfort in these patients.
Methods: 3 elderly men (over 80 years) with Parkinson's disease stage 3.0 on the Hoehn and Yahr scale and scored 51, 44, and 60 on the Unified Parkinson's Disease Rating Scale (UPDRS), underwent physical intervention.
During the 3-month observation period, the patients underwent two concurrent training regimens: 1) physical activity of one hour per session for two times a week; 2) a 20-min home exercise program twice a week on days other than the first intervention. Balance, lower limb strength, hand grip strength, endurance, and responsiveness tests were performed at the treatment's beginning and end.
Results: In the UPDRS there is a notable reduction in the score (approximately 20 points) in the three subjects. In the endurance test, subjects walked 136 m more (Δ 52% $p = 0.03$). In the tapping test, an increase in reactivity of 63% ($p = 0.005$) for the right hand and 82% ($p = 0.018$) for the left hand. The balance increased considerably: from 3 to 16 s ($p = 0.03$). In the lower limb strengths, the sample has increased by 6 reps in the chair stand test ($p = 0.038$), and the handgrip test showed an increase in strength in the right hand 36% $p = 0.01$; in the left hand 37% $p = 0.009$.
Conclusions: Results of this study suggest that individualized and consistent physical treatment, even at home, improves the quality of life in Parkinson's patients. This study aims to underline the importance of home training to increase the weekly training volume by reducing, at the same time, the discomfort created by travel to the gym that could represent a tremendous logistic problem for these patients. Both concurrent training methods could represent a valuable strategy to increase the workload in patients with neurodegenerative disease.
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The effects of an aqua-fitness program on body image in breast cancer survivors: a pilot study

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Purpose: the purpose of the present pilot study is to investigate the effects of a water fitness program on body image among breast cancer survivors.
Methods: Nine volunteers women (age: 52.6 $\pm$ 10.1 years; weight: 69.5 $\pm$ 11.7 kg; height: 1.66 $\pm$ 0.1 m; BMI: 24.9 $\pm$ 2.7 kg/m^2) enrolled in the National Association of Breast Operated Women participated in this four-months (January 2023 to April 2023) pilot study. All of them underwent surgical treatment, as well as chemotherapy or radiotherapy. The inclusion criteria were to be in good health and to have completed the treatment since at least three months. The intervention included thirteen 1-h supervised sessions of aqua-fitness. Thirty minutes after the end of each session the enjoyment was evaluated using the Physical Activity Enjoyment Scale (PACES) (Graves, et al., 2010) whereas the perceived fatigue was assessed by means of the sessions Rate of Perceived Exertion (sRPE) scale (Foster et al., 1995). Before the beginning and one week after the end of the intervention anthropometric measures and body image were assessed. For the body image investigation, the Italian version of the Body Image Scale has been adopted (Cheli, et al., 2016) to measure the impact of pathology on body image.
Results: Results from PACES scale showed high levels of enjoyability (95 $\pm$ 7.9%). According to the sRPE (4, 01 $\pm$ 0, 49), subjects rated the intensity of the activity as moderate. Finally, results from the BIS scale showed that, overall, body image improved from pre (11.70 $\pm$ 9.45) to post (7.78 $\pm$ 7.66) intervention.
Conclusions: The results of this study showed that a four-months aqua-fitness program might bring effective improvements on the body image among breast cancer survivors. The proposed activity was enjoyed by the participants, it is a feasible and safe activity since it was supervised and no accidents or adverse effects were recorded. Nevertheless, further research should evaluate the effect of this program involving a higher number of participants for a longer period.
Acknowledgments: Authors would like to thanks all the patients involved in the study.
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Preliminary evaluation of cardiorespiratory fitness, functional capacity, quality of life and physical activity level in young dialyzed and kidney transplant patients: an observational study

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Purpose: Chronic kidney disease (CKD) is a progressive disease with high morbidity and mortality. Kidney transplantation presents longer survival, less morbidity, and better HRQoL compared to hemodialysis (1). These two conditions in young population may lead to a reduction in physical performance. Scientific evidence reports a higher VO_2peak, VO_2max, and Physical Activity (PA) level in Healthy Population (HP) (2) than in Transplant Patients (TP) or Dialyzed Patients (DP). Moreover, higher anxiety and depression and lower HRQoL were observed in adult patients with CKD compared to the HP (3). The aim of the present observational study is to investigate possible differences in cardiovascular fitness, functional capacity, HRQoL, and PA levels in young TP and DP patients compared with healthy age-matched population.
Methods: 8 young subjects were enrolled, n = 5 TP (mean age 18.8 ± 3.7 years) and n = 3 DP (mean age 20.0 ± 10.1 years), underwent the following assessments: Medical evaluation, cardiopulmonary test, body composition, strength, balance tests. In addition, the Short Form Health Survey (SF-36) and the General Physical Activity Questionnaire were administered to analyze QoL and PA levels.
Results: Our preliminary results showed that both TP and DP have a worse cardiopulmonary capacity and QoL than the healthy target population. In particular VO_2max was respectively 32.0 ± 9.0 kg\min\l in TP and 37.1 ± 13.9 kg\min\l in DP, while is 42–46 kg\min\l in HP. The results of 1RM leg press are in line with those of the HP, and according to these preliminary results TPs seems to have an higher value (96.7 ± 41.9) than DP (93.6 ± 2.1). Both TP and DP do not reach the minimum PA levels recommended.
Conclusions: Preliminary results, that need to be improved further, suggest the need to involve more younger TP and DP in well-structured protocol of PA in order to improve their general health and to prevent cardiovascular complications related to chronic diseases.
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Role of adapted physical activity combined to plant dominant low protein diet on quality of life and functional capacity in chronic kidney disease patients

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Purpose: Chronic kidney disease (CKD) is a worldwide pathological condition characterised by several comorbidities, such as cardiovascular disease, metabolic syndrome, and sarcopenia. CKD leads patients to decrease physical capacity, quality of life and increase sedentary lifestyle, which are strong predictors of mortality in this population. Adapted physical activity (APA) and targeted nutritional therapy seem to positively influence CKD prognosis. An alternative to the 'classic' low-protein diet (LPD), which is strongly recommended in this population, is the Plant-Dominant Low Protein Diet (PLADO). PLADO provides 50% of the total dietary protein requirement from plant sources and could be an option where protein-free products are not available or when the patient refuses to use. To date, few studies investigate the combined effect of a well-structured APA and an alternative LPD in CKD patients. Therefore, the aim of this study is to evaluate the effect of 12-week online APA protocol combined with PLADO on quality of life, functional parameters, and related-CKD comorbidities.
Methods: 10 CKD patients, aged 64 ± 10.1, were enrolled and randomized into 2 homogeneous groups for age and gender: Group A) performed the 12-week online APA protocol combined with PLADO; Group B) received only PLADO. Quality of life using the 36-item Short Form Health Survey (SF-36), physical capacity trough 6-min walking test (6MWT), and laboratory parameters, such as body composition, blood pressure and cholesterol levels were evaluated at baseline (T0) and after 12 weeks (T1).
Results: The preliminary results, evaluated so far, evidenced that SF-36 Physical functioning domain increased in Group A and B of + 13, 8% and + 13, 3% respectively. Both Group increased the walking distance at 6MWT (Group A + 7, 5%; Group B + 8, 2) and the body mass index. No relevant changes were observed within Group B at the end of the protocol on body composition analysis, whereas Group A showed an improvement in the Fat Free Mass (+ 3, 1%).
Conclusions: This study promises to improve not only knowledge about the effect of APA and PLADO as an alternative approach on CKD patients, but also the combined effect of these two positive behaviours on quality of life and related-CKD comorbidities.

Effects of a supervised online mat pilates exercise program on muscular fitness components and body composition in overweight/obese adults: a pilot study

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Purpose: Overweight and obesity are major risk factors for the onset of non-communicable diseases. Traditional Pilates exercise protocols, along with a healthy diet, plays an important role in weight management and in the prevention of obesity and its complications. The effects of online mat Pilates on muscular fitness components remain

an open question. Therefore, the purpose of the present study was to evaluate the effects of a supervised online mat Pilates exercise program on body composition and muscular fitness components in a group of overweight/obese adults.

Methods: Nineteen overweight/obese participants (age: 42.7 ± 10.9 yrs; BMI: 33.2 ± 4.8 kg/m^2) were recruited and randomized in two groups: Intervention Group (IG, n = 11) and Control Group (CG, n = 8). IG and CG followed a prescribed diet while IG also performed an online supervised Pilates exercise program two times/week for 3 months. Body mass, height, BMI, and body composition were assessed at baseline (T0) and after 3 months of intervention (T3) in both groups. Lower limb maximal strength, endurance and rate of force development were assessed using an isometric dynamometer. Moreover, lower limb muscle power was assessed using the Chair Stand Test (CST).

Results: Both groups showed a significantly ($p < 0.05$) lower BMI at T1 compared to T0 (IG T1: 30.5 ± 3.9 kg/m^2 vs T0: 31.6 ± 4.0 kg/m^2; CG T1: 33.7 ± 4.3 kg/m^2 vs T0: 35.3 ± 5.3 kg/m^2). Fat mass percentage was significantly ($p < 0.05$) lower at T1 compared to T0 in both groups (IG T1: 39.6 ± 8.5% vs T0: 43.5 ± 7.2%; CG T1: 41.9 ± 6.8% vs T0: 44.1 ± 5.9%). The IG group showed a significantly ($p < 0.05$) higher free fat mass at T1 (47.6 ± 7.6 kg) compared to T0 (46.3 ± 7.5 kg). IG showed a significantly higher ($p < 0.05$) rate of force development at T1 (1794.0 ± 760.3 N/s) compared to T0 (1470.4 ± 841.2 N/s). No differences were observed for the other muscular fitness components.

Conclusion: This pilot study suggests that participation in a supervised online Pilates exercise program, plus diet, may promote an improvement in body composition and rate of force development.

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Evaluation of lifestyle, physical activity and endocrine disruptors exposure in Patients with mutation of brca 1/2 with/without breast and/or ovary cancer: the study stilvarca

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Purpose: It is known that pathological variants (PVs) in the BRCA1/2 genes can be found in about 20% of patients with breast (BC) or/and ovarian (OC) cancers. Physical activity (PA), incorrect diet and exposure to environmental pollutants (e.g. Cadmium (Cd), through contaminated food, cigarette smoke) may play a role in the development of BC and OC. Cd acts as an "endocrine disruptors" through the binding to estrogen receptor, increasing cell proliferation and mutation rate. Thus, lifestyle may be linked to cancer onset and progression in these women. Our study aimed to evaluate the role of lifestyle and environmental factors in the development of cancers in women carrying PVs in BRCA1/2 genes.

Methods: The study was a multicentric, observational, case–control, retrospective study of women with PV in BRCA1/2 genes with BC, OC, or both diagnosed from 2012 to 2020 (Group 1, G1), or without cancer (Group 2, G2). 89 patients (82.4%) developed BC, 17 (15.8%) OC, and 2 (1.8%) had both BC and OCs. Data were collected on demographics, body mass index (BMI), BRCA mutation (mBRCA), adherence to Mediterranean diet (PREDIMED questionnaire) and physical activity (IPAQ questionnaire), smoking habits (SH), pack/year index, estroprogestinic (EP) use. Fisher's exact test and ANOVA were used to compare patient's characteristics among the two groups. A univariate and multivariable models were also fitted to investigate the relationship between PA, adherence to Mediterranean diet, smoking habits (SH), EP use and cancer development.

Results: We evaluated 208 patients, 108 (51.9%) in Group 1 and 100 (48.1%) in Group 2. In particular, 128 (61.5%) had mBRCA1, 80 (38.5%) mBRCA2. Analysis of 2 groups showed differences in age (47.2 vs 35.6yrs in G1 and G2, respectively*; $p < 0.0001$)*, SH (38.9% in G1 and 20.0% in G2; *$p = 0.002$*), EP use (36.1% in G1 and 21.0% in G2; *$p = 0.021$*). No difference was found regarding pack/year index, EP intake duration, PA, adherence to Mediterranean diet. At univariate analysis, predictive factors for cancer incidence were: SH (OR 2.545; 95% CI 1.363—4.752—*$p = 0.003$*); EP use (OR 2.126; 95% CI 1.143—3.957—*$p = 0.017$*); adherence to Mediterranean diet (OR 1.500; 95% CI 1.016—2.215—*$p = 0.041$*). No relationship was found with BMI and PA. At multivariable analysis, SH (OR 2.606; 95% CI 1.370—4.959—*$p = 0.004$*), EP use (2.340; 95% CI 1.224—4.474—*$p = 0.010$*), and adherence to Mediterranean diet (OR 1.544; 95% CI 1–027—2.320—*$p = 0.37$*) were predictive of cancer development.

Conclusions: According to our preliminary analysis, the risk of developing BC or/and OC in women with BRCA mutation was influenced by SH, EP use, and adherence to Mediterranean diet. Thus, many lifestyle factors appear to play a role in cancer development in mBRCA VP patients. Further analyses are needed to evaluate a potential protective role of physical activity in these patients.

Effects of an aqua fitness program on upper limb mobility and strength in female breast cancer survivors: a pilot study

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Purpose: The purpose of this study was to investigate the effects of an aqua fitness program on upper limb mobility and strength in breast cancer survivors.

Methods: 9 women volunteers (Age: 52.6 ± 10.1 years; Weight: 69.52 ± 11.71 kg; Height: 1.66 ± 0.07 m; BMI: 24.98 ± 2.67 kg/m2) participated in the study. All participants completed chemotherapy and radiotherapy for at least 3 months and had no contraindications to the activity. The intervention protocol included thirteen 1-h supervised sessions of aqua-fitness.

To analyze the mobility of the upper limbs, the DASH questionnaire (Disable of arm, shoulder and hand) whereas for the upper limb strength the handgrip test was administered using a dynamometer (Jamar, USA). All tests have been administered one week prior (pre) and one week after (post) the intervention.

Results: Regarding the DASH questionnaire, descriptive statistics (mean ± SD) showed a 23.6% (SD: 20.8) decrease from the beginning (22.1% ± 17.2%) to the end (17% ± 12.2%) of the intervention. Concerning the upper limb strength, results showed an increase in strength expressed in both limbs (homolateral pre: 16.75 kg—ipsilateral post: 21.375 kg; contralateral pre: 22.00 kg—contralateral post: 22.75 kg).
Conclusions: The results obtained seem to recognize aqua fitness as an activity indicated for counteracting the side effects of the treatments for breast cancer. In fact, an improvement was noted in most of the subjects analyzed as regards the degree of disability of the hand, limb and shoulder. As far as strength is concerned, however, in all subjects participating in the activity, an increase in muscle strength was recorded in the limbs, both in the homolateral and contralateral limb.
Acknowledgments: We thank the national association of women with breast surgery (ANDOS) section of Fondi for participating in the study with their associates; we also thank the Sport Village Fondi club for the hospitality and availability provided during the intervention period.

Water runs quality of life: the effect of a water-based exercise program on shoulder joint mobility in breast cancer survivors

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Purpose: According to recent metanalysis, adapted physical activity (APA) has shown its effectiveness in improving quality of life (QoL) and psychophysical health in cancer survivors. Therefore, the present study aims at investigating the effect of a water-based exercise program on shoulder joint mobility in breast cancer survivors.
Methods: The exercise program included a group of 9 Breast Cancer Survivors (Age: 52.6 ± 10.1 years; Weight: 69.5 ± 11.7 kg; Height: 1.66 ± 0.07 m; BMI: 25.0 ± 2.7 kg/m^2) who underwent surgery such as mastectomy or segmentectomy. Inclusion criteria were a good health status at the time of intervention, no contraindication highlighted by their oncologists, and no radiopharmaceutical assumed for the last three months. APA program consisted in 4 months supervised of water-based classes for a total of 13 workout sessions. Assessments included the back scratch test (for both the dominant and the contralateral limb) for the evaluation of upper limb range of movement (ROM), and shoulder circumduction test using a wooden wand to facilitate the measurements. Assessments have been administered prior the beginning (pre) of the intervention protocol and one week after the end of the program (post).
Results: Descriptive statistics (mean ± SD) revealed a significant distance reduction between hands in the back scratch test. In particular, a reduction of 5.1 cm with the left upper limb on the right one (pre: 14 ± 9.6 cm; post: 8.9 ± 7.1 cm), and 2.8 cm with the right upper limb on the left one (pre: 8.1 ± 8.8 cm; post: 5.3 ± 6.5 cm). Although there have been improvements for both sides, better results were obtained when the dominant limb was in elevated position. As far as the shoulder circumduction test is concerned, not every patient has been able to perform it. However, comparing available data, an improvement of 5.9 cm has been obtained (pre: 99.9 ± 8.2 cm; post: 94 ± 9.0 cm).
Conclusions: Results of the present pilot study showed that a supervised and water-based APA program can lead to significant improvements of both muscles' elastic properties and shoulders' joint mobility in breast cancer survivors. Moreover, it may result in potential improvements of patients' quality of life by facilitating their everyday activities.

Acknowledgments: Authors would like to thank all the patients involved in the study.

On acute mountain sickness when travelling at high altitude

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Purpose: Altitude travelling has become popular, both for mountainneering, training, and hiking. However, lowlanders exposed to high altitude are at high risk for the high-altitude diseases, such as acute mountain sickness (AMS), particularly with rapid ascent plans. This work aims to evaluate prevalence of AMS during two common treks across either the Alps or Himalayas.
Methods: The Alpine study involved a group of 15 healthy adults (8 males and 7 females, 34.6 ± 11.9 years, BMI of 22.7 ± 3.4 kg/m^2), trekking up to Capanna Margherita (≈4550 m of altitude). The Himalayan study involved a group of 21 healthy adults (12 males and 9 females, 44.8 ± 15.6 years, BMI of 24.6 ± 3.4 kg/m^2), trekking up to the Pyramid Laboratory—Observatory (≈5000 m). The first was characterized by a rapid ascent plan, while the second envisaged more adequate stages of ascent. In both cases, before reaching the peak altitude all participants took 250 mg of acetazolamide per os once daily. AMS was verified with the Lake Louise score and defined as ≥ 3 points in the total score at least 6 h after the ascent, with at least one point from headache.
Results: In the Alpine study, 6 (40%) participants suffered from mild AMS; this proportion was lower than that reported by Mandolesi et al. [1]—24/50 (48%), whose 15 with moderate-to-severe AMS—and Modesti et al. [2]—31/44 (70%); both studies were conducted at Capanna Margherita, involving participants with similar age range and BMI. In the Himalayan study, 7 (33%) participants suffered from mild AMS; this proportion was lower than that reported by Boos et al. [3] at ≈5140 m—38/80 (47.5%)—and comparable to that reported by Modesti et al. [2] at ≈5400 m—16/47 (34%).
Conclusions: The lower percentage of participants with AMS in our studies is probably due to the use of acetazolamide, which was not mandatory in the other studies herein cited. It is possible that biases emerge whether comparing AMS diagnosed by the most recent scoring system [4] to AMS diagnosed by previous systems, although the difference are likely little, if any. As evident, the hypothesis that the higher the altitude the greater the risk of developing AMS can be reverted, at least below extreme altitudes, by avoiding rapid ascent plans.
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Physical exercise as a strategy to counteract the effects of microgravity on the musculoskeletal system

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Purpose: Weightlessness during spaceflight is a crucial deconditioning factor that can lead to several health issues in astronauts. This literature review aimed to analyse different exercise protocols to understand which counteracts effects of microgravity on the musculoskeletal system the most. Interestingly, these are the same effects as those caused by forced immobility conditions such as bedrest.
Methods: Analysis of 12 RCTs, using only microgravity simulation methods endorsed by main space agencies (HDT bedrest, horizontal bedrest, ULLS), published on Pubmed since 2000. Every type of training protocol was included and interventions ranged from 5 to 90 days. Participants were healthy adults under 50.
Outcomes were muscle cross sectional area (mCSA), muscular strength and endurance, bone mineral density (BMD) and body composition.
Results: Overall, triceps surae, quadriceps femoris, hamstring, paraspinals muscles, ankle dorsiflexors and plantar flexors **mCSA** decreased more in the exercise groups (EX) [0-17%] than in controls (CTR) [2.15%-25%]. Differences were found in body composition, none in pre/postflight body mass. Globally, **BMD** decreased less in EX [1.8%-3.2%] than in CTR [4.9%-9.9%]. Heel, tibia, hip, femur, lumbar spine and radius BMD was 10-60% higher in EX than CTR. Exercise was more effective in promoting bone formation than preventing bone resorption. Higher exercise intensity, frequency and volume were more effective both in preventing mCSA decrease and bone mass loss. Lastly, **muscle strength and endurance** increased in resistance EX and decreased in CTR for short-term bedrest, while decreased in CTR [16%-18.5%] more than in resistance EX [0%-14.7%] for medium-term bedrest. So, exercise intensity and strength decrease mitigation were proportional. Altogether, jump exercise protocols best prevented mCSA decrease, bone deconditioning and strength decrease.
Conclusions: All exercise protocols seemed effective in alleviating muscle atrophy and strength/endurance decrease. Regarding bone mass, exercise increased bone formation more than decreasing bone resorption. Jump-based training seems the best choice in both scenarios. Finally, higher exercise intensity, frequency and volume corresponded to greater musculoskeletal deconditioning mitigation.

Effects of a 6-month adapted functional training program on women with fibromyalgia

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Purpose: Fibromyalgia syndrome (FS) is a chronic disease characterized by widespread muscle pain and often in association with other symptoms such as fatigue, sleep disturbances, memory and concentration deficits. Previous studies suggest that physical activity improves quality of life in people with FS and reduces symptoms. The aim of the study was to investigate the effects of an adapted physical exercise protocol on aerobic endurance, upper and lower limbs strength, responsiveness and balance in women with FS.
Methods: Fourteen ladies aged 48 ± 6.7 years, height 160.3 ± 5.6 cm and weight 66.1 ± 11.6 kg with FS were enrolled in this study. They followed a 22-weeks of functional training protocol by Training Lab ItaliaÒ (CTLIP) 2 days/week in sessions of 60'. CTLIP consisted of circuit interval training with ratio 30''work: 30″rest. Physical fitness was evaluated through the Senior Fitness Test battery (SFT) at two different times: before the beginning of the intervention (T0), and after the about 6-month intervention (T1). SFT includes: 30'' Chair-Stand, 30'' Arm-Curl, 2' Step-Test, Sit & Reach, Back-Scratch and 8-Foot Up & Go to assess upper and lower body strength, cardiorespiratory efficiency, upper and lower body flexibility and dynamic balance, respectively.
Results: Statistical analysis with Student's T-Test showed significant differences for Chair Stand Test ($p < 0.001$), Arm Curl Test dx ($p < 0.001$), Arm Curl Test sx ($p < 0.001$), 8-Foot Up & Go ($p < 0.001$), 2' Step-Test ($p < 0.001$). No significant differences were found for the other variables.
Conclusions: Results showed that the intervention has significantly improved physical fitness, especially for lower and upper strength, dynamic balance and aerobic endurance. Our protocol seems to be a new trend in literature. Indeed, to expand existing available data, adapted physical activity should consider the inclusion of an interval training plan for fibromyalgia subjects.
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Structured progressive interval walking improved foot perfusion in patients with peripheral artery disease: a sex-oriented analysis

Purpose: Decreased arterial perfusion is a typical condition of patients with peripheral artery disease (PAD) and claudication. Microcirculatory diseases, particularly among females, may worsen the ischemic pattern. This observational study aimed to detect foot perfusion changes by assessing local temperature after a home-based exercise program and to analyze if a different response occur in males and females.
Methods: A total of 76 PAD patients at Leriche-Fontaine's stage II (72 ± 4 years; 52 males) were enrolled into a structured in-home exercise program [1] composed of two daily 8-min interval walking sessions (1: 1 walk: rest ratio). The walking speed, maintained at home by a metronome, was initially slow (60 beats/minute) and progressively increased each week.
Outcome measures were collected at baseline (T0), and at each hospital visit after 5 weeks, 12 weeks and 20 weeks in the same temperature-controlled environment.

Primary outcome was the foot temperature measured by infrared thermography at four regions of interests (ROIs) at the foot (anterior tibial, posterior tibial, dorsalis pedis and arcuate arteries [2]). Secondary outcomes included 6-min walking distance (6MWD) and Pain-free walking distance (PFWD).
Results: All patients completed the exercise program, with a very high adherence in both males (88% of sessions executed respect to the prescribed ones) and females (90%) and without adverse effects.
The foot temperature of both limbs showed a significant increasing trend with a mean variation of 1.3 °C for the more impaired limb and 0.9 °C for the contralateral ($t = 8.88$, $p < 0.001$; $t = 5.36$; $p < 0.001$, respectively), with significant changes occurring in all ROIs only after 5-week of training. The sex-oriented analysis did not highlight any significant difference, with an improvement of mean foot temperature o 1.5 ± 0.6 °C in females versus 1.2 ± 0.5 °C in males ($p = 0.42$).

At the end of the program respect to baseline, all patients exhibited a significant improvement of both 6MWD (+ 45 ± 34 m; $p < 0.001$) and of PFWD (+ 128 ± 94 m; $p < 0.001$), again without any sex difference.

Conclusions: In patients with PAD, a structured low-intensity exercise program was at high adherence and it significantly improved foot temperature and exercise capacity without any sex-related difference, as not yet reported in the literature. The design of effective training programs, in terms of setting, time of execution and tolerability, to obtain vascular adaptations in men and women with PAD.

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Feasibility of a home-based exercise program for patients with vascular claudication undergoing adjuvant chemotherapy for cancer: a case–control study

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Purpose: this pilot study aims to test the hypothesis that a graded low-intensity exercise program prescribed at hospital and executed at home can equally improve exercise capacity in patients with peripheral artery disease (PAD) undergoing concomitant chemotherapy treatment versus PAD patients not exposed to chemotherapy.

Methods: Patients affected by PAD and claudication enrolled in the Vascular Rehabilitation and Exercise Medicine Program at University Hospital of Ferrara with history of solid organ cancer were analyzed for this study. In particular, 10 patients undergoing adjuvant chemotherapy for solid organ malignancies (CT) and 10 PAD cancer survivors patients who had stopped chemotherapy for at least one year (NoCT) were included. All patients (9 females) completed the Test in-Train out home-based exercise program, consisting of two 8 min daily sessions of interval walking (1': 1' walk: rest) at low progressively increasing speed and maintained at home by a metronome application on smartphone. Outcome measures, collected by kinesiologists at the entry (T0), after 5-week (T1) and after 3 months (T2), included 6-min walking distance (6MWD) and pain-free walking distance (PFWD) during the 6-min test.

Results: At the entry, the two groups did not present any significant difference in terms of demographics, risk factors, comorbidities and PAD severity. Malignancies were located at breasts (CT n = 4; NoCT n = 4), prostate (CT n = 5; NoCT n = 4) or colon (CT n = 1; NoCT n = 2). All patients successfully performed the TiTo exercise program completing more than 90% of the prescribed home walking sessions in the absence of reported muscle pain, general fatigue or adverse events. The 6MWD significantly increased in the NoCT group (+ 39 m; from 269 ± 73 to 308 ± 75; $p = 0.015$) but not in CT group (+ 11 m; from 301 ± 85 to 312 ± 104). Conversely, PFWD was significantly improved in both groups (NoCT: + 79 m; from 117 ± 43 to 196 ± 78; $p < 0.001$—CT: + 81 m; from 118 ± 60 to 200 ± 50; $p < 0.001$). The between-group comparison did not highlight any significant difference for all the outcomes.

Conclusions: In a small sample of patients with vascular claudication undergoing chemotherapy the low-intensity TiTo home-based exercise program was safe, pain-free and feasible, with changes of mobility not different from a comparable population of cancer survivors with claudication. Future studies with larger sample sizes are needed to confirm these preliminary data.

The effects of one month of lower limb powered exoskeleton gait training compared to the conventional gait training performed on treadmills in multiple sclerosis patients: a pilot study

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Purpose: Multiple sclerosis (MS) is an autoimmune inflammatory disease of the central nervous system, characterized by a wide symptom spectrum. Ambulation dysfunctions are the most experienced impairments among MS patients. Lower limb-powered exoskeletons claim to reduce training-related fatigue levels while providing patients with task-specific stimuli. The aim of the study is to compare the effects of exoskeleton training (Et) compared to conventional training performed on treadmills (Tt) on walking abilities.

Methods: 5 MS patients with an EDSS $\leq$ 2.5, performed 4 weeks (2 sessions/week) of gait training for each training modality. Participants performed functional assessment sessions before and after each training intervention that included: a Timed-Up-and-Go test, a 6-min Walking test, a Balance assessment, and a Gait Analysis assessment. Friedman Test was used to test differences between training protocols.

Results: No significant differences were found between Et and Tt, nor between performances before vs. after each intervention. Only 2 participants showed improved balance and walking parameters independently from the training protocol. While one subject showed balance improvement only after Et.

Conclusions: Our study did not find significant results. However, individual results may increase existing knowledge and lead toward future studies that will compare the effects of Et and Tt on walking abilities in MS patients.

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Efficacy of a physical activity protocol on adolescent idiopathic scoliosis

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Purpose: Adolescent idiopathic scoliosis (AIS) affects 1–3% of children in the at-risk population of those aged 10–16 years [1]. Despite much clinical, epidemiological, and basic science research, the aetiopathogenesis of AIS remains unknown [2]. The prevalence of AIS is increasing, partly due to a lack of physical activity. Tang et al. suggested that AIS development could start with soft tissue anomalies that may be modified by exercise and stretching [3]. The purpose of this work was to verify the effectiveness of an integrated approach of methodologies to reduce or stop the progression of scoliosis, in order to improve the quality. of life.
Methods: A clinical trial was conducted from October 2022 (T0) to May 2023 (T1) with 15 adolescents (aged 13.27 ± 2.2 years), with a diagnosis of AIS from 9 months, described by a medical certificate and X-ray. All adolescents participated in three 50'/week training sessions, consisting of a warm-up phase and a final phase equal for all, plus a central phase of personalized training for each AIS diagnosis (Lyon, Schroth, Klapp, and Mézières methods). In T0 and in T1 Cobb angle and performance of physical tests (Hair stand test, Sit and reach, Curl up/crunch test, push up test) were measured.
Results: In T0 the mean curve of AIS patients was 21.87° ± 16.87° Cobb, while in T1 the mean curve significantly decreased to 16° Cobb (26.84% decrement, $p < 0.0005$). Among the 15 subjects, 14 had an improvement and only 1 did not undergo any alterations, in any case achieving the first objective of conservative treatment, i.e., avoiding worsening of the curve.
Chair stand test, push-up test, Sit and reach test and Crunch Test evaluated strength in the lower and upper limbs, the flexibility of the lower back and hamstrings, and abdominal muscle strength. A significant increase was demonstrated for each test from T0 to T1 ($p < 0$, 05); furthermore, the greater strength of the upper limbs positively and significantly correlated with scoliosis curve improvement ($p = 0.01939$).
Conclusions: Our study confirms that in agreement with another report [4], upper limb muscle strength correlates with scoliosis degrees.
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Effects of high-intensity physical activity combined with nutritional supplementation on metabolic and functional components in subjects with dementia—preliminary data from the choko-age study

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Purpose: It is known that cognitive decline and ageing leads to poor metabolic and functional performance and, up to now, it is not known whether the combination of diet and physical exercise can give benefits. The aim of this preliminary analysis is to investigate the effect of vitamin E-functionalized and polyphenol rich chocolate and regular exercise on metabolic and functional aspects in elderly people with dementia.
Methods: Participants were allocated to exercise (CG), exercise + chocolate with or without Vitamin E (EG1 or EG2, double-blinded) group. Three training sessions/week were performed for 12 weeks, consisting of 4 × 4' at 90% of heart rate maximum walking on a treadmill (HIIT) and 4 × 4 repetition at 90% 1 repetition maximum at the leg press. Subjects tested so far have been 7 (68 ± 7 years). The assessment included energy cost of walking (CW), maximal aerobic capacity (Vo2max) and functional tests: 6 Minutes Walking Test (6MWT), 1 repetition maximum (1RM) at the leg press, 30-s Chair-Stand (30CST) and Time Up and Go (TUG).
Results: Vo2max increased by 12% in the CG and 9.5% in EG1, while in the EG2 there were no pre-post test differences. The CW decreased by 33, 3% in the control group and EG2, while in the EG1 there were no differences. About the functional tests, the 1RM at the leg press improved in the CG (+ 34.6%) and in the EG1 (+ 20%), while in the EG2 there were no differences; the 6MWT improved in the CG (+ 7.4%); the 30CST improved in the CG (+ 9.1%) and in EG (+ 14.3%) and TUG improved in all groups (CG -25%, EG1 -12.5%, EG2 -16.7%).
Conclusions: The results presented are preliminary in nature and consequently no generalizable conclusions can be drawn about the data. However, what has emerged is that all subjects were able to complete the high-intensity trainings and that all groups have a tendency to improve the measured parameters. In any case, it is necessary to expand the number of subjects and data to draw more precise conclusions.
Acknowledgments: Choko-age is a scientific project funded by the Joint Programming Initiative (JPI) call PREVNUT through the ERA-HDHL cofund of the H2020 European programme.

High-Intensity interval training in a preabilitation program: effects on exercise capacity in subjects with colorectal cancer

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Purpose: Colorectal Cancer (CRC) is the third cancer type for incidence worldwide. Intestinal resection is the most effective treatment with post-operative complications in the 25–50% of cases. Several studies reported that the level of Cardio-Respiratory Fitness (CRF) is inversely associated with the risk of post-surgical complications. Therefore, the preoperative period can be used with exercise programs aimed to increase the level of CRF. It has been shown that High Intensity Interval training (HIIT) involves a series of rapid physiological adaptations that improve body composition and increase the maximal oxygen uptake (VO2peak). The purpose of this study is to analyze the feasibility and effectiveness HIIT in a "prehabilitation" program for increasing CRF.
Methods: Thirty-one subjects (F = 12) with CRC, in election by intestinal resection were involved. They were evaluated through the Six-Minute Walking Test (6MWT), CardioPulmonary Exercise Test (CPET) and muscle strength test (1-RM), four and one weeks before surgery (T-4 and T-1 respectively). In the period between diagnosis and surgery, the subjects followed a prehabilitation program consisting in 3-session/week for 4-weeks of HIIT and muscle strength training. HIIT was performed on the treadmill and structured as follows: 4 times 3 min at an exercise intensity in speed and grade corresponding to the 90% of VO2peak measured by CPET, interspersed with steps of 4 min at 30% of VO2peak. Every 3 sessions the workload was increased by 10%.
Results: Participants have a mean age of 68 ± 9yrs and an average BMI of 29.0 ± 5.5. During the first CPET four patients were excluded for ECG alterations and two patients withdrew from the study for personal problems. Twenty-five patients performed T-4 and T-1 evaluations and completed an average of 80% of the sessions. There was a significant increase from T-1 to T-4 of 10% in the distance of 6MWT, 3% in VO2max, 25% in the muscular strength of the lower limbs and 10% for the upper limbs.
Conclusions: The preliminary results demonstrated that the HIIT program was safe, feasible and effective in increasing CRF. The proposed program and the relative progression of workloads proved to be tolerable by the participants, recording a high adherence to the study. The ongoing study requires a larger sample to confirm this preliminary analysis.

Exercise-based and multidisciplinary model in primary and secondary prevention for outp-atients with cardiovascular disease: role of the kinesiologist

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Purpose: Cardiovascular disease (CVD) is the leading cause of death worldwide. Exercise prescription cardiac rehabilitation/secondary prevention (CR/SP) is strongly recommended by current international gidelines (class IA). Despite this overwhelming evidence it is often neglected for organizational and cultural reasons. This work is present an innovative organization model of the AUSL of Ferrara that involves the intervention of the M.Sc Kinesiologist alongside the Cardiologist.
Methods: Since October 2022, AUSL Ferrara organized an adapted physical exercise course (EFA) in primary and secondary prevention for outpatients with CVD referred to the Cardiologist of the "Casa della Comunità" of territorial relevance. Supported by the Cardiologist, the Kinesiologist carries out an interview and performs functional assessment tests. Based on cardiological indications and test results, patients perform a 8-week supervised-training, for two session/week in which the Kinesiologist monitors the heart rate and eventually adjusts the intensity of exercise, according to the perceived effort Borg scale. After 2-months, the fuctional tests were repeated. At the end of the 8-week, patients could decide to continue the supervised program, be involved in walking group on the territory or start an home-based exercise program.
Results: From October 2022 to July 2023, 23 patients (11F), mean age 65 ± 10, and BMI 29.0 ± 7 were followed. Two patients dropped out the training sessions, four are still being treated. Seventeen patients completed the two-month program, with an increase of 52% in VO2max estimated; muscle strength tests showed an increase of 42.8% in the upper limbs, 31.9% in the lower limbs and 1.8% in balance.
Conclusions: The proposed EFA program proved to be safe and effective in increasing the exercise capacity of outpatients with CVD. In the proposed model, the multidisciplinary collaboration between cardiologist and kinesiologist make possible the effective inclusion of EFA in primary and secondary cardiovascular prevention programs in territorial medicine. It is also feasible and effective in allowing adherence to treatment in almost all patients.

Effect of high-intensity exercise and chocolate with vitamin-e supplementation on body composition and strength in elderly people with dementia: preliminary data from the chokoage study

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Purpose: Ageing and cognitive decline are associated with undernutrition and dysregulation of the hypothalamic–pituitary–adrenal axis, with increased cortisol levels that seem to favour sarcopenia and fragility. This ongoing study aims to assess the effect of physical exercise and vitamin-E-functionalized dark chocolate on changes in muscle mass and strength in dementia patients.
Methods: Participants were allocated to exercise (EX), exercise + chocolate with or without Vitamin E (CH1 or CH2, double-blinded) group. Three training sessions a week were performed for 12 weeks, consisting of 4 × 4' @90% of heart rate maximum walking on a treadmill (HIIT) and 4 × 4 repetition @85% 1-RM at the leg press. We evaluated body composition, maximal voluntary contraction (MVC), rate of force development (RFD) and maximal voluntary activation (%VMA) during an isometric knee extension with interpolated twitch technique. CH1 and CH2 participants assumed 30 gr of chocolate daily.

Results: Data from seven participants are presented (68 ± 7 years). Lower limb lean mass seems unchanged in EX (+ 0.1% ± 0.8%) and increased in CH1 (+ 2.7% ± 0.7%) and CH2 (+ 4.2% ± 3.2%). All groups seemed to show an increase in MVC (+ 6.9% ± 0.6%, + 3.5% ± 18.5% and + 25.0% ± 43.6%), RFD (+ 48.6% ± 78.2%, + 14.1% ± 23.7%, + 48.8% ± 13.6%) and %VMA (+ 2.5% ± 5.6%, + 11.5% ± 19.8% and + 14.5% ± 23%), data for EX, CH1 and CH2 respectively.
Conclusions: To date, no study analysed the effect of high-intensity interval training combined with maximal strength training in improving body composition and strength characteristics in patients with dementia. Although preliminary results don't allow statistical analysis, some important indications appear. Firstly, almost all participants were able to perform the high-intensity training proposed. Secondly, most of the participants improved in all the outcomes.
Acknowledgments: This project has received funding under the umbrella of the European Joint Programming Initiative "A Healthy Diet for a Healthy Life" (JPI HDHL) and of the ERA-NET Cofund ERA-HDHL (GA N° 696, 295 of the EU Horizon 2020 Research and Innovation Programme).
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Relationship between upper limb strength and sprint ability in italian para ice hockey playerS

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Purpose: Para ice hockey, also known as sledge hockey, is the paralympic version of traditional ice hockey designed specifically for individuals with physical disabilities. Strong upper-body muscles play a central role in providing muscle power necessary for acceleration and maintaining speed and stability on the sledge during gameplay. This study aimed to explore the relationship between upper limb strength and sprint performance in Italian para ice hockey players.
Methods: Eleven para ice hockey players recruited from two different teams participated in this study. We assessed upper limb strength with shoulder muscles isometric strength and handgrip strength tests. In addition, linear sprint tests (i.e., 10, 20, and 30 m) and specific tests with acceleration change of direction were measured to assess sprint and agility performance. Spearman correlation coefficient was used to evaluate the relationship between upper limb strength in sprinting and agility performance.
Results: Significant correlations were found between the agility test and 10 m ($r = 0.88$, $p < 0.01$), 20 m ($r = 0.89$, $p < 0.01$), and 30 m sprint ($r = 0.89$, $p < 0.01$). Moreover, significant correlations were found between left-hand strength and 20 m ($r = -0.64$, $p = 0.03$) and 30 m sprint ($r = -0.64$, $p = 0.03$).
Conclusions: The study underlines that sprinting ability is related to agility effectiveness in para ice hockey. Furthermore, lower left-hand strength is related to the performance of 20 and 30-m sprints, directly affecting the speed during sprinting. These findings may contribute to understanding the key factors that influence on-ice performance and can help to guide the development of effective training programs.

Simple intradialytic low-intensity exercise supervised by a kinesiologist improved exercise capacity, mental health and quality of life in patients with kidney failure

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Purpose: In this subanalysis of the pragmatic clinical trial (Clinicaltrials.gov NCT04282616 [1]) that set up an exercise facilitator within a dialysis center, we aimed to test the effectiveness of 3-month low-intensity exercise program supervised by a kinesiologist and executed before the beginning of a dialysis session on functional, emotional and quality of life outcomes.
Methods: A total of 51 patients (age 72 ± 11, males n = 35) affected by end-stage kidney disease undergoing maintenance hemodialysis at Ferrara and Cordoba University Hospitals (n = 43 and n = 8, respectively) took part in the study by selecting among the training options offered, to perform supervised exercise prior to the beginning of the dialysis session. The training program, performed 3 times per week, was composed of 30-min sessions including two 4-min interval walking from slow to moderate gradually increasing speed, strengthening exercises for lower limbs (femoral quadriceps, biceps and calves) with ankle weights, mobility and stretching. The same experiences kinesiologist supervised all the training sessions. The outcome measures, collected at baseline (T0) and at the end of the program (3-month, T3) included the 6-min walking distance (6MWD, primary outcome), 5-time sit-to-stand test (5STS), 10-m gait speed (T10), the short-form 36 questionnaire (SF-36) and the Beck Depression Index (BDI).
Results: Eight patients did not start the program for hospital admission (n = 2), death (n = 5) or transplantation (n = 1), while four patients did not complete it for hospital admissions (n = 2) or death (n = 2). The remaining 39 patients completed 83 ± 7% of the prescribed session, without adverse events or falls occurring during training. At the end of the program, 6MWD significantly improved (+ 30 ± 35 m; $p < 0.001$), as well as 5STS (-1.8 ± 4.0 s; $p = 0.023$) and gait speed (+ 0.4 ± 0.3 km/h; $p = 0.009$). All the domains of the SF-36 questionnaire improved, with statistical significance for physical functioning (+ 15 ± 22; $p = 0.014$), general health (+ 8 ± 21; $p = 0.038$) and mental health (+ 10 ± 29; $p = 0.022$). Finally, depression symptoms were improved by a BDI score reduction of 2 ± 3 points ($p = 0.031$).
Conclusions: A low-intensity, low-cost training program conducted before the dialysis sessions and supervised by a kinesiologist of adapted physical activities was associated to good patients' adherence and to improvements of physical function, depression and quality of life in patients with end-stage kidney disease.
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Physical activity improves symptoms and performance in women with fibromyalgia

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Purpose: Fibromyalgia is a chronic syndrome characterized by widespread pain, fatigue, sleep disturbances and other physical and psychological features;it is often associated with low physical activity (PA) and sedentary life style.The main objective of this pilot study was to test the feasibility of a PA program in a group of women and evaluate the possibility to reduce the fibromyalgic pain and related fatigue perception.
Methods: 24 women (average age 54, 45 ± 4, 15 y) with clinical diagnosis of fibromyalgia were recruited for this study and then divided in two subgroups (group1 = 14; group2 = 10) for a better management of training sessions. Both groups underwent 12 wk physical activity program (1 h twice/week) mainly including low-intensity aerobic activity, strength, coordination exercises generally completed by flexibility and relaxing stages. Each subject was assessed before (T0) and after (T1) training program using these tests; Brief Pain Inventory (BPI), Multidimensional Fatigue Inventory (MFI), International Physical Activity Questionnaires (IPAQ), Standard Fitness Test.
Results: 18 of 24 (75%) women were able to complete the whole training period. Paired Student t-test between T0 e T1 showed significant differences in mental fatigue (p = 0, 001); while no significant differences were detected in physical fatigue. Results from Brief Pain Inventory test indicated that after training there were highly significant reduction in pain perception during habitual activities of daily life (p < 0, 001) and about the interference of pain in the general work capacity of women (p = 0, 002). Lower but significant pain changes were detected on their walking ability (p = 0, 032). The fitness tests showed a significant improvement in the lower limb strength (p = 0, 001), in the 6 Minutes Walking Test (6MWT) (p = 0, 001) and a large significant improvement in Time Up & Go Test (p < 0, 001*).
Conclusions: Our data indicate that a group based PA program can be suitable also for people suffering from fibromyalgia and it elicits global positive changes in pain management, in physical condition and in tolerance to mental fatigue. Even if not directly measured a very positive reaction and a explicit willing to continue the exercise program have to be reported.

Action-Perception coupling during free-throw shots in expert and amateur basketball players

Purpose: In basketball many matches are won or lost through critical skills, such as free-throw, a condition in which the player is "free" from defenders, so that the shooter can focalize the visual attention only on the action without visual distractions that could be unexpected and relevant for the performance. Successful free-throw requires both attentional skills and physical ability; therefore, understanding the attentional demands of this ability may provide guidance for improving performance. Considering the relationship between eye movements, action-perception coupling and the direction of attention, the current research investigated the role of saccades and microsaccades when different levels of basketball players were engaged in a free-throw condition.
Methods: We recruited twenty-four male basketball players (21.04 ± 3.0 yrs.), subdivided in two groups, 12 experts and 12 amateurs. Wearing an Eye-tracker for eye movement recording and an inertial sensor to identify the movement time initiation, participants made 20 free-throws in a basketball court.
Results: All participants made more correct than incorrect shoot, meanwhile movement time initiation was shorter in amateur than in expert groups. The analysis of eye movement parameters showed that experts had more stable gaze fixation than amateurs with higher microsaccades rate, duration and lower peak velocity. Amateurs showed higher saccades rate, peak velocity and amplitude than experts.
Conclusions: During precise aiming task, athletes fixate a precise location within 1–3 degrees of visual angle, for at least 100 ms before final movement initiation (i.e. Quiet-Eye). Seems that during this fixation the eyes are never still but make other types of eye movements, such as microsaccades and small saccades, that fit within normal definitions of fixation. These micro-movements enhance visual perception, are strongly modulated by visual attention, and, therefore, represent a fundamental motor process with a specific purpose for gaze behaviour. The spatiotemporal characteristics of microsaccades and saccades may reflect an optimal sampling method by which the brain discretely acquires visual information, and can differentiate between participants that use a fixation before the critical movement time with participants who moves the eyes in order to catch more visual cues to make decisions.
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Muscle shape changes affect the transmission efficiency during in-vivo human contraction

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Purpose: we investigated the muscle's ability to change shape during plantarflexions at low contraction intensities to understand how the uncoupling behaviour between the velocity of a muscle and its fascicles affects the cost of contraction (and muscle efficiency).
Methods: Metabolic, kinetic, EMG and ultrasound data (in soleus and gastrocnemius medialis) were recorded during cyclic triangular fixed-end contractions of the plantar flexor muscles in three different conditions: no load, + 5 kg and + 10 kg of compression. Muscle shape changes, mechanical power, metabolic power, belly gearing and the muscle and fascicle efficiency were obtained.
Results: No differences were observed in mechanical power and electrophysiological variables as a function of compression intensity, whereas metabolic power increased as a function of it. The changes in pennation angle (calculated from rest to the end of contraction) decreased as a function of compression intensity (P < 0.01), leading to a reduction in belly gearing (from 1.15 ± 0.3 to 1.05 ± 0.2 at no load and + 10 kg of compression, respectively). At each compression

intensity, differences in efficiency were observed when calculated based on fascicle or muscle behaviour. To note, muscle efficiency was more compromised than fascicle efficiency as a function of compression intensity. Significant positive correlations (R^2 range: 0.7–0.8 and $P > 0.001$) were observed between delta efficiency (DEff: Eff_{mus}—Eff_{fas}) and delta belly gearing (V_{mus}/V_{fas}) or DV (V_{mus}-V_{fas}).
Conclusions: Changes in the muscles' capacity to change in shape (e.g. in muscle stiffness or due to compressive garments) affect the metabolic demands of muscle contraction as well as the uncoupling behaviour between muscle belly and its fascicles, reducing belly gearing which in turn affect the efficiency of contraction.

Soccer and volleyball players do not land differently: a kinematic analysis of injury-related movement patterns

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Purpose: ACL injuries are common in team sports, often occurring without contact with other players, during landings or changes or direction. Despite these being frequent manoeuvers in soccer and volleyball, the injury rate in soccer is much higher than in volleyball. This study aimed to evaluate kinematic differences during the execution of a landing test battery between the players of these two sports. We proposed 2 monoplanar and 2 multiplanar drop-landing tasks, representing volleyball and soccer injury mechanisms, respectively. Considering the injury rate difference, we hypothesized that volleyball players can adopt safer landing strategies than soccer players, especially in monoplanar tasks.
Methods: 22 soccer (7 females—15 males) and 19 volleyball players (15 females—4 males) performed single-leg landing tasks: drop-landing, drop-jump in vertical, 45°-medial and 45°-lateral direction. Jump height and distance were adapted to subject's height and maximal single-leg horizontal jump distance. The hip and knee adduction and flexion angles were recorded using a 9-camera opto-electronic system. Two Mixed MANCOVAs (Sport and Task, Sex as covariate) were used to analyze initial contact and peak kinematics ($\alpha = 0.05$).
Results: Sport effect, as well as the Sport x Task interaction, were not significant in either analysis ($p > 0.05$), while both initial contact and peak kinematics were highly task-dependent ($p = 0.034$ and $p < 0.001$, respectively).
Conclusions: The Task was expected to significantly affect most of the initial contact and peak analysis variables. Despite we hypothesized that volleyball players would have landed with lower knee abduction and hip adduction, and more flexed lower limb, they presented similar patterns with respect to soccer players in each task. We thus suppose that sport-specific extrinsic factors, such as surface, shoes, and in-game situations, may be more influential on ACL injury risk in soccer and volleyball rather than only considering movement kinematics.

Single-leg stance stability assessment: an alternative perspective for sports

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Purpose: The assessment of single-leg stance stability (SLSS) is widely utilized for postural analysis[1] or following knee ligaments injuries[2]. The objective of this study is to examine the relationship between SLSS and motor control during landing and jumping tasks.
Methods: Fifteen high-level youth volleyball players (18.9 ± 1.2 years; 194.3 ± 9.6 cm; 83.2 ± 8.9 kg) underwent testing for SLSS and landing/jump performance using the original Landing Error Score System (LESS) protocol[3]. The stability assessment procedure included SLSS keeping the support leg both in an extended and flexed knee position, maintaining stability for ten seconds. A pressure platform (FreeMed, Sensor Medica, Italy) was used to measure stability in both legs and the center of pressure (CoP) sway path length was measured. For the LESS test the contact time on the ground between landing and jumping (CT), as well as the time of flight during jumping (ToF), were measured using a high-speed camera (GoPro9, Woodman Labs, USA) positioned in the sagittal plane view. The recorded videos were analyzed using 2D video analysis software (Kinovea, France) by a skilled professional who analyzed all tests. Data were analyzed using a Student's t-test to determine significant differences between the two legs, and a Pearson correlation coefficient was used to investigate relationships between parameters. The significance level was set at $P < 0.05$.
Results: No significant differences were found in the CoP sway path length between the right and left leg during SLSS with the knee extended and flexed (547.0 ± 168.0 mm left and 630.2 ± 104.4 mm right, $p = 0.115$; 674.0 ± 176.5 mm left and 606.5 ± 107.7 mm right, $p = 0.057$, respectively). However, a significant difference in CoP sway path length was observed between knee extended and knee flexed positions during left SLSS (547.0 ± 168.0 mm and 674.0 ± 176.5 mm, $p = 0.023$, respectively). When combining the sway path lengths of both legs to obtain a synthetic parameter for overall sway, significant correlations were found with CT and ToF in the LESS. CT showed a significant correlation with CoP sway path length during knee flexed SLSS ($R = 0.72$), but not during knee extended SLSS ($R = 0.17$). ToF correlated with CoP sway path length in both knee extended and knee flexed SLSS ($R = -0.66$ and -0.65, respectively).
Conclusions: The results of this study indicate that performing the SLSS test with the knee flexed may provide greater predictability of landing and jumping performance in volleyball players. Testing the SLSS with the support leg in a flexed knee position can be considered more demanding for the ankle, knee, and hip, providing a more comprehensive insight into the athlete's stability behavior compared to performing the test with the knee extended.
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Postural control and muscle co-contraction during unexpected perturbations of the support base in a group of young healthy subjects

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Purpose: The translation of the base of support represents a promising approach for objectively assessing dynamic balance

control. Indeed, muscles are engaged to react to those stimuli to regain balance and avoid falling. This study aimed to investigate postural control and lower limb and trunk muscle activity during unexpected perturbations of the support base.
Methods: Ten healthy subjects (F = 5; 24.00 ± 1.49yrs; 1.66 ± 0.06 m; 59.80 ± 7.33 kg) volunteered to the study. They were assessed on a force platform screwed over a servo-controlled, electrically driven movable plate combining the following settings: direction (forward (FW) and backward (BW)), displacement (25 mm, 50 mm, and 100 mm), and ramp rate (100 mm/s and 200 mm/s). The subjects underwent two sets of 12 trials, randomly combining the plate settings. From the centre of pressure (CoP) anterior–posterior trajectory of the 2.5 s time window after the perturbation occurred, the first peak (FP), the maximal oscillations (ΔCoPMax), and the standard deviation (PPV) of the CoP trajectory were calculated. The surface electromyography (s-EMG) of the tibialis anterior, gastrocnemius lateralis, rectus femoris, biceps femoris, rectus abdominis, and erector spinae was recorded within the same time window to calculate the co-contraction index (CCI) of the leg, thigh, and trunk.
Results: CoP displacement was influenced by ramp rate and direction. In detail, a higher ramp rate determined higher FP and ΔCoPMax values ($p < 0.001$). Similarly, BW direction produced greater FP ($p < 0.01$) and ΔCoPMax ($p < 0.05$) values. FP was also affected by longer displacement ($p < 0.01$). PPV increased along with displacement ($p = 0.001$) and ramp rate ($p < 0.001$). CCI values were globally lower when displacement increased ($p < 0.001$). Moreover, a significant increase in the leg CCI ($p < 0.001$) in the FW direction was observed, whereas this difference was not present in the thigh and trunk CCI.
Conclusions: The greater values of FP and ΔCoPMax in the BW than FW could depend on the foot–ankle complex that allows for a greater CoP displacement toward the tiptoes. The higher CCI values of the leg in the FW condition increased the ankle joint stiffness accounting for the reduced displacement of the CoP towards the heels.
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Alterations in single-leg drop jump kinematics and ground reaction forces after a subject-adapted fatiguing protocol

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Purpose: Neuromuscular fatigue reduces the capacity to produce force and alters motor strategies during dynamic movements. Whether these altered strategies increase the risk of musculoskeletal injuries is still unclear [1]. Here we investigate whether fatigue may be a risk factor for anterior cruciate ligament (ACL) rupture, one of the most common injuries during sport activity.
Methods: Fifteen healthy male volunteers performed four repetitions of single leg drop jump, before and after a fatiguing session on a cycle ergometer until exhaustion. This exercise was adapted to the fitness level of each participant by setting its intensity to 10% above their individual anaerobic thresholds, previously identified by means of cardiopulmonary exercise tests. Sagittal joint angles and the maximum weight-normalized vertical ground reaction force (vGRF) before and after cycling were compared using two-ways repeated measure ANOVA for both legs, evaluating whether the cycling exercise induced motor alterations typically associated with an increased risk of ACL injury.
Results: The cycling session caused a significant reduction of jump height for both legs (Δ = − 1.1 ± 0.4 cm, mean ± standard error; $p = 0.02$). Movement kinematics was also significantly affected by the fatiguing exercise for both legs. Post-cycling there was a reduction of hip flexion during ground contact after dropping (Δ = − 3 ± 1°, $p = 0.01$) and at heel strike after jumping (Δ = − 2.8 ± 1°, $p = 0.02$). There was a significant reduction of knee flexion at heel strike after both dropping (Δ = − 2.9 ± 0.7°, $p < 0.001$) and jumping (Δ = − 3.5 ± 0.7°, $p < 0.001$). Finally, there was a significant reduction of ankle dorsiflexion during ground contact after dropping (Δ = − 1.7 ± 0.5°, $p = 0.007$). The fatiguing session also caused a significant reduction of vGRF after dropping (Δ = − 0.18 ± 0.07 N/kg, $p = 0.03$).
Conclusions: The reduced hip and knee flexion that we observed post-cycling are motor strategies typically associated with an increased risk of ACL rupture [2]. The reduced ankle dorsiflexion may also load the ACL under the action of the ankle plantarflexor muscles. These kinematic alterations therefore suggest an increased risk of ACL injury after fatigue. Nonetheless, the unexpected reduction of vGRF at landing may reduce internal knee forces. Additional analyses on joint moments and muscle activity will be performed to further detail these results.
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The acute effects of wobble board performance on hand tremor: how much is it functional?

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Purpose: A range of wearable sensors has been used to capture human movements such as fine motor skills. Specifically, inertial measurements unit (IMU) have been used for the assessment of physical symptoms such as Hand Tremor (HTR), crucial to perform fine motor skills. Although training proved to be effective in improving HTR, little is known on the acute effects of specific hand exercises on HTR. Therefore, this study aimed to investigate the acute effects of 30 min hand exercises on HTR also in relation to sex.
Methods: 16 healthy subjects (Men(M) = 10; Women(W) = 6; age: 25.4 ± 2.9yrs) were asked to sit on a chair and extend their dominant upper limb forward with an IMU fixed under the palm at the middle finger level while resting the contralateral limb on the armrest. HTR was recorded for 10 s PRE and POST hand exercises. The exercises comprised four 15 s trials (antero-posterior, medio-lateral, clockwise, counterclockwise) performed on a computerized wobble board (WB), with a 30 s recovery period in between. The trained limb was positioned at a 90° on the WB placed on a table, and a monitor displaying the real-time performance of the WB was positioned at eye level.

Subjects were instructed to maintain a motion marker within a target zone, displayed on the screen, for as long as possible during each trial. The IMU's Acceleration (A) data on the z axis were downloaded using a USB connecting cable with proprietary software. Linear repeated mixed models were utilized to examine the effects of WB exercises on subject's Az axis HTR, in relation to sex. Significance level was set at $p < 0.05$.

Results: The analysis showed a significant main effect ($p < 0.034$) for sex on the Az axis, with M showing higher values than W. Specifically, significant differences were found between sex in PRE (M: 3.18 ± 0.4 cm/s^2; W: 2.65 ± 0.2 cm/s^2; p = 0.039) and POST (M: 3.23 ± 0.4 cm/s^2; W: 2.63 ± 0.2 cm/s^2; p = 0.013) evaluations. However, hand exercises led to distinct patterns in Az at different time points, with M increasing their HTR, and W decreasing it.

Conclusions: In line with the literature, findings showed that M had higher HTR than W. Although the implementation of training interventions to improve fine motor skills in healthy individuals is essential, future studies should evaluate the acute effects on gesture accuracy to understand whether this increase in HTR in M is a limiting factor on the performance of fine motor skills or a physiological adjustment that could improve precision and accuracy.

A pilot study on the neuromuscular excitation during indoor static skydiving

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Purpose. Indoor skydiving originated as a safe environment for military paratroopers and then became a training field to practice human flight under controlled conditions. Individual and collective competitions have been recently proposed, requiring the athletes to perform a combination of four fundamental body postures to execute a coded choreography moving in all the directions. The increasing interest in such discipline deserves a comprehensive physiological evaluation of this sport, including the assessment of the neuromuscular excitation. The present study describes the muscular excitation during the four fundamental static positions.

Methods. Nine expert indoor skydiving instructors (8/1 M/F; age 31±6 yr; body mass: 70.0±10.5 kg; stature: 1.74±0.08 m; mean ± standard deviation (SD)) participated in this study. The surface EMG signal was recorded on the anterior deltoid (AD), posterior deltoid (PD), pectoralis major (PM), latissimus dorsi (LD), rectus abdominis (RA), erector spinae (ES), rectus femoris (RF), and biceps femoris (BF), for each of the four fundamental positions: SUPINE, PRONE, SIT, head down (HD). Heart rate was recorded to assess the activity effort intensity. The EMG signal root mean squared (RMS) was determined and the neuromuscular load (NeLo, i.e., the sum of RMS of all muscles divided by muscles number), was determined as index of the general neuromuscular excitation. A one-way ANOVA RM evaluated the differences among positions. A correlation analysis was conducted to detect co-excitations. The statistical significance level was set to alpha = 0.05.

Results. Heart rate indicated SUPINE and HD as the least and the most challenging postures (85.3±8.4 and 132.3±19.7 bpm, respectively, $p<0.05$). SIT and HD were the most demanding postures in terms of NeLo (22.7±10.6 and 32.2±6.6 mV respectively, $p<0.05$) due to the higher engagement of LD, ES, RF and BF ($p<0.05$ vs SUPINE and PRONE). Noticeably, while SUPINE and PRONE required a uniform muscles excitation, SIT and HD presented signs of excitation variability, specifically in lower body muscles. Correlation analysis detected some co-excitations, likely to stabilize the shoulders and hip joints.

Conclusions. Attention should be given to the training of lower body muscles to facilitate the adoption and maintenance of SIT and HD postures. Nonetheless, both AD and PD should be carefully trained to stabilize the shoulder joint.

Acknowledgments: All authors are grateful to the Aerogravity General Manager and the instructors of Aerogravity (Milan).
Biomechanics and Motor Control.

Perception and reproduction of an illusory movement: a comparison between old and young participants using motion analysis

Purpose: Proprioception is the capability to sense the position and the movement of the body. The main contributors to this capacity are the muscle spindles, although several peripheral and central structures are involved. Some of these structures can be altered by the aging process. Using a vibro-tactile stimulus it is possible to elicit a kinaesthetic illusion of movement (KI), which can activate the muscle spindles as well as the sensory and motor areas in the brain. The aim of this study was to explore the differences in proprioception between old and young populations by assessing through KI the conscious perception of movement and the illusory experience.

Methods: Participants sat on a chair with both arms on a table, fixed in the same position with an adjustable brace. To induce a KI of wrist flexion, a mechanical vibrator was placed on the extensor retinaculum of participants' dominant wrist. Seven different frequencies of vibration were used: 50 Hz, 60 Hz, 70 Hz, 80 Hz, 90 Hz, 100 Hz, 110 Hz. During the vibro-tactile stimulation, subjects were asked to reproduce the illusory movement with the contralateral wrist and rate on a VAS scale the vividness of the illusion, the amount of movement perceived and its fluidity. Qualisys motion capture system was used to record the movement. To assess differences between old and young participants, the kinematic parameter of angular displacement and velocity were considered, as well as the scores related to the subjective perception of the KI.

Results: Eighteen subjects were recruited and divided in two groups based on their age; the young group (11 females, 1 male, mean age ± SD = 27.83 ± 5.32 years), the old group (3 females, 3 males, mean age ± SD = 69.3 ± 3.8 years). Angular displacement and angular velocity were significantly higher in old than in young subjects and increased as the frequency of vibration increased. The subjective scores of vividness of illusion, amount of movement and fluidity increased as the frequency increased in young but not in old people.

Conclusions: Differences between old and young participants were reported in both the kinematic parameters of the reproduced movement and in the experience of the illusory sensation of movement. These preliminary findings suggest that aging alters the perception of movement evoked by a vibro-tactile stimulation. Further data are needed to better characterize this phenomenon.

Phase-Specific predictors of swinging and fixed arm countermovement jumps in healthy non-athletes

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Purpose: Countermovement vertical jumping (CMJ) is a commonly used exercise to monitor an individual's neuromuscular capacity (https://doi.org/10.1123/ijspp.2013–0413). Previous research has shown that increased eccentric rate of force development appears to be a better predictor of jumping performance than concentric rate of force development during jumps with swinging arms in power ath letes. The aim of the present study was to investigate the magnitude of changes in phase-specific predictors of countermovement jumps per formed with both swinging and stationary arms in healthy active participants.
Methods: After a familiarisation session, 32 collegiate male and female non-athletes performed two sets of five CMJs each with either swinging or fixed arms on a force platform. All phase-specific performance predictors were derived, and a correlation analysis was performed between concentric and eccentric force variables and jump height measured by the impulse momentum method and the modified Reactive Strength Index.
Results: The best predictor of jump performance in the two different jump modalities was the average concentric force, while the eccentric RFD shows little positive correlation with performance.
Conclusions: Both jump modalities in non-athletic subjects are influenced by the concentric phase. Healthy subjects seem to have different performance predictors during the CMJ, probably due to an inability to perform an effective stretch–shortening cycle and a lack of proper coordination.

Electromyographic analysis of core training exercises using BOSU® and FLYBOARD® tools

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Purpose: Core stability and strength exercises are commonly included in different training programs in order to improve performance, prevent injuries and enhance functional rehabilitation. Previous researches highlighted the importance of these components to increase neuromuscular control and trunk strength in sport, fitness and medical fields, and several tools have been suggested. In particular, unstable surfaces (like Bosu® and Flyboard®) have been investigated in order to analyse core musculature during specific exercises. Even if previous studies suggested how to train those muscles in different conditions, the role of unstable surfaces is still debate. The aim of this study is to investigate the activation of abdominal and lumbar muscles during trunk movements executed with specific tools and body positions.
Methods: Ten healthy and trained people volunteered for the study (8 male and 2 female, mean age 27, 8 years). They performed 4 exercises using Bosu® and Flyboard®: trunk flexion (supine position on the tools—FLEX), trunk extension (prone position on the tools—EXT), sagittal body sway (vertical position on the tools—SAG) and frontal body sway (vertical position on the tools—FRONT). Each movement was executed by holding static muscles contraction at specific body position in order to highlight muscles activation. Muscle activity was recorded using electromyography (EMG) for rectus abdominis (RA), obliquus externus (OE) and lumbar erector spinae (ES) in right (R) and left (L) side of the body. Data were analysed in order to compare different surfaces (Bosu® and Flyboard®) and to quantify the role of each muscle.
Results: Muscle activity changed in relation to specific tool and body position. In particular, FLEX evidenced higher values for RA using Flyboard® and for OE using Bosu® in both sides, even if the differences between two surfaces were not significant ($p > 0.05$). EXT highlighted similar EMG activity for ES R and ES L in both tools ($p > 0.05$). FRONT global muscle activity is significantly superior using Flyboard® compared to Bosu ® ($p < 0.05$). In particular, OE and ES for R and L side showed higher values in relation to sway direction ($p < 0.05$). SAG evidenced increased muscles activity for RA and OE during posterior sway and for ES during anterior sway, ($p < 0.01$) even if no differences were found between two tools ($p > 0.05$).
Conclusions: Bosu® and Flyboard® increase muscle activity in a similar way during trunk flexion and extension movements. Although the differences were not significant, Bosu® and Flyboard® seem to mainly improve OE and RA activation, respectively. The level of instability and tool's shape could determine these results. Body sway movements in frontal plane elicit higher muscle activity using Flyboard®, while no differences between surfaces emerge in sagittal plane. The stabilizing role of core musculature is highlighted during anterior and posterior sway, where front and back muscles are differently involved in lumbo-pelvic control. Consequently, isometric exercises using Bosu® and Flyboard® can effectively challenge the core region.
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Flexibility of the lower back and hamstring muscles as predictors of front saddle pressure in cyclists

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Purpose: Abnormal pressures on the saddle could lead to injuries to the perineum in cyclists [1]. Several factors can influence saddle pressures, including the different anatomical conformation of the pelvis and its position with respect to the sagittal plane. Movements of the pelvis in the sagittal plane (anteversion and retroversion) are possible thanks to different muscles, such as the lower back muscles. The purpose of this study was to evaluate the relationship between the V-sit and reach test, which measures the flexibility of the lower back and hamstring muscles, and the pressure in the anterior region of the saddle.

Methods: Fifteen young cyclists (11 m, 4f) were recruited. First, each participant was asked to perform the V-sit and reach test [2]. Then, each participant was evaluated on their bike installed in a specific bike roller (MagneticDays). Saddle pressures were recorded at 3 different intensities (100, 140, 180 W) using a sensor matrix inserted in the saddle (W-Saddle Pro).
Results: The score of V-sit and reach test was a significant predictor of pressure in the anterior region of the saddle at 100 W of pedaling intensity ($R^2 = 0.602$, $F_{(1, 13)} = 7.39$, $p = 0.018$), of pressure in the anterior region of the saddle at 140 W of pedaling intensity ($R^2 = 0.540$, $F_{(1, 13)} = 5.35$, $p = 0.038$), and of pressure in the anterior region of the saddle at 180 W of pedaling intensity ($R^2 = 0.591$, $F_{(1, 13)} = 6.96$, $p = 0.020$).
Conclusions: The V-sit and reach test could be considered a method of predicting front saddle pressures. In particular, higher values of the V-sit and reach test (i.e., greater flexibility) could predict lower pressures in the anterior region of the saddle.
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Characterization of gut microbiota in elite soccer players

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Purpose: Evidence of the relationship between physical activity and gut microbiota composition is steadily increasing. The purpose of the study is to compare the gut microbiota composition of a group of elite male soccer players with a group of subjects with different physical activity levels.
Methods: Cross-sectional studies were performed on 91 healthy young males, in detail: 17 elite soccer players (23.7 ± 4.2 yrs, BMI 23.2 ± 1.2 kg/m2), 14 with high levels of physical training (24.5 ± 5.6 yrs, BMI 22.7 ± 0.8 kg/m2), 23 with moderate levels of physical training (29.3 ± 3.9 yrs, BMI 22.5 ± 0.8 kg/m2) and 37 healthy men without exercise habits (28.1 ± 5.9 yrs, BMI 22.4 ± 1.0 kg/m2).
Relative microbiota composition was determined by analyzing DNA extracted from stool samples. The quality and quantity of extracted DNA were assessed using the Qubit Fluorometer. Differences between subjects' populations were analyzed using a one-way ANOVA, and Bonferroni's post-hoc test was employed to identify localized effects.
Results: Élite soccer players and high physical activity levels showed a significantly higher prevalence of the nine microbiota populations analyzed than subjects with moderate physical training and sedentary. At the same time, no differences were found in Firmicutes to Bacteroidetes ratio among the different study populations.
Conclusions: This study reports the gut microbiota parameters of elite footballers for the first time. In addition, it brings new insights into the effects of different levels of physical activity on the composition of the gut microbiota.

Changes of brain-derived neurotrophic factor (bdnf) levels after different exercise protocols: preliminary results of a systematic review of clinical studies in Parkinson's disease

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Purpose: Brain-Derived Neurotrophic Factor (BDNF) serum levels are reduced in patients with Parkinson's Disease (PD). This study aimed at assessing if exercise volume, intensity and type are associated with changes in BDNF in patients with PD.
Methods: We used the methods proposed in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We included both controlled and non-controlled experimental studies with patients with PD, which assessed BDNF before and after different exercise protocols. We searched clinicaltrials.gov, CINAHL, Embase, PubMed, Scopus, Web of Science for studies listed from 2003 to 2022. Intensity of exercise was estimated with a time-weighted average of Metabolic Equivalent of Task (MET). Exercise volume was estimated by multiplying MET and duration of each exercise session for the number of sessions. Exercises were classified into the following categories: aerobic, resistance, balance and others. For each study arm we computed Cohen's d as a measure of pre-post intervention change in BDNF values, and calculated its correlation with weekly volume, total volume, average intensity and time spent in different exercise types.
Results: A total of 5681 unique records were identified and 53 were considered potentially relevant by screening titles and abstracts. Sixteen studies (8 controlled trials and 8 single-arm trials) were eligible for the systematic review. Overall these studies included 384 patients with PD, with sample size ranging from 9 to 95. The time-weighted average of MET was often greater than 2.5, whereas the total number of MET-hours ranged from 24.7 to 123.2. Nearly half of all exercises were aerobic and about one in five were resistance exercises. We found moderate-to-good correlations between Cohen's d and total MET-hours ($r = 0.52$, $p = 0.028$), time-weighted average of MET ($r = 0.69$, $p = 0.001$) and total time spent in aerobic exercise ($r = 0.69$, $p = 0.002$). A positive correlation, based on only 5 study arms, was found between time spent in resistance exercise and Cohen's d, whereas time spent in other types of exercise and weekly volume did not show a significant correlation.
Conclusions: These preliminary findings suggest that exercise intensity, overall volume and time spent in aerobic exercise may increase BDNF levels in patients with PD. Future studies should improve the description of exercise protocol in order to better characterise intensity, volume and type of training.

Multidisciplinary approach to investigate a deep vein thrombosis event in a young elite basketball athlete

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Purpose: In recent years, laboratory medicine has assumed considerable importance in sports medicine, providing a valid tool for monitoring the athlete's health. In fact, it is known that practicing sport at agonist levels exposes athletes to an increased risk of infections, inflammation, muscle damage and cardiovascular disorders, which can be seriously harmful, if not promptly treated.
Methods: In this study, we designed an integrated approach to explore the causes of a deep venous thrombosis event in an elite basketball player.
Results: To investigate the health status of the athletes, we measured concentrations of C-reactive protein, ferritin and iron, all of which were within the normal range. Since the complete blood count revealed a marked platelets number (838 × 103μL), and thrombophilia screening tests did not reveal any significant alteration, we evaluated the thrombin generation. This test revealed an increase in the peak height (125.7%), Endogenous Thrombin Potential (ETP) (100.4%), Velocity Index (124%) and with an ETP inhibition, following the addition of Thrombomodulin, of 16.05%, highlighting a state of hypercoagulability. First level haemostasis exams showed only a slight prolongation of the activated Partial Thromboplastin Time (aPTT). Thus, a screening tests for von Willebrand Disease showed a reduction of vWF parameters. Therefore, we directed our hypothesis towards a diagnosis of acquired von Willebrand disease secondary to Essential Thrombocythemia (ET). To confirm this hypothesis and highlight the molecular mechanism underlying the observed phenotype, molecular tests were performed to evaluate the presence of the most common mutations associated with ET, revealing a 52 bp deletion in the coding region of CALR exon 9, classified as "pathogenic" according to ACMG guidelines.
Conclusions: This case report highlights the importance of an integrated approach in monitoring the athletes' health status to personalize training and treatments, thus avoiding the appearance of diseases and injuries which, if underestimated, can undermine the athlete's life.

Evaluation of the antioxidant system in professional basketball athletes

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Purpose: It is known that constant physical activity carried out adequately and followed by a correct diet has a positive impact on the physical and mental health of the individual. Nevertheless, regular physical activity as well as prolonged and intense physical activity is considered one of the conditions that induce oxidative stress. Exercise increases stress levels oxidative through the overproduction of reactive oxygen species (ROS) as the anion superoxide (O2-), hydroxyl (OHHO) and peroxide radical (RO2).
Methods: To evaluate the impact of the physical excercise on the antioxidant system, we determined the gene expression by RT-PCR of four genes involved in the antioxidant system such as XC/T, GCLM, G6PD and CHAC1. For this study we recruited a group of professional basket athletes and and a group of sedentary controls at two different time: 0 month, in September and after 2 months, in November.
Results: : Our results showed that XC/T, GCLM and CHAC1 increased in both months, September and November, in athletes compared to the controls. XC/T, GCLM and CHAC1 are also increased in athletes in November respect to the athletes in September. Instead the trend of G6PD is different: we noted that its gene expression increased in the month of September in athletes compared to the controls, while in the November it decreased in the athletes and almost constant in the controls.
Conclusions: In professional athletes, the antioxidant system is more activated and allows the athlete to support the performance of intense physical exercise, guaranteeing protection from ROS. This study showed that constant monitoring of the athletes helps to safeguard the general state of health of the athlete, avoiding loss of form and/or injuries in order to optimize athletic performance.

Impact of structured exercise in primary school children oral microbiota composition

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Purpose: We have recently shown that active primary school children have an enrichment of oral microbiota species and genera associated with a healthier profile compared to sedentary counterpart[1]. The aim of our study was to evaluate the effects of different physical activity programs on saliva microbiota composition in primary school children.
Methods: 61 sedentary primary school children belonging to Turin schools were divided into 3 groups of physical activity based on different programs for 6 months: 22 Structured exercise (SE—2 h/week of muscle activation, strength and coordination exercises, supervised by kinesiologists), 20 Ecological Activities (EA-1 h/week plus 15 min/4x/week of walking/running outdoors, supervised by class teacher) and 19 curricular activities, as a Control Group (CG—2 h/week of physical activity, supervised by class teacher). The composition of oral microbiome was investigated in all children using 16S rRNA sequencing. Amplicon sequence variants were filtered, decontaminated and phylogenetically assigned using DADA2 software. Differential abundance analysis for microbiome taxa and pathway data were obtained using LEfSe algorithm.
Results: Neisseria and Abiotrophia genera (LDA score: 5.34 and 3.98 respectively; $p < 0.05$) and Gemella Sanguinis and Abiotrophia Defectiva species (LDA score 3.92 and 3.98, respectively; $p < 0.05$) were more abundant in CG compared to SE oral microbiota. Conversely, Prevotella and Dubosiella were more abundant genera (LDA score: 5.56 and 3.68; respectively; $p < 0.05$) in SE compared to CG oral microbiota.
Conclusions: We found an abundance of Prevotella[2] and Dubosiella[3] genera associated to anti-aging functions in SE compared to CG saliva and an abundance of *Gemella Sanguinis*[4] and *Abiotrophia Defectiva*[4] species, associated to infective endocarditis in CG compared to SE saliva. Our results highlight the influence of Exercise on the healthier oral microbiota composition.
Acknowledgments: Funded by "Bando PRIN 2017 Prot. 2017RS5M44_003".

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Study of the modulation of soccer players' salivary extracellular vesicles in response to a training session: an innovative source of exercise biomarkers?

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Purpose: Physical exercise represents a highly complex metabolic stimulus which leads to systemic adaptations that improve cardiorespiratory fitness and consequently the capacity for oxygen uptake by working muscles. For this reason, investigating these mechanisms on a molecular level would be of particular importance for the development of personalized exercise protocols to increase sport performance. In this context, extracellular vesicles (EVs) released following an exercise bout and isolated from accessible biological fluids (such as saliva) could represent a non-invasive, complex and dynamic diagnostic tool. Therefore, the present project aims to develop an effective EV isolation protocol from saliva samples, to characterize and utilize these vesicles as a novel source of exercise biomarkers.
Methods: Saliva samples were collected from 18 professional soccer players (Ternana Football Club—BKT Italian League) pre- and post-training (2 h, 15 h and 24 h recovery) and then processed by serial ultracentrifugation. In the preseason period, the training session consisted in a strength workout (30 min.) and small side games (36 min.). In order to characterize salivary EVs, protein content (BCA), particle counting (NTA) and vesicles marker detection (Dot Blot) were performed.
Results: The obtained NTA results showed typical EV size concentration and distribution. Interestingly, Dot Blot highlighted higher CD63 and HSP60 positivity levels in EXOs compared to MVs, and assessed a tendency of the highest CD63 and HSP60 positivity at 15 and 24 h hours post-exercise, suggesting that there is an increase in EVs in response to physical exercise, which could reveal metabolic changes and muscle adaptation to exercise.
Conclusions: The ultracentrifugation protocol applied allowed us to isolate salivary EVs and to further reveal an increase in EVs following the training session. Hence, Salivary EVs could represent an innovative source of exercise biomarkers. For this purpose, further studies would be needed to confirm these preliminary data.

Effects of C-MIR-1303 expression and lifelong football training on proliferation and invasion of human breast cancer cell lines MCF-7

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Purpose: The aim of this study was to evaluate the effect of c-miR-1303 expression and lifelong football training on proliferation and invasion pathways in the human breast cancer cell line (MCF-7).
Methods: Blood samples from 15 veteran football players (VPG; trained at least 60y) and 15 untrained (CG) healthy males matched for age (74.4 ± 4.1 y) were collected from Danish Football Association (DK). MCF-7 proliferation was assessed by *wound healing* assay. In brief, cells were starved in 0.5% FBS for 18 h, scratched and cultured in 5% sera pool from VPG or CG or FBS (as control) or transiently transfected with 25 mM of miR-1303 or miR-1303-Inhibitor for 24 h and 48 h, respectively. The wound closure percentage was calculated in each group and among the groups. The expression of c-miR-1303 in sera from VPG and CG pools and in transfected MCF-7 cells was determined by RT*q*PCR. For the invasion assay, cells were treated as described above and then layered at a confluence of 5000 cells/well over GrowDex in the 24-transwell chamber. After 24 h, the cells were fixed and stained with crystal violet and then counted. Western blot

was performed on extracted protein from MCF-7 cells after 24 h of treatment.

Results: c-miR-1303 expression was downregulated in sera from VPG compared to CG ($p < 0.05$), similarly to the expression found in the *vastus lateralis* muscle biopsy in VPG compared to CG[1]. At 24 h, a significant increase in wound closure was observed in MCF-7 cells transfected with miR-1303 compared to miR-1303-I ($p < 0.05$). Moreover, MCF-7 cells treated with VPG sera pool showed a significant reduction in wound closure compared to CG ($p < 0.05$) and to miR-1303 transfected cells ($p < 0.01$). miR-1303 over-expression increased the MCF-7 invasion compared to miR-1303-I ($p < 0.01$) transfected cells; VPG sera pool treatment induced a shut-down of invasion process in MCF-7 cells compared to CG ($p < 0.05$). A mild increase of p21, p27 and β-Catenin proteins expression was found in miR-1303 compared to miR-1303-I transfected MCF-7 cells ($p < 0.05$) after 24 h.

Conclusions: Our results confirm the reduced expression of c-miR-1303 in VPG compared to CG and that c-miR-1303 expression promotes proliferation and invasion processes in MCF-7 cells. Ongoing experiments are in progress in order to further elucidate the pathways.

Acknowledgments: Funded by "Bando PRIN 2017 Prot. 2017RS5M44_003".

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A cross-sectional study on the relationship between aggressive behaviour and sport practised

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Purpose: This cross-sectional study aimed to measure aggression in a more heterogeneous population of athletes, with the purpose of determining whether some specific conditions are related to aggressive behaviour.

Methods: Athletes of 18–64 years old were enrolled in the study. The Italian version of Buss Perry Aggression Questionnaire was administered.

Results: A total of 390 questionnaires were collected. Males showed higher levels of physical aggression than females and we found a significant reduction in all domains of the questionnaire with advancing age, except for physical aggression. Furthermore, we found that subjects who practise—or have practised—full contact sports showed higher levels of physical aggression than those who practise—or have practised—partial contact or non-contact sports. Finally, we found that those who have played competitively in the past show, now, lower levels of anger than those who have played amateurishly.

Conclusions: Age and gender appeared to be significant in aggression scores. Martial artists and combat sports players showed significantly higher levels of physical aggression than those who practise partial contact or non-contact sports. The type of sport (individual or team players), the practise time (beginners or experts) and the current level of sport (amateurs or competitive players) did not affect the aggression scores. Instead, the past level of sport is correlated with current anger.

Multidimensional study on the psychological factors involved in the relationship between coaches and athletes in rhythmic gymnastics

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Purpose: The central point of the thesis is the study of psychological factors involved in the relationship between coaches and athletes in the athletic context of rhythmic gymnastics. There are many factors that are associated, in particular the athlete's motivation, the quality of the relationship with the coach, performance anxiety and burnout, which were all analysed.

Methods: Data collection took place through a self-report questionnaire (anonymous and online) divided into 5 parts: sociodemographic data and questions about motivation, coach's behaviour, performance anxiety and burnout. A sample of 92 competitive adolescent gymnasts took part in the survey. The data was analysed using the SPSS program, version 27.

Results: The gymnasts registered a strong intrinsic level of motivation and self-determination. The predominance of these factors justifies the strong contrast that emerged between a high degree of performance anxiety and a low amount of burnout. This is a result that is in keeping with most studies.

Conclusions: Despite the scientific evidence, the coaches of this discipline tend to neglect the emotional and psychological dimension of their gymnasts, causing, in fact, an increase in physical and mental levels of anxiety and a decrease in self-confidence. The final conclusions have been expressed in guidelines and actions oriented towards reducing athletic burnout and preventing the risk of abandoning sports early.

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Dreaming consciously: spotlights on the effects of yoga nidra on mental and physical recovery in two elite karate athletes

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Purpose: The purpose of this study was to investigate the effects of an aware sleep state induced by yoga nidra (YN) on recovery-stress balance in two elite karate athletes adopting an idiosyncratic and multimodal approach. YN is a relaxation technique which naturally stimulates a hypnagogic state wherein individuals are physiologically asleep while maintaining a certain level of awareness to follow a guide's instructions.
Methods: Two elite karate athletes (one male and one female) underwent a 10-session YN intervention. Measurements of recovery-stress balance, perceived stress, cognitive and somatic anxiety, subjective and objective sleep quality, and individual alpha peak frequency (iAPF) were conducted before intervention, after intervention, and three weeks later. The perceived quality of recovery was continuously monitored for three months including the investigation period. Feelings and arousal levels before and after each YN session were also assessed. Athletes wore an ActiGraph wGT3X-bt wrist activity monitor (Actigraph, Pensacola, USA) to record sleep parameters. Furthermore, they received a sleep diary to record bedtime and wake-up time. Data from the sleep diaries and wrist activity monitors were used to determine the amount and quality of sleep across all measurement points. Descriptive statistics were computed on the data from questionnaires administered before the intervention, after the intervention, and three weeks later, while iAPF values were subjected to inferential analysis (i.e., analysis of variance).
Results: Overall, the results showed positive effects of YN, with the intervention having a more pronounced impact on sport-specific outcomes in the male athlete compared to the female athlete. In the female athlete, YN exerted beneficial effects both emotionally and physically. We also noted an intertwined relationship between interoception (particularly interoceptive awareness), perceived stress, and YN effects. Moreover, findings suggested that iAPF modulation may reflect improved recovery skills or better control of stressful situations, while the acute effects on arousal levels were expression of anxiety or energy reduction.
Conclusions: Overall, YN improved both perceived quality of recovery and sleep quality, highlighting its importance in enhancing recovery-stress balance in the context of elite sport.

The influence of audience absence on "Sports Performance Share" in the summer paralympic games

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Purpose: The Paralympic Games are the main sporting event for athletes with physical, intellectual, and sensory disabilities. The last edition of the Tokyo 2020 Paralympic Games has undergone profound changes following the Covid-19 pandemic, including the absence of the audience in each race. The dispute of the event without the presence of the audience is a rare and unique event; it follows that the aim of this study is to compare the last two Paralympic editions (Rio 2016 with an audience and Tokyo 2020 without an audience) in order to analyze its role in the sports performances of Paralympic athletes.
Methods: The historical archive of the International Paralympic Committee was used for data collection. Two mathematical calculations were used in order to compare the results; "market share" and "Performance Sports Share" were calculated. All the sports played were analyzed within two macro-categories, subjective sports, and objective sports. Welch's t-test was used to compare the SPS values.
Results: Only sports that have been judged primarily objectively showed a statistically significant change ($p < 0.05$).
Conclusions: Although our study showed a positive effect in objective sports in these two Paralympic Games editions, further studies should be conducted in order to clarify the role of the public in sports competitions. It could be useful to analyze more Paralympic editions or every single sport.

Physiological and performance effects of anodal transcranial direct current stimulation during severe-intensity exercise

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Purpose: Transcranial direct current stimulation (tDCS) is a form of brain stimulation with exciting potential for exercise performance. The apparent ergogenicity of tDCS during dynamic, whole-body exercise, has been extensively studied, but often with conflicting findings. While some authors have found tDCS-induced improvements in exercise tolerance, others reported no effect. The discrepancies between studies may be partially attributed to differences in exercise intensity. The possible influence of tDCS on short-term, high-intensity exercise, however, has not been previously investigated. We, therefore, examined the physiological and performance effects of anodal tDCS during severe-intensity exercise.
Methods: Nine recreationally active men (mean age 26.8 ± 5.1 yr, peak oxygen uptake ($\dot{V}O_2$) 51.7 ± 7.6 ml/kg/min) were required to report to the laboratory on three occasions. On *Day 1*, they performed a ramp incremental exercise test on an electronically braked cycle ergometer to determine GET, peak $\dot{V}O2$, and peak power. Then, on *Days 2* and *3*, participants received, in a random and crossover order, 20-min of brain stimulation of either sham tDCS or anodal tDCS (current intensity: 2 mA). In both experimental conditions, participants completed a severe-intensity exercise bout to exhaustion at 75% of the difference between the gas exchange threshold (GET) and the peak power attained during the ramp exercise test (75%Δ). Pulmonary gas exchange and ventilation, muscle oxygenation, and hemodynamics data were collected continuously during the exercise bouts. Blood lactate and perceived exertion (RPE) in response to the exercise bouts were also measured.

Results: There were no significant effects of brain stimulation on exercise tolerance ($P > 0.05$). The exercise protocol lasted, on average, 251.3 ± 62.1 s and 247.3 ± 58.9 s in sham tDCS and anodal tDCS conditions, respectively. Neither sham tDCS nor anodal tDCS altered the physiological responses to the severe-intensity exercise bout ($P > 0.05$). Similarly, RPE during the exercise bout did not differ between the two experimental conditions ($P > 0.05$).
Conclusion: Our findings indicate that brain stimulation with anodal tDCS applied over the M1 region does not appreciably alter physiological responses to severe-intensity exercise or enhance exercise tolerance. These results confirm that this simple, noninvasive neuromodulatory technique is ineffective during short-term, high-intensity activities requiring large muscle mass.

The stress-reduction effects of natural environment delivered through virtual reality: a systematic review

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Purpose: The current study aims to examine the acute stress-reduction effects of natural environments delivered through virtual reality (VR).
Methods: For conducting the review, we followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, while concerning the inclusion criteria, we used the Population, Intervention, Comparison, Outcome, and Study design (PICOS) protocol. The inclusion criteria were (a) nonclinical population as sample; (b) the comparison of the exposure to virtual nature through 360° images, biophilic elements, VR prerecorded videos, or immersive environments, excluding augmented reality, and controls; (c) objective (physiological parameters) or subjective (e.g., self-report questionnaires) measures; (d) the reported measures should be quantitative outcomes; and (e) the records were published between 2010 and 2023.
Results: From the initial pool of studies (n = 409), 19 were finally included for synthesis. These studies comprised a total of 1, 168 participants. After a quality assessment on the studies, it emerged that they were of overall moderate quality. It seems that exposing participants to virtual reality nature reduces both objective and subjective stress levels. Moreover, the presence of (a) natural sounds, (b) natural lighting, and (c) water elements seem to be key elements that help VR users reducing stress.
Conclusions: Virtual reality nature can be administered whenever real nature is not accessible, especially if the environment has natural sound, natural light, and water elements.

Executive functions and gross-motor coordination development during a sport season in young artistic gymnasts

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Purpose: Open-skill sports show superior effects on executive functions enhancement, compared with closed-skill. However, also children practising closed-skill sports seem to show better Executive Functions (EFs) compared to sedentary peers. Therefore, the first aim of this study was to investigate whether a high volume of gymnastic training could affect EFs enhancement in young athletes. The second aim was to analyse if there is a correlation between gross-motor coordination development and EFs improvement in young gymnasts.
Methods: Twenty-two advanced female gymnasts (Group A, mean age = 10.64 ± 0.53 yrs, BMI = 17.98 ± 1.94 kg/m^2) and sixteen amateur female gymnasts (Group B, mean age = 10.67 ± 0.73 yrs, BMI = 17.86 ± 2.54 kg/m^2) were included in the study. The group A trained on average 7.5 h/week 4 times/week and the group B trained 2 h/week 2 times/week. Athletes' EFs (Eriksen Flanker and Digit Span tasks), gross-motor coordination (Körperkoordinationstest für Kinder battery—KTK: balance beam, jumping laterally, hopping on one leg over an obstacle, and shifting platforms tests), strength tests (counter-movement jump CMJ, chin up CU, and hollow hold HH) and gymnastics skills (GS) were assessed before and after a 6-month competitive season to verify the impact of different training load volumes in both cognitive and movement areas.
Results: Group A showed higher scores in gross-motor coordination (KTK total score) and fitness tests (CU, HH, GS) than group B, but no-significant differences were revealed for cognitive tests. Both groups significantly improved over time in all KTK tests, CMJ, GS, Flanker and Digit reaction time and rate of correct score tests. However, group A showed higher improvement of gross-motor coordination level than group B (p = 0.04).
Conclusions: Advanced gymnasts showed higher levels of fitness and gross-motor coordination compared to amateur gymnasts with similar levels of EFs. All gymnasts improved their EFs levels over the season, however the role of training should be further investigated whereas this positive effect could also be age-dependent. Although both groups showed over time a volume-dependent improvement in gross-motor coordination, it seems not to be related to a concurrent enhancement of EFs levels.

Psychological aspects and performance in female rhythmic gymnasts: the role of body image

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Purpose: In aesthetic sports, physical appearance is considered crucial for performance. Recent studies emphasize that athletes' concerns about their body can have adverse effects on performance. Conversely, a positive body image can act as a protective factor for athletes' well-being and enhance performance. The aim of the present study is to investigate how different psychological aspects, including body image, predict performance in a sample of female rhythmic gymnasts.
Methods: The study included 27 female athletes (M_{age} = 14.96 ± 2.34; range = 12–22) practicing rhythmic gymnastics at different levels. Athletes compiled different questionnaires investigating positive (Functionality Appreciation Scale, FAS; Body Appreciation

Scale-2, BAS-2) and negative body image (Body Surveillance subscale of the Objectified Body Consciousness Scale, OBCS), competitive state anxiety (Revised Competitive State Anxiety Inventory-2, CSAI-2R), and interoceptive awareness (Multidimensional Assessment of Interoceptive Awareness, MAIA). Furthermore, rhythmic gymnasts' performance (i.e., free-body and with tools) during training and competition was assessed by the judges using performance grids created following the Rhythmic Gymnastics Code of Points.

Results: Positive correlations between performance with tools during training and FAS scores (r = 0.394, $p = 0.042$), and the self-regulation scale of MAIA (r = 0.502, $p = 0.008$) were found. Concerning performance during competition, the self-confidence scale of CSAI-2R positively correlates with free-body performance (r = 0.448, $p = 0.019$) and performance with tools (r = 0.514; $p = 0.006$). BAS-2 scores positively correlated while OBCS negatively correlated with specific performance aspects (all $ps < 0.05$). Regression models were computed to predict performance with tools during training and competition. Performance during training was largely explained by the scores obtained at self-regulation scale of MAIA, FAS scores, and by daily hours of training ($R^2_{adj} = 0.57$, $p < 0.001$). Performance during competition, instead, was largely explained by the scores obtained at self-confidence scale of CSAI-2R and by age ($R^2_{adj} = 0.312$, $p < 0.001$).

Conclusions: This study underscores the importance of body functionality appreciation, self-regulation, and self-confidence in influencing performance outcomes in rhythmic gymnastics. Coaches should consider integrating strategies to improve positive body image and build self-confidence to enhance athletes' performance and well-being.

Occurrence of alexithymia in adolescent team sport

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Purpose: Alexithymia, a neuropsychological phenomenon in which the ability to recognize, describe and express emotions is impaired, is described as a common personality trait, with a 8–20% prevalence rate (1). Since personality traits plays a key role in sport performance (accounting for up to 45%), here we evaluated the degree of alexithymia in young male football players.

Methods: Two young soccer teams, competing in the regional championships, were enrolled: Under16 (U16, n.18, age 15.5 ± 0.6yrs, w 60.4 ± 5.7 kg, h 172.8 ± 6.0 cm) and Under19 (U19, n.18, 17.6 ± 0.5yrs, w 72.9 ± 10.7 kg, h 175.4 ± 6.9 cm); they had at least 2 years of experience, trained 3 times a week (90 min/bout), and played about 30 competitive matches/year. Alexithymia was evaluated by Toronto Alexithymia Scale (TAS-20), composed of three subscales: difficulty identifying feelings (DIF, n.7 items), difficulty describing feelings (DDF, n.5), and externally oriented thinking (EOT, n.8). A total score ≤ 51 refers to non alexithymic subjects, while a score ≥ 61 identify alexithymia. Internal consistency was evaluated with the Cronbach's alpha coefficient. The comparisons of the TAS total score, or the subscale scores, or the single item score between U16 and U19 were estimated by Student's t-test ($p < 0.05$).

Results: The internal consistencies of the test performed by all players, U16 and U19 were acceptable (a > 0, 78). When the internal consistencies of the subscales were evaluated, only DIF had an acceptable evaluation (a > 0, 73). The DDF subscale had a questionable Cronbach's alpha for U16 (alpha = 0, 65), and poor (alpha = 0, 52) or unacceptable (alpha = 0, 34) for all players and U19, respectively. The internal consistencies of EOT subscale was slightly better than DDF but still acceptable for U16 (alpha = 0, 75), questionable for all players (alpha = 0, 62) and unacceptable for U19 (alpha = 0, 40). The total score of the TAS-20 was 58 + 11 for all players and U19, and 57 + 11 for U16. Only items n.15 and n.18 displayed statistically different replies between U16 and U19 (p ≤ 0, 05).

Conclusions: An alexithymia prevalence of at least 30%, higher than general population, was found in U16 (44%) and U19 (33%). Such results are in agreement with previous reports (2, 3) that suggest a correlation with the typical adolescent anxiety (student life stressors) or the duration/intensity training. Further studies need to investigate the cause/effect relationship between alexithymia and sports.

Acknowledgments: DM 737/2021 Univ Napoli "Parthenope".

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Effects of adapted physical activity on psychological condition during rehabilitation. preliminary data from a follow-up study

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Purpose: Adapted physical activity (APA) allows for a global intervention on the individual's resources that is particularly useful in different areas of rehabilitation, acting favourably both on the motility and on the psychological condition of the patient. The present study recruits subjects affected by disability due to acute pathological event or to chronic progressive disease, and aims to evaluate the efficacy of APA on the emotional state, on quality of life and on clinical and personality features, such as depression, anxiety, self-esteem and resilience.

Methods: A longitudinal observational correlational study (3-months follow-up) was conducted on consecutive patients who participated in APA sessions. Inclusion criteria: age over 18; no cognitive impairment; diagnosis of at least one chronic progressive disease or stabilized disease with functional limitations. Personal and anamnestic data were collected and the following psychometric tests were administered: Scaled General Health Questionnaire-28 (GHQ-28); Rosenberg Self-Esteem Scale (RSES); Beck Depression Inventory-II (BDI-II); State-Trait Anxiety Inventory (STAI Y); 14-Item Resilience Scale (14-RS); Short Form 12 Health Survey (SF-12).

Results: First assessment: 76ss (37 M, 39 F), average age 70.7 yrs; average BMI 27.13, with 65% of the sample overweight; Follow-up assessment: 58ss (28 M, 30 F), mean age 69.7 yrs. In all psychometric scales improvement scoring variations were observed, with the exception of the SF-12 MCS. Positive correlations: between RSES, quality of life indices (PCS and MCS) and resilience scores; between BMI and GHQ-28 scores, only in males. Negative correlations: between RSES, depression and social dysfunction GHQ-28 subscales and BDI-II scores; between RS-14 and depression GHQ-28 subscale,

BDI-II, STAY Y-1 and STAY Y-2 scores; between PCS, total GHQ-28 and social dysfunction GHQ-28 subscale, BDI-II and STAI-Y2 scores.

Conclusions: This study supports the evidence of efficacy of APA on the psychological condition of rehabilitation patients, with overall reduction of anxiety and depression, increased self-esteem and resilience, and improvement in perceived physical health. Resilience and self-esteem were confirmed as protective factors for psychiatric comorbidity and for the maintenance of a good quality of life. No gender differences were observed in the psychometric profiles. The improvements obtained in psychometric variables with APA were not attributable to age-related factors.

Predictors of choking under pressure in a sample of archers

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Purpose: Identifying predictors of the choking under pressure episodes in a sample of archers, focusing both on the individual components (anxiety, regulatory modes, decentralization) and environmental components (perception of coach assistance).

Methods: The Decentering Scale for Sport (DSS), the Self-Regulatory-Modes Scale (SRM) and the Sport Anxiety Scale (SAS) were administered to a sample of 115 archers, members of Fitarco Italia Federation.

Results: The correlation analysis found associations between the frequency of choking episodes and the following variables: concentration disturbances (0.27**), cognitive rumination (0.31**), decentralization skills (-0.32**), somatic anxiety (0.24**), assessment regulatory mode (-0.286**), locomotion regulatory mode (0.236**), perceived coach support in competition (-0.248**). The gender was also associated indirectly to the occurrence of choking under pressure. Female athletes registered higher values of cognitive rumination: T (113) = – 2.262 $p < 0.05$ Sig: 0.03 Mmale = 2.93 (DS = 1.34); Mfemale = 3.51 (DS = 1.40), and lower levels of decentralization skills: T (113) = 2.007 $p < 0.05$ Sig: 0.04 Mmale = 3.40 (DS = 1.92); Mfemale = 2.75 (DS = 1.47), both variables associated with choking episodes. The analysis of variance indicated the non-significance of the experience factor. However from the observation of the trends it was possible to observe the importance of the coach support factor on the frequency of choking episodes especially with experienced athletes with high levels of cognitive rumination (R2 = 0.262). Using the hierarchical regression method, the significance of the previous variables was evaluated as predictors of the phenomenon under investigation. The following variables showed significance at the change of R2 with a total of 0.162: Cognitive rumination R2 = 0.101, Beta stand. = 0.357; Support perceived in competition R2 = 0.062, Beta stand = – 0.251.

Conclusions: The study showed that anxiety's cognitive rumination was the main predictive element for choking, while the perceived technical support of the coach during a competition could be an additional mediator of the frequency of choking. The results of the study partially confirm the findings of the previous literature concerning the importance of the anxiety and attention factors in the choking under pressure process. Results of the study suggest to consider also the possible indirect effects of self-regulatory modes where an excess of locomotion or focus on the goal ends up stiffening the athlete preventing him/her from gaining an optimal balance in the control of the performative process, while the capacity of decentralization could instead help the athlete to reduce the worry and preoccupation and to indirectly contain the occurrence of performative choking.

Bioenergetics of the VO2 slow component within and between exercise intensity domains

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Purpose: recent studies suggest that the VO_2 slow component (VO_2sc) may result from a delayed adjustment of the VO_2 in the heavy domain plus a loss of efficiency over time in the severe domain only. These results need to be confirmed within and between domains in males and females.

Methods: 25 individuals (10 females, 27 ± 5 yrs) performed 9-min constant work exercise at four intensities, two in the heavy (H_1 and H_2, 167 ± 46 and 188 ± 50 W) and two in the severe domain (S_1 and S_2, 224 ± 56 and 237 ± 60 W). The $AdjO_{2Eq}$ (VO_2 − VO_2 of ventilation + VO_2 equivalent of [La^-]) was determined for time segments 0–3, 3–6, and 6–9 min and compared by three-way RM-ANOVA (time x intensity x domain).

Results: the $AdjO_{2Eq}$ increased significantly as an effect of time x intensity and time x domain ($p < 0.01$, for both). Beyond the 3–6 time segment, $AdjO_{2Eq}$ between domains was significantly affected by time in the severe ($p < 0.01$) and unaffected in the heavy domain ($p = 0.37$). Within domains, $AdjO_{2Eq}$ was unaffected by time in H_1, H_2, and S_1 (ml*3 min^{-1} at 3–6 and 6–9, H_1 5675 ± 1539, 5781 ± 1590, $p = 0.44$; H_2 6445 ± 1596, 6534 ± 1766, $p = 0.17$ and S_1 7626 ± 2099, 7814 ± 1991, $p = 0.076$) while a significant increase over time was observed for the higher intensity of the severe domain (S_2, 7813 ± 2052 < 8137 ± 2049, $p < 0.001$).

Conclusions: in males and females, our data confirm a delayed steady state of VO_2 within the heavy intensity domain and a true loss of efficiency emerging over time in the severe intensities only.

Understanding the influence of exercise and diet on glycemic responses in healthy cyclists—insights from a randomized crossover trial

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Purpose: Continuous Glucose Monitors (CGMs), which record interstitial glucose levels minute-by-minute, have gained popularity among professional endurance athletes due to their potential benefits in monitoring and optimizing fueling adequacy during training sessions and competitions. While the use of CGMs has been supported by evidence in active and non-active diabetes patients, limited data exist on their application in healthy populations, particularly among athletes. The aim of this study was to investigate the glycemic responses of healthy competitive cyclists, wearing a CGM, to short term low-carbohydrate or high-carbohydrate diets.

Methods: A randomized crossover design was employed in this study. Sixteen competitive cyclists (mean age: 29 ± 11 years, height: 174 ± 7 cm, weight: 70 ± 9 kg, critical power: 303 ± 41 W) followed a standardized 3-day run-in diet and then underwent 7 days of either a low-carbohydrate (< 130 g/day) or high-carbohydrate diet (> 5 g/kg/day), with the order randomized. Throughout the 14-day duration, food diaries were recorded and interstitial glucose levels were continuously measured. Participants were asked to maintain their regular training schedule, and power data were recorded for each training session. Glucose data was segmented into sleep and wake phases for subsequent analyses. A linear mixed model was used to test the effect of diet and exercise on glucose metrics, with mean glucose levels and coefficient of variation as dependent variables.
Results: The findings showed significant effects of carbohydrate intake both on diurnal ($\beta = 0.62$, $p = 0.008$) and nocturnal ($\beta = 1.07$, $p < 0.001$) mean glucose levels, while exercise showed an effect only on nocturnal glucose ($\beta = -2.42$, $p = 0.005$). Glucose variability (coefficient of variation) appeared to be influenced by carbohydrate intake only during wake hours ($\beta = 0.36$, $p = 0.017$).
Conclusions: CGMs offer a fast and an easy snapshot of interstitial glucose levels. In this study, the diurnal average glucose levels were found to be influenced only by the amount of carbohydrates ingested during the day, but not by the exercise practice. However, variations were small and likely negligible. Data showed considerable individual variability. Further investigation is needed to determine the utility of this technology in optimizing off- and on-the-bike fueling strategies to enhance training adaptations and performance.

Neuromuscular perspective of lack of muscle strength in dementia. a failure to communicate!

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Purpose: Dementia is characterized by macroscopic atrophy from synaptic and neuronal loss within the central nervous system (CNS). A common consequence of the structural and functional CNS changes is that neuromuscular function deteriorates. Indeed, demented individuals are often accompanied by lack of muscle strength, preferably affecting lower limbs, that may cause limitation in physical function. However, no previous studies have investigated neuromuscular function in demented individuals.
Methods: Maximal voluntary activation (MVC), voluntary activation (VA, central component) and potentiated twitch force (Qtw, pot, peripheral component) were determined via the interpolated twitch technique in 8 demented individuals (68 ± 5 years, 23 ± 4 MMSE) and 8 non-demented controls (Ctrl, 68 ± 7 years) matched for age and sex.
Results: Demented individuals exhibited a reduced MVC (-19%, $p = 0.048$) compared with Ctrl, as well as a reduced VA (-23%, $p = 0.0394$) while Qtw, pot did not differ between groups ($p = 0.3969$).
Conclusions: The present study highlights novel and so far unique data on neuromuscular function in demented people. Results show how in this neurodegenerative disease, the central component of the muscle strength, rather than the peripheral one, is twisted… failing the efficacy of the signal from the brain to the muscles.
Acknowledgments: Choko-age is a scientific project funded by the Joint Programming Initiative (JPI) call PREVNUT.

On pulse oximetry, ventilatory function and oxygen delivery at high altitude

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Purpose: We reasoned that respiratory function may be impaired by a combination of exercise and hypoxia stressors, with an incremental ascend hypoxia increasing the risk of altitude-relatedhealth deterioration. We considered the possible restorative effects on the variablesrecorded of acetazolamide, a carbonic anhydrase inhibitor which serves to re-absorb bicarbonates by kidney This study aimed to evaluate changes in lung function assessed by spirometry and blood gas content in healthy high-altitude sojourners during a trek in the Himalayas.
Methods: A group of 19 Italian adults (11 males and 8 females, mean age 43 ± 15 years, and BMI 24.2 ± 3.7 kg/m^2) were evaluated as part of a Mount Everest expedition in Nepal. Spirometry and arterial blood gas content were evaluated at baseline in Kathmandu (≈1400 m), at the Pyramid Laboratory—Observatory (peak altitude of ≈5000 m), and on return to Kathmandu 2–3 days after arrival at each site. All participants took 250 mg of acetazolamide per os once daily during the ascent.
Results: Arterial hemoglobin saturation, O_2 and CO_2 partial pressures, and the bicarbonate level all decreased (in all cases, $p < 0.001$ with $R^2 = 0.70–0.90$), while pHa was maintained stable at the peak altitude. Forced vital capacity (FVC) remained stable, while forced expiratory volume in 1 s (FEV1) decreased ($p = 0.010$, $n_{p2} = 0.228$), resulting in a lower FEV1/FVC ratio ($p < 0.001$, $n_{p2} = 0.380$). PaO_2 and SaO_2 obtained from arterial blood gas analysisbetter predicted AMS development at high altitude than SpO_2. SaO_2 from ABG analysisand SpO_2 from pulse oximetry were moderately associated at high altitude, but the finger pulse oximeter overestimated the results.
Conclusions: High-altitude hypoxia alters the respiratory function and the oxygen saturation of the arterial blood hemoglobin. Additionally, air rarefaction and temperature reduction, favoring hypoxic bronchoconstriction, could affect respiration. Pulse oximetry seems not enough to assist medical decisions at high altitudes. There is still a need to find a theory of pulse oximetry, establish a standard method of calibration, and improve the accuracy of measurements during low perfusion or body movement. These developments will allow to deepen the analysis of the fluctuation patterns that define the oxygen saturation variability as a proxy for the coupling of systems involved in cardiorespiratory control.

Physical activity and diet as a multidisciplinary approach in adolescent obesity

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Purpose: Over the past forty years, many developing countries have witnessed a rapid nutritional transition that has contributed to the spread of one of the most serious public health phenomena, obesity, which mainly affects young adolescents [1]. This condition may predispose to the development of several chronic diseases, such as hyperlipidaemia, which is involved in multiple signalling pathways for bone homeostasis, as well as vitamin D (VitD) [2]. There is communication between adipose tissue and bone, which can regulate each other through feedback mechanisms, including glucose uptake by bone, also regulating insulin levels. In our study, we aimed to investigate the effects of a combined swimming programme and structured nutritional therapy in obese adolescents.
Methods: We observed potential changes in body composition and bone metabolism markers in obese adolescents dictated by the application of a physical activity and nutrition programme during a 6-months period. For this purpose, 21 obese subjects aged between 8 and 12 years (height CG 143 ± 7.89 cm vs. EG 142 ± 13.2 cm) were recruited according to the parameters specified by the World Health Organisation (WHO) for determining BMI. Investigations of body compartment changes were performed using the Akern Bioelectrical Impedance Analysis (BIA) 101 device (AKERN SRL, RJL Systems, Detroit, USA). Participants were followed up before, during and at the end of the intervention period by nutrition professionals specialised in childhood obesity at a frequency of 45 days.
Results: Initially (T0), our statistical investigations showed no significant differences between EG and CG. However, after 6 months (T3) of the intervention, based on the modification of the dietary plan, boosted with Vit D supplementation, statistically significant results emerged both within the same group and between both groups, compared to the initial period. Specifically, about FM, Vit D and insulin levels. But although, the intervention determined changes in both these were more pronounced in the EG, which additionally had swimming sessions (FM 21.55 kg vs 15.06 kg, $p < 0.001$; Vit D 9. 27 ng/ml vs 25.64 ng/ml, $p < 0.001$; Insulin 29.31 IU vs 12.66 IU, $p < 0.001$) compared to the CG (FM 20.66 kg vs 18.09 kg, $p < 0.01$; Vit D 8.70 ng/ml vs 13.70, $p < 0.001$; Insulin 28.45 IU vs 22.76 IU, $p < 0.001$).
Conclusions: In conclusion, this study confirms the importance of diet and exercise in improving the health of adolescents, particularly those with obesity. However, it is still necessary to recognize the need to intervene at several levels in the fight against paediatric obesity involving the family network, the school and doctors and health professionals in general, there is still a field to explore, especially that which concerns sport, individual and group, and dietary supplementation [3].
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Anthropometric profile of youth water polo players after, according to the maturity offset and bia vector migration after an acute bout of training

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Purpose: (1) To describe the anthropometrical and bioelectrical characteristics of young water polo players according to biological maturity; (2) to evaluate, with the bioelectrical impedance vector analysis (BIVA) method[1], the hydration status before and after a typical training session for regional youth championship participants.
Methods: Twenty-four young water polo players (age: 13.30 ± 0.55 years) performed a training session. During the training session, they drank about 1 lt. of water, ad libitum. Bioelectrical variables (R, resistance; Xc, reactance; PA, phase angle; Z, impedance) and body mass (BM) were measured pre-and post-training. Stature and sitting height were also assessed before training to normalize bioelectrical values and to classify players as growth peak not-achieved (GPNA) or growth peak achieved (GPA), according to the distance from peak height velocity in years (YPHV)[2]. BIVA was used to characterize 1) the distribution pattern of the bioelectrical vector (BIA vector) for both groups and 2) pre- to post-training BIA vector migration.
Results: The BIVA point graph indicates that half of the sample fell inside the 50% tolerance ellipse of the reference population[3]. The remaining participants were distributed outside the 50% and 75% tolerance ellipses, with the majority on the left quadrant.
The BIA vector comparison showed that both subgroups differed statistically from the reference population, and the sub-groups were also statistically different. Following training, a reduction was found in BM (about 400 gr; 0, 7%). However, the shortening of the BIA vector does not align with the change in BM.
Conclusions: The study suggests that biological maturity influences the BIA vector position on the RXc graph. Furthermore, training causes only mild dehydration is not detectable with the BIVA method when it's concurrent with fluid intake during training.
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A single moderate-duration bout of dynamic stretching within the warm-up improves running economy and running performance in trained distance runners

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Purpose: Runners commonly perform stretching before an endurance event to achieve optimal performance and static stretching (SS) or dynamic stretching (DS) are the most used. The effects of stretching on performance have been shown to depend both on stretch modalities and durations per muscle group applied. However, their impact on running economy (RE) and performance is still debated. The aim of the study was to investigate, in trained distance runners, the acute effects of a single moderate-duration bout of stretching (60 s per muscle group) within the warm-up on RE, performance and perception of effort.

Methods: Twelve trained male distance runners (age: 23.75 ± 2.49 years, VO_2max: 52.53 ± 5.38 $mL \cdot kg^{-1} \cdot min^{-1}$; training volume: 3 times/wk) performed a maximal incremental test to determine both the second ventilatory threshold (VT_2) and the speed associated to the VO_2max (vVO_2max). Then, they completed a submaximal continuous treadmill running test (5 min at 75%VT_2 plus 5 min at 85%VT_2) and a treadmill running until-exhaustion test at vVO_2max in three different warm-up conditions: SS condition: running plus SS, DS condition: running plus DS and NS condition: running without stretching. All sessions were performed once a week and in a randomized order. During the SS and DS conditions, the warm-up consisted of 5 min of running plus 10 min of SS or DS exercise, while in the NS condition, the warm-up consisted of 15 min of running without additional stretching. RE@75% and 85%VT_2, Time to exhaustion (TTE) and total running distance (TRD) were evaluated. The perception of effort was derived from the rating of perceived exertion (RPE).

Results: Our results showed that RE@75%VT_2 was significantly better in the DS condition than in the SS ($p < 0.05$) and the NS ($p < 0.001$) conditions, while RE@85%VT_2 ameliorated in the DS condition compared to NS condition ($p < 0.001$). Moreover, both TTE and TRD were significantly improved in the DS condition compared to the SS ($p < 0.01$) and the NS ($p < 0.001$) conditions. No differences in RPE values among the three conditions were found.

Conclusions: Our results show that a single DS bout of 60 s per muscle group improved the energy costs of running and enhanced endurance performance. This study indicate the efficacy of a pre-exercise DS compared to the SS and suggest the importance of including a moderate-duration bout of DS within the warm-up, before an endurance event, in order to optimize the energy costs of running and to improve performance.

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A comparison of morphological characteristics in aesthetic bodybuilders and contest ranking in Italian amateur competitions

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Purpose: The aim of this study was to analyze body composition, somatotype and anthropometric characteristics of amateur bodybuilders during national Italian contests, in aesthetic categories and to compare to competition's ranking.

Methods: 38 bodybuilders, 15 female (age: 32 ± 11.5 years; mass: 51.0 ± 6.0 kg; height: 159.0 ± 6.1 cm; training experience: 5 ± 4.8 years) and 22 male (age: 34.4 ± 9.3 years; mass: 79.0 ± 7.4 kg; height: 173.0 ± 5.2 cm; training experience: 12.0 ± 9.4 years), were observed at the time of competitions. The measurements carried out were: 4 lengths (torso, arm, bi-iliac, bi-acromial), 9 skinfolds (pectoral, axillary, subscapular, abdominal, suprailiac, triceps, biceps, thigh, calf), 8 circumferences (waist, hips, relaxed arm, contracted arm, thigh at the root, calf, forearm, chest) and 2 bone diameters (knee, elbow). From these measurements the following proportionality anthropometric, body composition and somatotype parameters were calculated: BMI, sum of 9 skinfolds, body fat percentage, free fat mass (FFM), fat mass (FM), free fat mass index (FFMI), cross sectional area (CSA) arm, CSA thigh, endomorphy, mesomorphy, ectomorphy, waist/hip (W/H) torso length/height (TL/Ht), chest/waist (Ch/W), biacromial/biiliac (Biac/Bi-i)l, arm/height (Arm/Ht). Proportionality of circumferences was calculated through the Phantom model proposed by Ross and Wilson (1974). Z-index was calculated for the following variables: circumferences of relaxed arm (pArm), forearm (pForea), chest (pChest), hips (pHips), thigh (pThigh), calf (pCalf). Individual ranking was calculated dividing the ranking position by the number of competitors in the division. The relationship between selected morphological parameters and ranking position was determined using Spearman's rank order correlation.

Results: For female a significant correlation was found between ranking and pForearm (r = 0.53; 95% CI: 0.0081–0.83; p = 0.04), between ranking and W/H (r = 0.60; 95% CI: 0.011–0.85; p = 0.02) and between ranking and TL/Ht (r = 0.76; 95% CI: 0.38–0.92; p = 0.001). For male only one significant positive correlation was found between the ranking and the sum of the 9 skinfolds (r = 0.44; 95% CI: 0.004–0.73; p = 0.04).

Conclusions: In amateur aesthetic bodybuilding competitions differences between female and male morphological characteristics for judges' scores were found. It was decisive for better placement a low W/H, a low TL/Ht and a small forearm circumference for females. A low skinfold sum for men is highly correlated with final score.

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Effect of lifelong football training on bone health and body composition in female handball and football players

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Purpose: Aging is a physiological process characterized by a progressive decline of biological functions and a deterioration process in cells and organs with loss of bone and muscle mass (1). Physical activity and exercise training have been shown to have positive effects delaying decline in most of age-related factors (2). Team sports as handball and in particular football, are two form of exercise that has been extensively studied for their positive effects on health (3, 4). Thus, the aim of present was to examine the effect of lifelong handball and football training on bone health and body composition in football and handball female players compared with untrained age-matched subjects.

Methods: 17 veteran football/handball players (VFHP, 65.9 ± 5.7 yrs) from Danish local sport clubs and 21 healthy age-matched untrained women (CG, 67.7 ± 5.0 yrs) were recruited. VFHP regularly played football for more than 35 years at least two times/week including matches approximately once a week; CG did not participate in regular physical activity and sport lifelong. All participants underwent a regional and whole-body dual-energy X-ray absorptiometry scan to determine Body Mineral Density (BMD) and Body Mineral Content (BMC). Total and regional body composition were also evaluated.

Results: VFHP had 9.1% and 11.7% higher leg BMD and BMC, respectively ($p < 0.05$), and 8.1% higher whole-body BMD compared to CG, respectively ($p < 0.05$). VHFP also had 2.9 kg and 1.3 kg higher total lean body mass and leg lean mass, respectively ($p < 0.05$) and 4.9% and 5.0% lower total and gynoid body fat, respectively ($p < 0.05$) compared to CG.

Conclusions: This study suggests that lifelong participation in handball and football sports promotes a healthier body composition and improve legs and whole body BMD and BMC reducing the risk of osteoporosis in older females.

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Alterations in biochemical markers of muscle damage following rapid weight loss and high intensity training in wrestlers

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Purpose: Rapid weight loss (RWL) is widely known phenomenon among wrestlers, and refers to reducing ∼ 5% of body weight within the last week prior to competition. This type of weight cycling athletes use to compete in the lowest weight category possible with an intention to increase the probability of victory against a potentially lighter opponents. To hasten the weight loss process, wrestlers usually attend high intensity sport-specific training (HISST) sessions which can additionally affect the biochemical markers of muscle damage. The aim of this study was to differentiate the influence of RWL combined with high intensity sport-specific training and the impact of HISST without RWL.

Methods: A total of 12 Greco-Roman wrestlers (mean body weight 73.48 ± 4.52 kg, age 24.3 ± 5.1 years, body height 175.22 ± 3.68 cm) participated in this study. The investigation consisted of 3 phases: Initial measurement (IM), high-intensity sport-specific training combined with RWL of 5% (phase 1—P1) and only high-intensity sport-specific training (phase 2 –P2). During P1 athletes underwent self-chosen methods of weight reduction. After each phase blood sampling was done to measure the alterations in following muscle damage markers: Myoglobin (Mb), creatine kinase (CK), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and lactate dehydrogenase (LDH).

Results: All participants successfully reduced 5% of their body weight. In both phases (P1 and P2) significant increase in almost all biomarkers was notable. Nevertheless, comparing the two phases (P1 and P2) with initial measurement, higher level of significance was observed in P1 for the following biomarkers: Mb (P1: $p = 0.001$, P2: $p = 0.002$), ALD (P1: $p = 0.003$, P2: $p = 0.027$), CK (P1: $p = 0.000$, P2: $p = 0.042$), AST (P1: $p = 0.009$, P2: $p = 0.026$) and LDH (P1: $p = 0.001$, P2: $p = 0.018$).

Conclusion: This study demonstrated that weight reduction of 5% along with high intensity sport specific training induce the increase in examined biomarkers to a higher extent then intensive training performed alone. Hence, indicating a meaningful impact of weight cutting on muscular damage among wrestlers. Forthcoming research in this field is critical to supply athletes and coaches with potentially less harmful weight cycling techniques.

Day-To-day variability in female breast sensitivity to touch, temperature, and wetness over menstrual cycles: a pilot study

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Purpose: During the menstrual cycle, breasts size changes and consequently skin' sensitivity to touch, temperature, and wetness in the female breasts may vary. Several studies showed that breast sensitivity increases and may peak during the middle of the menstrual cycle as well as at menstruation [1]; yet, only few studies performed sensory assessments over multiple days and with high frequency. As a result, our knowledge could be of fundamental value, as could inform the design of intimate and sport clothing that optimize wearers' comfort and performance [2]. The aim of this study was to evaluate with high frequency the day-to-day variability in female breast sensitivity to touch, temperature, and wetness during several, consecutive menstrual cycles occurring over a period of six months, in young healthy women.

Methods: A number of 3 female (26, 3 ± 0, 5y; 163, 29 ± 6, 3 cm; 63, 4 ± 3, 7 kg) who represented both a normal menstrual cycle (ID1) as well as various contraceptive use (ID2 = Intra Uterine Device; ID3 = Vaginal Ring) and two males (acting as control, IDM) (31, 5 ± 5, 2y; 180, 45 ± 12 cm; 92, 9 ± 9, 8 kg) took part in this prospective study. Participants visited our testing laboratory for a minimum of 3 to a maximum of 5 times a week over the course of past 2 months (May to July 2023). During each visit, participants underwent well-established quantitative sensory testing of tactile, thermal, and wetness sensitivity at the breast (or chest) and at the xiphoidal process [3]. Data were analysed for within-subject variability in minimum and maximum sensitivity across the tested period.
Results: Data collection and analysis is ongoing. At the time of writing, women participants have been tested during 18 separate days. Preliminary analyses indicated that when considering e.g. warm sensitivity at the breast women presented grater day-to-day changes (variation = 70%) than the males control (variation = 21%). However, when considering tactile, temperature and wetness sensitivity altogether, we observed this trend only in 3 out the 10 stimuli applied to each participant.
Conclusions: Our preliminary observations support the feasibility of our approach and provide initial, albeit partial, support to the potential fluctuations in breast skin' sensitivity over the course of menstrual cycle. Completing our prospective data collection will help determining the repeatability of sensory fluctuations and their potential rhythmicity with menstrual cycles.
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Body composition in soccer and basketball. Bio impedance measurements in elite athletes

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Purpose: Football and basketball are two different sports, but both are characterized by being very complex activities that require strong psychophysical stress, necessary to be able to maintain high performance during training and competitions. For this reason, players have to develop certain morphological and functional characteristics related to the performance. Among these characteristics, a particular interest is directed towards body composition.
The studies carried out on body composition through BIA provide data on metabolically active cell mass (BCM), extracellular mass (ECM) and fat mass (FM).

The aim of this study was to examine body composition through bioimpedance on two elite teams: Cagliari Calcio football team and Dinamo Academy basketball team. The objective of the study was to analyze any similarities or differences that exist in the body composition between the two teams, highlighting in particular the role of the BCM (body cell mass).
Methods: The analysis was conducted on a sample of 26 soccer players and 14 basketball players, all athletes participating in their respective national championships.
The study on Cagliari Calcio was carried out during the first week of August 2017, in full pre-season athletic preparation. The study on Dinamo Academy was carried out during the first days of the 2017/2018 competitive season, in the first week of October.

For each subject, the personal data and the following anthropometric parameters were recorded: —body mass (kg);—height (cm);

The following parameters were extrapolated from the impedance analysis: FFM%: FM%: TBW%: BCM (kg) and BCM%

The means and standard deviations for the parameters considered were calculated. Differences between the two groups were evaluated using Student's t-test.
Results: The body mass is significantly higher in basketball players, as well as the eight. The FFM shows values show a strong significance in favor of soccer players. From the data collected on FM % it is possible to deduce values significantly higher for basketball players. The TBW % detected shows no significant differences between the two groups. The BCM expressed in kg is highly significant in basketball players. The BCM% shows a moderate significance in soccer players against the basketball players.
Conclusions: All quantitative parameters related to body composition, as could be expected, are defintely higher in basketball players. Instead, the parameters that express the quality of the body composition were higher in the soccer players. This is also a sign of the different characteristics of the two sports especially regarding the different kind of training carried out during the year.

Physiological responses to short bouts of effort-modulated exercise

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Purpose: Exercise protocols prescribed based on effort levels are commonly used to investigate the physiological responses associated with perceived exertion. However, we are not aware of previous studies investigating the physiological responses to short bouts of intermittent exercise performed at different levels of perceived exertion. This is of great relevance for numerous sports disciplines and activities of intermittent nature. Hence, this study systematically investigates the physiological responses to short bouts of effort-modulated intermittent exercise.
Methods: Ten well-trained male cyclists performed a preliminary ramp incremental test and a familiarization session with experimental procedures and tests. In the experimental visit, participants performed 10 × 10-s bouts of effort-modulated exercise interspersed by 50 s of recovery. The first work phase was prescribed at 10% of effort through the visualization of the Effort subscale of the NASA Task Load Index scale. In the subsequent work phases, effort levels increased by 10%, thus reaching 100% of effort in the 10th bout.
Results: Power output showed an exponential increase ($P < 0.05$) with linear increases in effort, reaching average values of 507 ± 113, 613 ± 139, and 817 ± 148 W at effort levels of 80, 90, and 100%, respectively. Generally, respiratory frequency (f_R) showed a fast response to work-recovery alternation, although abrupt changes

($P < 0.05$) in f_R were mainly observed at high effort levels (80, 90, and 100%). Conversely, tidal volume (V_T) showed a decrease or a delayed response at exercise onset and a substantial increase at exercise offset. The opposite responses of f_R and V_T generally make variations in minute ventilation only evident at effort levels higher than 50%. However, substantial interindividual variability was found in breathing patterns. A delayed response was observed in oxygen uptake ($\dot{V}O_2$), carbon dioxide output ($\dot{V}CO_2$), and heart rate (HR) both at exercise onset and offset.

Conclusions: Short bouts of effort-modulated exercise show a non-linear increase in f_R with progressive increases in effort levels. Abrupt changes in f_R to work-recovery alternation were only observed at high effort levels, and this f_R response is consistent with a major modulation from central command. This exercise paradigm clearly reveals the existence of a differential control of f_R and V_T. Our findings encourage the monitoring of f_R as a marker of physical effort in intermittent-based sports disciplines and exercise protocols.

Adherence to the mediterranean diet in young Italian University students: is it still an attractive model?

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Purpose: The aim of this investigation is to understand if young Italian students adhere to the Mediterranean Diet (MD) and how much this adherence is related to a healthy lifestyle.

Methods: 166 students were recruited from two University of Rome. These students were subjected to a questionnaire that investigated their eating habits and lifestyle and which also included two specific questionnaires to investigate the degree of adherence to the Mediterranean Diet (Mediterranean Diet Adherence Screener, MEDAS) and for the assessment of habitual physical activity (Rapid Assessment of Physical Activity, RAPA-Q).

Results: Study polulation showed a mean age of 24.06 ± 1.7 years, a Body mass index (BMI) of 21.93 ± 2.7 kg/m^2, 42.8% of them were male. Most of them were no-smokers (71%). 18.1% of students did not practise any kind of structured physical activity, 66.9% practised not competitive sports and only 15.1% of them practised competitive sports. About eating habits, 14.37% of students reported eating 3 meals/day, 42.51% eats 4 meals/day, 43.31% eats 5 meals/day and 1, 79% eats 6 meals/day. Moreover, 56% of students declared to consume snacks between meals. Mean score of MEDAS questionnaire was 7.76 ± 1.92, while mean score of RAPA-Q was 4.96 ± 2.04.
A significative relation was observed between gender and BMI (females were less likely to be overweight or obese) and the practise of sport activities (males practise more frequently competitive sports), while no significative relations were observed with the habit of smoking, number of meals and snack consumption.

Significative correlations were observed between MEDAS score and: BMI (normal weight adhere most to MD), the practise of sport activities (not competitive adhere most to MD), the habit of smoking (no smokers adhere most to MD) and number of meals (who eats 4 or 5 meals/day adhere most to MD). No significative relations were observed with gender, snack consumption and RAPA-Q score.

Conclusions: The study population showed an intermediate degree of adherence to the Mediterranean diet according to MEDAS questionnaire and they showed a low-medium level of physical activity according to the RAPA-Q score. A significative relation was not observed between MEDAS score and RAPA-Q score. However, students who have a correct lifestyle (optimal BMI, non-smoker, correct number of meals and practice of non-competitive activity) are those who showed better adherence to the Mediterranean Diet.

A regional survey to assess levels of physical activity in adolescents: preliminary results

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Purpose: The contribution of physical activity for the promotion of health and the prevention of chronic degenerative pathologies has been amply highlighted by international literature, which describes different types of intervention involving different sectors and educational contexts: school, sports start-up, sport, public health, free time, etc. Unfortunately, a large percentage of young people and adolescents in Italy do not respect the international physical activity recommendations and guidelines, and this is even more evident in Southern Italy. The present paper aims (a) to collect and analyze epidemiological data referred to the practice of physical activity in a sample of adolescents in Apulia Region, and (b) compare the obtained results with other national and international report.

Methods: The sample consists of 237 secondary school students (M = 119, age = 15, 25 ± 0, 92 years old; F = 118, age = 15, 10 ± 0, 94 years old). Students were asked to complete an online version of some items of the Youth Risk Behavior Surveillance System (YRBSS). In this study, only the levels of physical activity (PA) during the last week, PA during the last 12 months, PA during physical education lessons, PA during free time, and active transport were considered and analyzed.

Results: Results revealed that a large percentage of boys and girls were insufficiently physically active, and most of the adolescents preferred move to school with car than active transport. However, boys were generally more active than girls. These data are in line with the data of the latest HBSC report, according to which (a) only 20% of children and adolescents practice daily physical activity, and (b) with increasing age the percentage of children/adolescents who regularly practice physical activity is reduced.

Conclusions: The interpretation of the data shows the need to systematically monitor the healthy habits and levels of physical and, consequently, to intervene through the implementation of good practices in school context and free time.

Relationship between motor efficiency and health in sedentary desk-workers: a cross-sectional study

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Purpose: Desk workers typically live in physical inactivity and sedentary conditions, indeed they remain seated for about 10 h daily during working activities. Consequently, sedentary occupations are often associated with increased cardiovascular risk and a higher likelihood of developing musculoskeletal diseases. Conversely, a stimulation of physical activity and efficiency are valuable and strictly related to principal health outcomes, especially in sedentary populations. Hence, this study investigated the relationships between physical efficiency and health outcomes in a desk workers' sample.
Methods: Sixty-seven desk workers spending daily a mean of 8 h per day in sedentary behaviour during working hours were recruited to participate in this cross-sectional study. After familiarization, they underwent a submaximal battery test (Cubo Fitness Test, CFT) to assess cardiovascular, muscular, and flexibility fitness, resulting in a final index of motor efficiency. Accelerometers and the International Physical Activity Questionnaire measured the weekly physical activity. Participants further completed questionnaires regarding eating habits (EHQ), psychological well-being, and self-efficacy. Pearson's correlation coefficient (r) was performed to investigate correlations between CFT and health-related variables.
Results: Weak but significant correlations were found. As expected, and widely evidenced by the literature, the time spent in physical activity correlated with physical fitness (from r = 0.262 to r = 0.341 in the CFT tests) and motor efficiency (r = 0.253). In addition, desk workers who are more trained in cardiorespiratory fitness seem to be more educated about adequate eating habits (EHQ items: $0.277 < r > 0.317$). A possible relationship between muscular tone and self-efficacy can be detected (correlations between shoulder mobility and self-efficacy: r = 0.365; between sit and reach and self-efficacy: r = – 0.279), but more data are needed to deepen the topic. Physical fitness and physical efficiency are not correlated with psychological well-being.
Conclusions: Physical fitness and efficiency are related with physical activity and eating habits. The same cannot be asserted for psychological wellbeing possibly because of the low amount of physical activity performed by participants (they spent 84% of the day in sedentary behavior) and the high impact of sedentary work (7.6 ± 1.8 h/day) in generating stress during daily routine.

Smart vs. on-site working: correlation between working modality and psycho-physical health

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Purpose: The workplace is a cause of sedentarism and stress, negatively affecting the quality of life and working performance. The SARS-CoV-2 pandemic changed working habits favoring smart working, impacting employees' behavior, working involvement, and physical activity. This study assessed the associations between smart and on-site working modalities and individual physical and psychological well-being.
Methods: Sixty-seven desk workers with at least seven hours per day of sedentary work participated in the study. The number of working days and hours spent in smart or on-site working was surveyed to correlate working patterns with physical and well-being shapes. Participants performed a submaximal-effort-based battery test to assess physical efficiency (Cubo Fitness Test) and questionnaires to assess eating habits (EHQ), the amount of physical activity (IPAQ), working habits (JCQ), psychological well-being (PGWBI), and self-efficacy (GSES). In addition, the weekly physical activity was further measured through accelerometers.
Results: Significant correlations were found. The weekly working hours were weakly related to muscular fitness ($r > 0.326$). No relationships were found between eating habits and working modality. Conversely, the daily working hours were slightly related to sedentary habits (r = 0.278), and the hours and days spent in smart working to weekly physical activity ($r > 0.322$). Specifically, they showed moderate correlations with vigorous physical activities ($r > 0.518$). On the other hand, a negative correlation was retrieved between days in on-site modality and vigorous (r = – 0.449) and total physical activity (r = – 0.288). Referring to JCQ, weekly working hours were directly associated with supervisor (r = 0.304) and co-worker support (r = 0.322), and the on-site modality was weakly related to co-worker support (r = 0.257), which indicates the positive role of social relationship during working time, especially on-site. Working modality did not correlate to psychological well-being and self-efficacy.
Conclusions: The higher the number of working hours, the higher the sedentary behaviors. Smart working moderates this association, possibly because of increased opportunities to save time to perform physical activities compared with the on-site modality that entails time for home-work displacements. Conversely, on-site working grants more effective and positive social relationships.

Experimental study. Covid-19 and hypokinetic disease: lockdown, postural defects and overweight

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Purpose. Previous studies have shown that the most sensitive to lockdown restrictive measures have been young and old. From this scientific evidence we have developed the initial hypothesis of the study, and that more sedentary subjects during the lockdown had greater negative effects on their health.
Methods. Forty-five healthy subjects, divided into two groups (young group from 12 to 17 years and adults group from 67 to 75 years), were recruited for the study. During lockdown they went out once or twice a week to purchase basic necessities. Among the inclusion criteria none of the participants had to be obese before the lockdown and had to suffer from hypokinetic pathologies. The exclusion criteria were envisaged pre-existing obesity, metabolic or cardiovascular diseases, mental and/or neurological diseases. Anamnesis was taken and evaluation of anthropometric data. The indices of lean and fat mass, muscle, skin folds and BMI; self-assessment questionnaire on one's health status and the Borg scale. The study was conducted for six months.
Results. The results obtained demonstrated the negative impact of the lockdown due to the COVID-19 pandemic on the health. Joint pain, postural problems (the cervical and lumbar tract are more involved) and respiratory deficits have significantly increased in people who previously led a more active life. Those who previously lived a sedentary life showed the need to undertake recreational and motor activities that would allow movement and relationship. In young people, fat mass increased by 55%, many declared that they had reduced physical activity, that they had spent more time between tablets/pc/tv and sofa/bed and that they had taken little care of their diet, increasing the use of "junk foods". In adults, fat mass increased

by 64.7% with a significant reduction in mobility, which also hindered the correct performance of some daily life activities (going up and down stairs).
Conclusions. In conclusion it is necessary to intervene on raising awareness of the population to motor skills. Not only for physical fitness, but above all to improve health, prevent the risk of hypokinetic diseases and the consequent mortality. Evidence-based exercise recommendations are a safe and effective strategy for achieving these goals in healthy individuals and people with pre-existing medical conditions, provided there are no medical contraindications.

The affective experiences of exercise and environmental factors influence attendance at outdoor physical activity

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Purpose: Regular physical activity (PA) has several benefits, including better physical and mental health. PA behaviors are influenced by individual-related, socioeconomic, exercise-related, environmental, and psychological (cognitive and affective domains) factors.
The aim of the study was to examine if there is a relation between perception, attitudes, and motivation, along with different environmental and individual factors (e.g., temperature, distance from the site, psychological factors), and the level of adherence to outdoor PA.
Methods: Structured exercise sessions were scheduled during the spring/summer period in the various parks and gardens in the municipal area of Vignola, Italy. The exercise sessions included a mix of the following activities: bodyweight gymnastic fitness, postural and muscle toning exercises, gentle anti-aging gymnastics and aerobic activity with the "walking group".
The Affective Exercise Experiences (AFFEXX) questionnaire was administered to assess different components of motivation. The primary subscale of interest in this study was the "attraction-antipathy" subscale. Moreover, sample characteristics, such as age, gender, depression, smoke and drink habits, presence of other comorbidities, daily medications, and distance from home to the park, were collected. The exercise sessions attendance's levels and temperatures were also recorded.
Results: A total of 68 participants (64.6 $\pm$ 8.6 years, 57 females) were included in the analysis. Concerning the AFFEXX questionnaire, the median value of "attraction-antipathy " sub-scale was 5.50 (Q1 = 4.6; Q3 = 6.2), and it was positively correlated to the attendance's level ($r = 0.301$, $p < 0.05$). No significant correlations were found between the level of attendance and age, gender, depression, alcohol consumption, presence of comorbidities, and distance from home. On the contrary, non-smokers and citizen with a higher number of daily medications exhibited a higher level of attendance to exercise sessions ($p < 0.05$; $r = 0.239$, $p < 0.05$). Furthermore, participants were less likely to attend exercise sessions on days with higher temperatures ($r = -0.384$, $p < 0.05$).
Conclusions: Overall, these findings could provide valuable insights into the factors influencing the level of attendance in exercise sessions within open and green environments. It is fundamental to consider the factors that influence PA behaviors in order to enhance participation.

The stump bone quality in amputee patients: a systematic review and meta-analysis of 561 lower limb amputees

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Purpose: Lower limb amputation primarily occurs due to trauma and significantly influences all aspects of a person's life. After limb amputation, prosthesis application and rehabilitation are necessary to regain autonomy and independence. However, the risk of falls and fractures should be carefully considered. Bone mineral density (BMD) is a biological parameter that is closely related to bone quality and often associated with the risk of fractures. Therefore, predicting bone fractures is crucial, especially for individuals who wear a prosthesis after amputation. It has been suggested that the level of BMD decreases rapidly after amputation, particularly in the amputated limb stump. This systematic review aimed to investigate the state of stump bone quality in patients with limb amputations.
Methods: The eligibility criteria were: adults, total upper- and- lower-limb amputation, healthy limb or recent amputation, and bone quality outcomes. The research was conducted on Pubmed, Embase, Scopus, Cochrane, and Web of Science. The Newcastle–Ottawa Scale was used to assess the risk of bias. Statistical significance was set at $p < 0.05$.
Results: After the screening 16 studies were included in the analysis which involved 561 participants (443 men, 47 women, and 71 not defined) with at least one lower limb amputation and 61 health control. No randomized control trials and intervention studies were included. Dual-energy X-ray absorptiometry was the most used tool for the BMD evaluation and areal BMD and volumetric BMD were the most reported outcomes. A higher level of amputation was associated with a lower BMD level (SMD = 2.11; $p = 0.009$). In patients with unilateral amputation, the amputated limb (AL) has lower BMD values than non-amputated limb (nAL) (SMD = – 1.23; $p < 0.001$). In patients with recent amputation ($\leq$ 12 months from the evaluation), the mean BMD (SMD = – 0.66; $p = 0.003$) was lower than in patients with late amputation (> 12 months from evaluation) (SMD = – 1.26; $p < 0.001$).
Conclusions: This systematic review has presented a summary of the existing understanding regarding bone quality in individuals with limb amputations. These outcomes can serve as a valuable resource for future investigations into the impact of mechanical bone stimulation through physical activity on bone quality in lower limb amputees. Furthermore, they may prove beneficial for patients and clinicians seeking normative BMD data specific to amputee patients.

Are amateur pole dancers comparable to general population? Body composition, bia-derived phase angle and health-related physical fitness

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Purpose: A few data are available on the relationship between body composition (BC) and health-related physical fitness (HRF) in non-elite sportspeople. Bioelectrical impedance analysis (BIA) raw variables, i.e. bioimpedance index (BI-index), as a proxy of fat-free mass (FFM), and phase angle (PhA), as an index of body cell mass, are both candidates for predicting HRF. The practice of pole dance, which is a type of functional training that involves the use of a vertical pole to perform exercises and figures, is increasing in the world. Few previous studies showed a lower percentage of body fat (%BF) and higher handgrip strength (HGS), FFM and flexibility in a pole dance group compared to controls. Against this background, we aimed to assess body composition, raw BIA variables and HRF in pole dancers compared to sedentary controls and explore the mutual relationships between these variables.
Methods: Thirty-seven amateur pole dancers and fifty-two control women (18–35 years; BMI 18–27 kg/m^2) participated in the study. Anthropometry was measured according to standardized procedures. BIA was performed at 50 kHz for measuring whole-body impedance e PhA. FFM and %BF were estimated by BIA predictive equations for the general population, while BI-index was calculated as stature^2 divided by impedance. The following field tests were performed for assessing muscle strength (HGS, standing broad jump = SBJ, squat jump = SQJ and counter-movement jump = CMJ, cardiorespiratory fitness (six-minute walk distance = SIXMWD) and flexibility (sit-to-reach = SITR).
Results: There was no statistical difference between the two study groups for age, stature, weight, and BMI, while %BF was significantly lower and PhA was significantly higher in pole dancers than controls. Greater HGS, SBJ and SITR were observed in pole dancers (no differences for SQJ, CMJ, SIXMWD). In the two groups separately, all HRF tests showed a significant association with PhA, while a positive association between HGS and BI-index was found in pole dancers only. In a multiple regression model, PhA resulted as independent predictor of SBJ, SQJ, CMJ and SITR (while BI-index was a predictor only for HGS).
Conclusions: Amateur pole dancers exhibited higher PhA, lower %BF and performed better in commonly used HRF tests than sedentary young women. PhA was a significant predictor of all HRF measures and might be taken into consideration as a variable useful for a more consistent assessment of HRF.

Post-Acute covid-19 syndrome is not associated with a reduction of physical function, cognitive state and psychological parameters in people living with HIV

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Purpose: Post-acute COVID-19 syndrome (PACS) is characterized by persistent and deabilitating symptomps including fatigue and cognitive symptoms. The aim of this study was to assess physical function and cognitive function in people living with HIV (PLWH) of more than 50 years old who had contracted COVID-19 (Covid +) at least 9 months ago compared with PLWH who had not contracted COVID-19 (Covid-).
Methods: This is a case–control study that enrolled PLWH $\geq$ 50 years old with or without previous COVID-19. Muscle strength was tested by handgrip and chair-stand-test; balance by the Mini Balance Evaluation Systems Test (Mini-BESTest); cognitive function by the Brief Neuro-Cognitive Screen (BNCS), including the trail-marking A (TMA), trail-marking B (TMB) and digit symbol; presence and severity of anxiety and depression by the Hospital Anxiety and Depression Screen (HADS). Change differences between groups were assessed by Mann–Whitney test.
Results: We enrolled 48 PLWH Covid + [age: 60 (57–63) years; height: 1.71 (1.68–1.75) m; body mass: 74 (69–84) kg; BMI: 25.7 (23.4–27.4); CD4$^+$ 854 (620–1028) μ/l; months after diagnosis: 14 (11–28) months; symptoms: 14% asyntomatic, 77% paucisymptomatic, 29% moderate/severe symptoms; months after first vaccination: 23 (20–25) months; months after second vaccination: 21 (19–24) months; months after third vaccination: 16 (13–18) months] and 50 PLWH Covid- [age: 61 (57–64) years; height: 1.72 (1.66–1.76) m; body mass: 73 (65–82) kg; BMI: 25.3 (22.5–27.5); CD4$^+$ 743 (518–874) μ/l; months after first vaccination: 22 (20–24) months; months after second vaccination: 21 (19–23) months; months after third vaccination: 15 (13–16) months]. No significant statistical differences were observed between the two groups as for values of handgrip [36.7 (29.7–41) vs 34.1 (29.9–41) kg, p = 0.352], chair-stand test [15 (12–18) vs 15 (12–18) repetitions, p = 0.743], Mini-BESTest [26 (23–27) vs 26 (22–28) points, p = 0.959], TMA [27.7 (23.0–36.5) vs 32.3 (24.6–38.4) sec, p = 0.167], TMB [66.9 (49.3–86.7) vs 61.9 (47.6–80.0) sec, p = 0.198], digit symbol [40 (35–51) vs 42 (36–50) score, p = 0.800], and HADS [9 (6–15) vs 12 (4–17) sec, p = 0.672].
Conclusions: Covid-19 seemed not to impact physical function, cognitive state and psychological parameters in this cohort of PLWH assessed 14 months after the disease.

Orthopedic surgeons' attitudes toward physical activity for people with total hip and knee replacement: Italy vs The Netherlands

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Purpose: Regular physical activity (PA) is a key factor of lifestyle behavior enhancing general health and fitness, with additional benefits for people after total hip or knee replacement (THR and TKR). Orthopedic surgeons have a primary role in discussing and making people aware of the impact of an active lifestyle for the sake of general health and the lifespan of prosthesis itself. The aim of this study was to compare the differences in terms of surgeons attitudes towards PA for people after THR/TKR between a Netherlands and Italy country and which factors can explain this difference.
Methods: A cross-cultural study was conducted using a questionnaire to examine and compare the differences in Italian and Dutch orthopedic surgeons' attitudes towards PA for people with THR and TKR. The questionnaire was composed of 37 items divided into 4 sections: background, personal information, health service, and attitudes towards PA. An exploratory factor analysis (EFA) was employed to determine the underlying factor structure of the questionnaire.
Results: A cohort of 159 surgeons (103 Italians and 56 Dutch) was analyzed. The EFA identified 3 sub-factors labelled as follows: (1) the relevance of PA, (2) positive attitude towards PA, and (3) negative attitude towards PA. The comparison between the sub-factors 1 and 2 did not show significant differences between countries. On the contrary, the sub-factor 3 showed that Italian surgeons had more concern about the impact of PA on the prosthesis health ($p < 0.001$). The overall results showed that Dutch surgeons have a more positive attitude towards PA ($p < 0.001$). The regression analysis showed that

"Country" and "Sports or PA participation (of the surgeon)" were the variables most strongly associated with the surgeons attitude towards PA, with correction for surgeon and clinic characteristics that differed between countries.

Conclusions: Dutch orthopedic surgeons have a more positive attitude towards PA, likely because they are more liberal in allowing PA (sub-factor 3). Cultural, socio-economic, or contextual differences influence the disparities between Dutch and Italian orthopedic surgeons. The orthopedic surgeon is one of the main figures with the potential to promote a behavioral change in people after THR and TKR. For this reason, the educational pathway of orthopedic surgeon should involve the more recent knowledge about the benefits of PA and sport.

Unraveling barriers to a healthy lifestyle: understanding barriers to diet and physical activity in patients with chronic non-communicable diseases

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Purpose: The study aims to highlight the barriers that patients with chronic-degenerative diseases experience in implementing a healthier diet and an exercise-based therapeutic program, by using a quantitative approach to develop a point-by-point list of the most frequent barriers to both nutritional improvement and exercise. By recognizing and addressing these barriers, it is possible to empower patients with NCDs to adopt healthier lifestyles, enhance their quality of life (QoL), and reduce the burden of NCD management.

Methods: The search for the studies was conducted by drawing from the Pubmed database using the following search string "(physical activity OR exercise OR diet) (prescription OR participation) AND barriers NOT rehabilitation". To be eligible, studies must have the following characteristics: (1) Quantitative or mixed descriptive studies; (2) adult population (age > 25 years) with chronic pathologies of a non-neurological or psychiatric nature; (3) interventions of a non-rehabilitative nature; (4) period of publication not exceeding 10 years. The search produced 432 results.

Results: Various similar barriers to a healthy diet and exercise emerged and we presented them in five subcategories: (1) Lack of time; (2) Environmental barriers; (3) Health state; (4) Psychological barriers/insights; (5) Communication errors between Clinicians and Patients.

Conclusions: Although it is the subject of consistent research in the last years, the study of the barriers that prevent patients from adopting a healthy nutritional and PA lifestyle remains a crucial point on which researchers' efforts need to be concentrated. Having greater knowledge of the various types of barriers patients face would allow professionals in the clinical teams who take care of patients with NDCs to frame more accurately the obstacles that hinder patients' adherence to a healthy lifestyle. Precocious identification of which barriers patients present would primarily allow them to improve awareness of their difficulties and healthcare and non-health professionals to propose truly effective solutions. Given the complex nature of some barriers, their early identification would allow the various stakeholders to collaborate in the creation of environments, policies, and intervention programs that can help the general population and those with chronic pathologies in adhering to a healthy lifestyle, an effective tool for prevention and treatment for NCDs.

Are there sex differences in the glucose response to a meal after postprandial exercise?

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Purpose: A high glucose response to a meal is an important predictor of cardiometabolic disorders. Exercise is a key tool for reducing post-meal glycemia. Some differences between male and female individuals have been previously observed in the physiological response to exercise. However, little is known on the differences between males and females in the postprandial glucose response to exercise. Hence, this study aims at evaluating the effects of postprandial exercise on the glucose response to a meal in healthy males and females.

Methods: Twenty-six males (25 ± 4 years old, 1.8 ± 0.1 m, 79.1 ± 13.2 kg, 24.7 ± 2.6 kg/m^2) and twenty-one females (23 ± 2 years old, 1.6 ± 0.1 m, 59.9 ± 6.1 kg, 22.3 ± 2.2 kg/m^2) participated in this study. All participants were health and active individuals. Each participant performed two three-hours protocols in a randomized order. In particular, in one visit they remained seated for the whole experimental period (CON_M and CON_F). In the second visit, they performed 30 min of moderate-intensity (i.e. 120 steps per minute) walking started 15 min afer the beginning of a high-carbohydrate standardized meal (WALK_M and WALK_F). The meal consisted of 1 g of carbohydrate per kilogram of body weight. Glycemia was regularly assessed during the three hours and the positive incremental area under the curve (iAUC) was calculated at one, two and three hours.

Results: No between-groups significant interaction (conditions $\times$ time) for glycemic time course was found. A significant within-group interaction (conditions $\times$ time) was found ($p < 0.001$). In particular, WALK_M had lower glucose values at 30 and 45 min compared with CON_M ($p < 0.001$). In addition, WALK_F showed lower glucose values at 0, 15, 30 and 45 min compared with CON_F ($p < 0.018$). The glucose iAUC analysis did not reveal differences between groups. However, WALK_M showed significantly lower iAUC at 0–60, 0–120 and 0–180 min compared with CON_M ($p < 0.027$). Similarly, WALK_F showed significantly lower iAUC at 0–60, 0–120 and 0–180 min compared with CON_F ($p < 0.009$).

Conclusions: Thirty min of postprandial walking significantly improved the post-meal glucose response in healthy individuals, showing a similar attenuation between male and female of the glucose peak and the whole glucose response to the meal.

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A proposal to compare the effects of two physical exercise modalities on psycho-physical wellness for overweight people: outdoor-based aerobic vs indoor-based combined training

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Purpose: This proposal aims to compare the effects of two different physical exercise interventions on overweight people in relation to the physical fitness (PF) components of strength, flexibility, cardiorespiratory efficiency (CRE), body composition and to balance as well as on enjoyment and health status.

Methods: Sixty subjects aged 50 to 60 years, with $25 < \text{BMI} < 35$, without prior or concomitant diseases will be recruited and will be divided into 3 groups of 20 each: first, combined exercise training (CET) with both aerobic and resistance training at medium–high intensity; second, exclusively aerobic exercise training (AET) at low intensity and a control group (CG). The proposal is a 16-week longitudinal study based on 3 weekly sessions, two of which for CET will be conducted indoor, and one outdoor; instead for AET, two outdoor and one indoor. Physical fitness will be assessed through the Senior Fitness Test battery and Shoulder mobility from Functional Movement Screen on three separate times. Individual workload and exercise intensity will be estimated by lower and upper limbs 1RM and heart rate max. SF-36, IPAQ, PACES questionnaires will also be administered for health status, level of physical activity and enjoyment, respectively.

Results: It is hypothesized that participants of CET and AET will increase their psycho-physical wellness more than the control group: AET should be more effective in body weight reduction and fat loss, instead the CET should impact more on lean mass, CRE and muscle strength. In addition, as many studies suggest, it is expected that exercising in natural environments will be associated with greater psycho-physical benefits and positive engagement compared with exercising indoor.

Conclusions: This proposal aims to be a contribution to adapted physical activity, exploiting the benefits of indoor and outdoor training and emphasising AET and CET training in overweight individuals.

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Influence of physical activity on cardiovascular risk in childhood obesity

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Purpose: Childhood obesity (CO) is a problem of considerable social importance worldwide. In Italy it affects 1/4 children. CO has a multifactorial genesis; in fact, it is the result of different causes, more or less evident, which interact with each other. Main causes are an inadequate diet, linked to a reduced physical activity and a genetic predisposition. During CO, there is an increase in adipose tissue that occurs with weight-gain; consequently, persistent inflammatory state is created. The release and the increase of inflammatory markers affect insulin sensitivity, glucose metabolism and atherosclerosis, eventually leading to a higher cardiovascular risk.

Methods: To evaluate the impact of physical exercise on cardiovascular risk, we evaluated lipid profile and specific biomarkers related to cardiovascular risk such as Lipoprotein(a) [Lp(a)], adiponectin and PCSK9 by ELISA assay. For this study, we recruited two population: 45 sedentary obese children (OSe), age = 11 ± 3.3, weight = 70 ± 23.3 kg, height = 1 ± 0.27 m, BMI = 3 1 ± 6.9 and 31 obese children who practice sports (OSp), age = 10 ± 2.5, weight = 61 ± 17.3 kg, height = 1 ± 0.13 m, BMI = 28 ± 4.4.

Results: Our results showed a decrease in serum level of Total-Cholesterol, LDL- Cholesterol and Triglycerides in OSp population in comparison to OSe; on the other hand, HDL-Cholesterol levels in OSp group are increased respect to OSe. Moreover, Lp(a), adiponectin and PCSK9 levels are significantly reduced in OSp if compared to OSe.

Conclusions: Physical activity can be considered a non-pharmacological therapy useful for the reduction of cardiovascular risk in obesity and related diseases. Introduce sport as integral part of anti-obesity strategies in children and adolescents could be a valuable tool to safeguard the health of obese children, protecting them from obesity-related risks.

Lifestyle intervention based on mediterranean diet and resistance training in the treatment of benign prostatic hypertrophy and tumorigenic control in prostate cancer cells: a case study

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Purpose: Benign prostatic hyperplasia (BPH) with chronic inflammation represents a prostate cancer risk factor. We aim to investigate the effects of a 16-week lifestyle intervention (LI) in a patient with BPH. We utilized the International Prostate Symptom Score (IPSS) to monitor improvement in the symptoms [primary outcome], and we evaluated health-related (HR) parameters and the effect of serum blood in tumorigenic control in prostate cancer cells [secondary outcomes].

Methods: One 57-year-old male subject—with a medical history of BPH, an IPSS > 12, a prostate volume 60 cc, and intestinal dysbiosis—undertook a LI based on the Mediterranean Diet (MD) and progressive resistance training (RT) for 16 weeks. The MD was enriched with probiotics, omega-3, and aloe vera. RT was performed 3 days/week with a progressive intensity from 8 to 12 repetition maximum for 3 sets per exercise. Each exercise session involved upper- and lower-body exercises supervised by an exercise specialist. Variation of the prostate symptoms (by the IPSS questionnaire), HR parameters including anthropometrics, MD adherence (by the MEDIET questionnaire), physical activity level (by IPAQ-SF), upper limb strength (by hand grip dynamometer), metabolic, endocrine, and inflammatory serum biomarkers [glycemia, insulin resistance, progesterone, testosterone, prostate-specific antigen (PSA), neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), insulin-like growth factor-1 (IGF-1), Vitamin D, and Testosterone], constipation, and gut microbial composition and relative abundance (by the Bristol Stool Form Scale (BSFS and 16S rRNA gene sequencing, respectively) were performed at baseline (T0), after 12- (T1), 16-week (T2) of LI and 12-month of follow-up.

Additionally, the in vitro test for controlling tumor proliferation—in a prostate cancer cell line (LNCaP)—using LI-conditioned serum collected at T1 and T2 *vs.* T0 was applied.

Results: IPSS was significantly improved after the 16 weeks of LI and maintained at the follow-up. The study shows significant enhancement in all HR outcomes, including reduction of PSA (− 56%), NLR (− 55%), PLR (− 20%), and increase of IGF-1 (+ 78%), Vitamin D (+ 77%), and Testosterone (+ 121%). Muscle strength, urinary problems, and BSFS for stool consistency also improved. Additionally, the in vitro test for tumor proliferation control showed a reduction in the number of cancer cell colonies (− 24%) induced by LI-conditioned serum. Moreover, the patient reported an amelioration of sexual function, gastrointestinal symptoms, and sleep quality.

Conclusions: Incorporating a LI program in the diagnostic and therapeutic care pathway for patients with BPH may ameliorate lower urinary tract symptoms and reduce cancer risk.

Is horseback riding able to preserve physical efficiency and bone health in post-menopausal women? comparison with conventional training

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Purpose: Horseback riding at various levels is a particularly popular activity among women and it is becoming increasingly popular, even in middle-age groups. It is well known that, after menopause, women experience a decline in physical efficiency, which is also related to an increased risk to develop osteopenia/osteoporosis. Despite the benefits of physical activity in counteracting this decline, most of the women in this age group do not meet the minimum levels of recommended physical activity. The present study aims to compare physical efficiency and bone health in two groups of post-menopausal women, one practicing horseback riding (HG) for at least three years, and the other performing combined training (CG) for the same period.

Methods: 30 post-menopausal women (age 50–65), active for at least three years with an IPAQ score between 1, 500 and 3, 000 MET/sett, were recruited; 15 of them (HG) were practicing horseback riding at various levels, and 15 (CG) combined training. All participants underwent functional assessments (i.e. 6MWT, Handgrip, balance test, 30STS), bioimpedance analysis, and Dual-Energy X-ray Absorptiometry (DEXA).

Results: Both groups evidenced normal values, related to their age, for the functional evaluations; the HG reported a higher value of 6MWT ($p < 0.01$) and lower values in the Borg scale ($p < 0.05$) compared to the CG. The CG group showed higher values in the 30STS in respect of HG ($p < 0.01$). Both groups evidenced normal values in bioimpedance analysis, but statistically significant differences were reported in TBW% (HG: 60.2 ± 4.7; CG: 53.7 ± 5.6), FFM% (HG: 78.0 ± 4.5; CG: 71.9 ± 5.5), BMC% (HG: 41.1 ± 2.1; CG: 37.2 ± 2.9). BMI, although in the normal range in both groups, highlighted significantly lower values in HG compared to CG ($p = 0.05$). The DEXA analysis evidenced no significant differences between the two groups, which were homogeneous in terms of diagnosis of osteopenia/osteoporosis.

Conclusions: Both horseback riding and combined training performed continuously, are able to counteract the decline in physical efficiency in this population. Further studies are needed to assess their effects on bone health. Considering this preliminary investigation, horseback riding, which is particularly popular among women, could be recommended as an alternative form of exercise that can engage them in regular physical activity.

Active mobility and mental health in italy: the passi surveillance data

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Purpose: *Sustainable Development* (1) promotes *Active* Mobility (AM, i.e., walking, cycling) as a source of people and environment health promotion (2). In Italy, the behavioural risk factor surveillance PASSI (6) collects data on AM and health indicators, including depression and quality of life (QoL). Despite MH significantly impacting people's life and societal well-being (7), their relationship with AM has been neglected. The COVID-19 lockdowns saw depression levels and sedentary habits rising; however, QoL has improved since then (8). The Italian National Health Institute (ISS) states the relevance of research in implementing measures that promote MH and public well-being (9). The authors are collaborating with Modena's Local Health Authority (AUSL) to fill this gap.
Methods: The study uses a quantitative and cross-sectional methodology and primary source data from a large sample (PASSI database, N > 50.000 adults living in urban and rural areas). The variables include AM as the exposure (bike, walk, both; minutes/week) and MH outcomes (depressive symptoms, PHQ-2, and self-related health, H-RQoL). Also, controlling variables (sociodemographic, environmental, and other health indicators) will be considered.
Results: The literature is promising (3–5) but mixed: although the relationship seems overall positive, this is not true for every subsample. The findings would deepen our understanding of AM and its correlates, particularly in Italy.
Conclusions: According to the University's *Third Mission* (10), this joint work will encourage health, economy, urban and transport planning experts networking and will spark further experimental research to define active mobility as a successful public health and sustainability strategy.
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Factors influencing the socio-economic impact of small and medium-sized sports events on participants, tourism and local communities: the case study of the 2022 Italian National University sport championships

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Purpose: This research aims at measuring the socio-economic impact of small and medium-sized sport events, paying special attention to the evaluation of the experiential value and the stakeholders' satisfaction, emotions and participants' future intentions.
Methods: The study consists of two parts: a systematic review of the literature and an empirical research with on-site data collection. The systematic review was carried out in Scopus and Web of Science according to the PRISMA checklist. For the second part of the research, questionnaires were used and the data collection was performed during and after the National University Championships (CNU), held in Cassino in 2022, trying to ensure the representativeness of sport disciplines/genders. The sample consists of athletes and technical staff (n.726), spectators (n.219) and local business companies (N.100). Three versions of the questionnaires were realized including: socio-demographic data, information about the stay, individual expenses, expectations, assessment of the quality of the Event, personal experience and satisfaction, destination image and emotions, behavioural intentions, social impacts perception. In order to assess the direct economic impact, we also used the DEC—Direct economic impact calculator.
Results: In our analysis, the economic impact is discussed, emphasizing the positive effects on local economies including the generation of production and GDP through expenditures on goods and services. The determinants of individuals' spending are explored, including factors like age, origin of visitors, scheduling, and the sports team's ranking. The social impacts of sports events are also examined, including increased opportunities for entertainment, community development, and enhanced community pride. Findings show that the perception of social impacts varies among different stakeholders, and both positive and negative effects are acknowledged.
Conclusions: The findings about the economic significance of small and medium scale sporting events, their potential benefits for host communities, and the importance of managing negative impacts while optimizing the positive effects of these events, might serve in the future as a tool for event organizers by providing guidelines regarding the best practices to chase success in the complex world of sports events.

The university training of the sports manager in italy between legislative misapplications and overlapping degree courses

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Purpose: The implementation of the 2021 sports reform in Italy introduced new professional figures, including the sports manager. According to this provision, a master's degree in Organization and Management of Exercise and Sport Science Services (LM-47) is required to practice this profession. However, some universities offer bachelor's and master's degree courses in sports management under different study classes, such as Sciences of Legal Services (L-14), Administration and Organisation Sciences (L-16), Business and Management Sciences (L-18), and Business Economics (LM-77). These degree courses may qualify individuals as pseudo-sports managers, despite substantial differences in the educational content compared to the legally defined sports manager profile. This study aimed to assess the illegitimate overlap of degree courses outside the study class LM-47 and the discrepancies in their study plans compared to those of LM-47.
Methods: This document survey used the two Ministerial Decrees of 2007 of the bachelor's and master's degree classes to extrapolate the degree courses involved in the overlap. Universitaly portal was used to identify the relevant subjects included in the individual degree courses in sports management other than the LM-47. Textual analysis of the objectives and content of the degree courses was done through the PRISMA literature review tool, highlighting relevant or consistent elements of the sports manager profile as established by the provision.
Results: Degree courses in Law and Sports Management in study class L-14 have a juridical professional profile, which is minimally relevant to the sports manager's role. Similarly, degree courses in

Economics and Business Management Sciences in the study class L-18 and Administration and Organization Sciences in the study class L-16, focus on economic-financial administration and management control, lacking alignment with the sports manager profile. Even master's degree courses in the study class LM-77 exhibit disparities with the sports manager profile as defined by the law. Furthermore, all these degree courses lack European credit transfer system (ECTS) credits in the Exercise and sport sciences area.
Conclusions: There are clear contradictions in the degree courses designed for sports managers other than LM-47. This situation may lead to the misapplication of the legislative provision and result in problems with professional accreditation and limited employment opportunities for graduates of such study courses. To promote the development of this professional figure, it is necessary to improve the educational offerings of the LM-47 with a more integrated approach to the different economic-legal disciplines for the training needs of future sports managers facing the real dynamics of the sports sector.
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Sports worker versus kinesiologist: the Italian case

Purpose: After several years, Italy has taken steps to legislate on professions related to sports with delegation law no. 86 of August 8, 2019, which has produced various legislative decrees establishing very precise rules regarding sports work, surpassing the anachronistic framework of the National System of Sports Qualifications (SNaQ) of the Italian National Olympic Committee (CONI) and the related job profiles of ATECO codes. In substance, specific objects of the type of work of master's degree graduates in exercise and sport science have been arranged complementary to those of technicians licensed by National sports federations (FSN), Sports promotion bodies (EPS) and Associated disciplines (DA) and Paralympic sports bodies. A hypothetical equivalence has been introduced between SNaQ qualifications and academic titles, but its implementation is doubtful due to potential conflicts between titles of different origins (academic and professional). The problem lies in the confusion that arises from the succession of legislative decrees, corrections, and integrations, as well as sporadic and additional legislative interventions, such as decree laws converted into law containing postponements in application, derogations, and reversals regarding specific approvals from Europe, all of which increase the complexity of understanding the reforms in the field of sports. The objective is to provide clarity through a careful analysis of the laws that have rapidly followed one another in this recent period and their practical effects.
Methods: The research method is based on the analysis of Italian regulations concerning sports work, the study of European laws aiming to harmonize sports regulations among member countries, and the evaluation of the legal, social, and economic implications of these normative provisions.
Results: The Government has acknowledged many critical aspects of the reform raised by all the entities involved in the various hearings of the parliamentary committees. Secondly, there is a need to mitigate these critical aspects with the intention of not completely stalling the reform, which would risk nullifying all the work done. Some corrections to the draft text definitively distinguish between the three categories of kinesiologists and the technicians of CONI, FSN, EPS and DA, maintaining, for the latter, the ownership of sports activities and the exclusion of kinesiologists from the category of sports workers.
Conclusions: The research highlights the complexity and challenges faced during the process of reforming sports-related professions in Italy. The path to clear and effective regulation is still in progress, but the recognition of critical points and the willingness to make corrections demonstrate a commitment to finding an appropriate solution for the Italian sports sector.
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Perceptions/Opinions on the training of the bachelor of science in physical education and sport by students aimed at the new professional profile of the basic kinesiologist

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Purpose: The study aims to measure the perceptions and opinions that students have with respect to training in their studies and also to analyse any gaps in terms of knowledge and skills to be applied in the professional field, taking into account the new and recent legislation that provides for specific training to be provided by universities, with the three-year degree course in Science of Motor and Sporting Activities (L22) for the cultural and scientific profiling of the new professional figure of the basic kinesiologist.
Methods: A questionnaire was administered to 30 students consisting of 15 questions divided into 3 sections: section 1 identifies the sample, section 2 assesses perceptions on knowledge acquired and section 3 assesses perceptions on skills learned. A chi-square ($\chi 2$) analysis was performed to check for significant differences.
Results: The results showed a difference of opinion. Despite the fact that 84.2% of the sample had a good opinion of the training on offer, discordant data emerged on the knowledge and skills taught within the courses of study. Although this high percentage is convinced and entrusts its training to the university course, it is found that 19% have qualifications issued by national sports federations, 4.8% by other and 1.6% by sports promotion bodies. In addition, there is significance $P = 0.001$, which demonstrates satisfaction with the training received.
Conclusions: The study shows that the basic kinesiologist is regarded as a key figure within sports organizations and university training is also considered positive by those trained by national sports federations, sports promotion bodies and associated disciplines.
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Motor learning and inclusion: the role of video modelling in teacher training

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Purpose: On the basis of what studies are outlining in the area of motor learning and inclusion, it is essential to recognize the underlying complexity of practices in both contexts, which requires non-linear approaches that take into account the co-evolutionary characteristics of individual/environment interaction processes, in which the concept of participation takes on new meaning. By framing motor-sport activities in an ecological-dynamic and bio-psycho-social perspective, the contribution aims to understand to what extent the use of video-modelling supports teachers, from an inclusive perspective, in observing the child's spontaneous motor investment as an expression of intentionality and its specific possibilities of functioning, in order to reflect on the possibilities of expanding each individual's experiential baggage.
Methods: The study involved a convenience sample of n = 118 participants in the Methods and Didactics of Physical Activities (Primary School) laboratory of the Courses for Instructional Support, who were administered a semi-structured questionnaire on the advantages of video modelling in the literature, in which each respondent expressed their degree of agreement on a Cantril scale 1 (total disagreement) 6 (total agreement), for each item.
Results: In general, the monovariate analysis gives mean values always very close to the maximum value (6) for each item, with standard deviations always relatively low, indicating a good degree of agreement between the perceptions expressed by the respondents. An analysis of the content of the open-ended responses, which aimed to investigate the efficacy of video modelling, reveals a general consistency between quantitative and qualitative data.
Conclusions: In particular in the field of motor activities, it is complex and yet indispensable to promote learning situations that favour the active and personalized participation of the child with disabilities, in meaningful and enjoyable movement experiences that, if not properly designed, assume characteristics of exclusivity and disintegration. In this vision, in which the functioning of an individual represents the results of the interaction between individual and environmental characteristics, it is indispensable to promote in teacher training, the ability to respond to the special educational needs of individual learners.
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Exploring the relationship between self-efficacy, perceived ability, and actual performance in youth basketball players

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Purpose: The complexity of sport performance requires a training model oriented toward both physiological and cognitive elements. To design an effective training, coaches need specific feedback from athletes, which could help modulate the proper "doses" of quantity and quality in exercises. Self-efficacy (SE), the one's belief to successfully perform a task and achieve a desired outcome, is a key element to optimize training effectiveness. To avoid both overconfidence and underestimation of abilities, coaches should develop athletes' SE through experience and performance evaluation. The aim of this work was to assess the relationship between SE esteem (SEE), squat jump (SJ) perceived test (SJPT) and actual performance (AP) in young male basketball players, also highlighting the importance of group dynamics in sports training.
Methods: Young male basketball players (n 81) aged 9 to 16 years, with a range weight from 27.3 to 94.3 kg and a range height from 129 to 188 cm, were enrolled. Regarding SJ performance, participants were asked to: complete an online questionnaire about their SE which was used to estimate their jump height (SEE) and perceived rank in SJ ability within the group; perform a SJPT which consisted of indicating, on a measuring stick placed vertically on a wall, the maximum height they thought they could jump; perform SJ 3 times using an optoelectronic system (Optojump) indicating, after each jump, the perceived height achieved. Descriptive and inferential statistics were conducted. Cronbach's α and McDonald's ω were calculated to evaluate the internal consistency scales. Pearson's correlation coefficient was determined to examine relationships between variables.
Results: Data showed good internal consistency for both SEE ($\alpha = 0.828$; $\omega = 0.842$) and SJPT ($\alpha = 0.838$; $\omega = 0.854$). Consistent with the literature, AP increased with age ($r = 0.758$; $p < 0.001$). The significant positive correlation between SEE and AP suggested that the questionnaire could be considered a reliable tool ($r = 0.523$, $p < 0.001$). On the other hand, the SJPT did not correlate with AP ($r = 0.198$: $p = 0.076$). Moreover, players were able to rank their performance within the group ($r = 0.247$; $p = 0.027$).
Conclusions: As an ongoing study sample size is growing. SE should be a key factor in sports training. While SEE could be a useful tool to assess AP, the reliability of SJPT should be interpreted with caution, especially among younger athletes. Coaches should provide opportunities for athletes to gain experience and evaluate their own performance to prevent overestimating or underestimating abilities.

From gross motor assessment to teaching planning

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Purpose: Kindergarten and primary school first years constitute a particularly fertile period for the development of broad and solid basic motor skills that impact the global development of the child. This favours the participation in more complex motor and sports activities. At this developmental stage critical issues in motor development may occur: some are linked to the lack of adequate stimuli or experience opportunities, others are often associated to other specific learning difficulties or disabilities. The Test for the evaluation of gross motor development (TGMD-3) allows a full understanding of critical issues that can negatively affect appropriate management of body movements, that inevitably also influence motivation and physical self-efficacy perception.
Methods: An intensive-descriptive case study analysis allowed through this contribution to outline the possible teaching methods that can be useful for implementing practical and personalized proposals. The TEO-Test Erickson Online is an innovative digital platform that provides guidance to professionals in their activities from test's administration to the design of final reports. The TEO Platform provides a detailed output of student's performance, through the automatic calculation of their raw scores, summarising the data that emerged, the positioning with respect to the reference data and an overall descriptive profile.
Results: The teacher can be guided using this technology in his/her selection of learning objectives, contents of teaching activity and methodologies, through the recording of raw values for each test (locomotor skills and ability to control the ball), the measurement of the strengths-weaknesses-balance (criteria met or not), and the qualitative analysis of personal and contextual barriers and facilitators. This can provide a personalized approach in motor organization and learning, allowing the child to adapt and re-adapt his movements according to the different external and inner cues.
Conclusions: This study gives a methodological procedural example that can be used for and inclusive teaching planning of activities, while considering the complexity and of the multiple variables involved in the teaching–learning process.

Physical education teaching in primary school from the perspective of internal stakeholders (Teachers and Headmasters) of the same schools

Purpose: Physical education teaching by a specialized teacher only in the fourth and fifth classes creates a discontinuity in the educational organizational model, where the generalist teacher is the only one in charge of teaching the other subjects. The presence of external sports projects and the requirement of only 2 h of physical education for fourth and fifth classes raise concerns among internal stakeholders (generalist teachers and headmasters) of individual schools. Previously, perceptions and opinions were investigated among categories of internal stakeholders: teachers, primary school university training students, and sports tutors, regardless of their affiliation with the same school. The purpose of this study was to measure the perceptions and opinions of internal stakeholders from the same school to gain a precise understanding of the impact within the same work context.
Methods: Seventeen headmasters and eighty generalist teachers from the same schools were recruited. They were administered a questionnaire with closed and open-ended questions. The Chi-square test and critical analysis of the responses were used to evaluate the significance of the findings.
Results: From the results obtained from the headmasters, it emerges that the majority are in favour of introducing the specialized graduate teacher in Exercise and sport sciences, but doubts arise regarding their qualitative contribution. As for the generalist teachers, some contradictions emerge: while the majority considers specific training necessary to teach physical education, a smaller percentage believes that the generalist teacher is not able to do this but can plan adapted physical activities for students with disabilities.
Conclusions: Externally funded schools' projects have demonstrated the benefits of having an expert physical education teacher in primary school, including motor skills, school performance, and lifestyle improvements. Despite some identified critical points in the projects, the Ministry of Education has made the right decision to mandate physical education teaching by graduates in Exercise and sport sciences. It is hoped that this practice will be extended to all primary school classes, as it has proven advantageous for physical education.
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Basic kinesiologist: perceptions of students from universities with different Prevalence of ects in the three basic and characterizing areas of exercise and sports science degrees (Physical Activity-Sports, Biomedical and Psycho-Pedagogical)

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Purpose: Several studies showed the high degree of heterogeneity in the distribution of European credit transfer system (ECTS) allocated in the three essential fields (physical activity-sports, biomedical, and psycho-pedagogical) in exercise and sports science degrees (L-22). This resulted in different University training for students with the same degree but taken in different sites, allowing the practice of the basic kinesiologist. Further scientific evidence is needed to understand how to re-design curricula, measuring students' opinions. The aim was to compare the perceptions of students from three Universities with different prevalence of ECTS in the three essential fields on the adequacy of their training to perform the basic kinesiologist.
Methods: Convenience sampling was used to recruit L-22 students from three Universities, selected by Universitaly, with different prevalence of ECTS in the three essential fields. An ad hoc questionnaire, including questions about the study course and the adequacy of own training to perform the basic kinesiology, was administered to students. Chi Square, followed by a post hoc, was used to compare differences in perceptions, the magnitude of which was measured with Cramer's V.
Results: The results showed most students from the University with a prevalent number of ECTS credits in physical activity-sports field perceived themselves to be better prepared to perform the profession of basic kinesiologist ($p < 0.05$).
Conclusions: It is necessary to consider if applying the experimental evidence of student opinion to improve aspecific training. The study

has sample limitations; therefore, based on this pilot study, replication is recommended to verify the reliability of the findings.

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Motor assessment in primary school: motor skills and physical abilities

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Purpose: With this work we intend to define the state of the art in the teaching and assessment of Physical Education (P.E.) in Europe, in addition to this we want to carry out a comparison of physical abilities and motor skills. In order to make this comparison, coordination and conditional abilities have been verified in students of average age (9, 625 ± 0, 485), enrolled in the fourth and fifth classes of the Istituto Comprensivo di Cossato (BI) by subjecting them to 6 tests for conditional abilities and 5 tests for coordination abilities selected from two different protocols: MOTORISCHER TEST FÜR NORDRHEIN-WESTFALEN and MOBAK 5–6.

Methods: A total of 160 pupils were involved, of which 60 were boys and girls aged 9 (in the year of their 10 years) and 100 were boys and girls aged 10 (in the year of their 11 years). Two test protocols were used: MOBAK 5—6; MOTORISCHER TEST FÜR NORDRHEIN-WESTFALEN.

The data collected during the trial were analysed by converting the result of each test into a numerical value 1 to 5 for conditional tests and 1 to 2 for coordination tests (respectively), and, subsequently, assessing the degree of correlation of each by Pearson test (r) This analysis highlighted a moderate/positive correlation ($r > 0.25$) between conditional and coordination abilities for 43.3% of the comparisons performed.

Results: This analysis highlighted a moderate/positive correlation ($r > 0.25$) between conditional and coordination abilities for 43.3% of the comparisons performed. This data indicates that although there is already a moderate correlation between the two groups of abilities, not yet fully developed in the tested subjects, a correlation between conditional and coordination abilities cannot be fully defined. Saying that, you could note a possible increase in correlation with a study, with the same protocol, but with older subjects, due to the development of all motor skills. Overall, this type of tests allows to visualize the deficiencies and the strengths, depending on the age group, during the development of conditional and coordination abilities.

Conclusions: This type of protocol and analysis can be a potential tool for teachers of physical education of each level, to detect the skills of their students during the months/ years of education. Each subject could be evaluated according to their own objective improvements.

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Innovative technologies: exergames and motor skills in children

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Purpose: Nowadays children spend significant portions of their day engaging in sedentary behavior [1]. However, an active lifestyle during childhood is beneficial for physical, cognitive, and brain health. In this regard, exergames encourage physical activity focused on children's interests [2], thanks to the dynamics of fun games [3]. Thus, the aim of this work was to evaluate the effects of physical activity through exergames on motor skills in healthy children.

Methods: 18 children (aged 9 ± 1.2 years) were randomized in the Control group (CG), not using exergames, and the Experimental group (EG) using exergames 45'/die (Kinect Adventures and Nintendo Ring Fit Adventures). This study lasted from January to June 2023 and both groups performed monthly EUROFIT tests.

Results: We used the Standing Long Jump and Sargent's Jump tests to assess lower limb muscle strength and motor coordination. Before the intervention, there was no significant difference between both groups. However, at the end of the program, the standing long jump distance increased by 12.4% in the EG ($p < 0.01$) and by only 5% in the CG. Similarly, Sargent's jump test showed an increase in jump height by 65% in EG ($p < 0.01$) and by 30% in CG, respectively. Also, the speed and endurance (measured by the Shuttle Run Test) increased by 2% in EG ($p < 0.05$), and by 1.1% in CG; while the flexibility of the lower back and hamstrings (evaluated with Sit and reach test) increased by 75% in EG ($p < 0.01$) and by 28% in CG ($p < 0.05$).

Conclusions: Results indicated that exergaming was generally enjoyed and able to evoke benefits for physical activity and fitness [4]. This study encourages the introduction of exergaming in primary and secondary schools in order to improve conditional skills and increase student enjoyment. Finally, exergames shouldn't completely replace traditional physical activity but they can certainly be excellent allies for an active lifestyle.

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Sport and bodily practices to deal with youth discomfort: a case study

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Purpose: Our research focus on the link between bodily-physical practices, sport, and youth discomfort, in particular on social disadvantaged young, as an educational experiences to improve the wellbeing, quality of life, and capabilities of young individuals experiencing discomfort. Evidence on this topic reveals two prevailing tendencies: one assumes the positive impact of sport on vulnerable youth; the second adopts a more critical stance, highlighting the lack of longitudinal studies and evidence.
Between 2019 and 2021, our research group monitored two projects conducted in Bergamo by two sport organizations, both involving disadvantaged young people in participating sport-based activities, someone also as team manager.

The main purpose of our research study has been to identify success/unsuccess criteria of the interventions in the perspective of the sustainability, in terms of duration of sport practice, of the outcomes.
Methods: Our research group monitored and evaluated the progress and results of the two projects through interviews with project leaders (n = 3), focus groups with project partners (n = 6), observation of organizational and evaluation meetings (between project partners) (n = 23) and field observations of some young people during sport activities (n = 35).
Results: The two monitored projects led discording results; the more successful was realized by the organization deeply embedded within the community, with the advantage to be more compliant during the pandemic and foster a more informal collaboration. Regarding this project, our results could also highlight other prodromal aspects for the success, such as the variability in purposed sport rules participation, often fitting with the young people needs, the customization of the actions, the collaborative interaction between educators and coaches, also in joint training experiences.
Conclusions: In order to be effective and sustainable, a sport-based project should be: 1) durable; 2) flexible and promptly reacting, 3) informal at communicative and cooperative levels; 4) integrated with the opportunities given by the welfare system; 5) managed by social educators and sport operators with shared competences. Our results are preliminary, longitudinal research has been planned.

Health-related physical fitness in Italian adolescents: a call for action from the PE4MOVE project

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Purpose: Physical fitness (PF) is a determinant and a consequence of physical activity (PA), and it is considered the best indicator of health status in youth (Ortega et al., 2008). Physical education (PE) is an ideal setting to test and monitor PF for pedagogical and surveillance purposes (SHAPE America, 2017; Ortega et al., 2023). This research aimed to study three health-related PF components, cardiorespiratory fitness (CRF), muscular fitness (MF), and BMI among Italian adolescents, identifying differences based on sex and age.
Methods: The PE4MOVE project (Carraro et al., 2022) involved 5307 adolescents (11–18 years) in the Marche Region, Italy, in 2021–2023. Their 107 PE teachers were trained to monitor students' PF during PE classes using standardised protocols (www.fitbackeurope.eu; Geiger et al., 2007). CRF was measured with the 6-min walk test (6MWT), MF with the standing long jump test (SLJT), and the handgrip strength test (HGST). BMI was computed using self-report weight and height. A 2 sex × 8 age design was used for ANOVAs. Percentiles and the prevalence of unfit adolescents based on FitBack cut-offs for health-risk zones were also calculated.
Results: Significant sex x age interactions were found for the 6MWT ($p < 0.001$, $\eta p^2 = 0.016$), SLJT ($p < 0.001$, $\eta p^2 = 0.067$), and HGST ($p < 0.001$, $\eta p^2 = 0.077$). Significant effects on BMI were observed for both sex ($p < 0.001$, $\eta p^2 = 0.005$) and age ($p < 0.001$, $\eta p^2 = 0.100$). Girls showed lower PF levels than boys. Significant differences by age in CRF and MF were found in both boys and girls, indicating distinct trends in CRF and MF across ages compared to previous findings on adolescents' PF. Boys and girls aged 15 and 16 showed a significant decline in CRF compared to younger peers. Boys aged 14–16 and girls aged 13–17 showed a levelling off in the increase of lower limb MF, while boys aged 15 and 16 and girls aged 14–18 displayed a plateau in the increase of upper limb MF. A higher percentage of mid-adolescent boys and girls were found unfit than early adolescents.
Conclusions: Approximately half of the participants appeared unfit, showing a moderate-to-high risk for health. Results offer insights into Italian adolescents' PF, highlighting: (a) the need to consider sex and age when investigating PF; and (b) the key role that PE can have in supporting public health actions. Suggestions for interventions to promote health-enhancing PF and PA among Italian adolescents will be presented. Future studies should adopt a socio-ecological approach to explore the determinants of youths' PF.

Training gaps on teaching methods of physical education between generalist and specialist teacher in primary school: a systematic review

Purpose. Currently in Italian primary schools both Physical Education (PE) and Movement Education (ME) are taught by teachers with different basic training: generalist teachers (GT—graduates in Education and training) in classes I, II and III; specialist teachers (ST—graduates in Exercise and Sport Sciences) in classes IV and V. The different basic training leads different mastery on PE teaching methods, with a contrast of approaches/methods/styles/teaching role/didactic tools, despite the same students. There is a methodological gap of GT, which doesn't allow promoting PE for the purposes envisaged by the national guidelines and by provisions laid down by Law 230/2021for health and physical well-being. To reduce the training differences between GT and ST and the gaps of GT, this work aim to identify the most common PE teaching styles to promote efficient use of teaching methods of PE by GT during their university training through academic discipline MEDF.
Methods. A mixed method has been adopted: a documental analysis (DA) on Education and training degree order and a systematic review (SR) on PE teaching styles have been carried out. For the systematic review the literature search on Scopus, Eric, WoS focused only on studies investigating teachers 'use of Spectrum teaching styles, according to Mosston and Ashworth.
Results The DA confirms the homogeneous structure of the GT training model, and it shows the role that laboratories should assume to build the methodological competences of GT. The descriptive results of the SR indicate that the pattern of teaching style employed by the teachers across different countries was similar, with reproduction teaching styles used more often than production teaching styles. In particular, the use of the command, practice, and inclusion styles dominated in the classrooms internationally. Combining the results of the DA and of the SR, it emerged that GT training programs should encourage and challenge GT to explore and use a broad range of teaching styles.
Conclusions. The training programs in MEDF should help GT to develop more comfort and confidence with the PE teaching styles. It

would be useful in MEDF GT training to combine lecture, discussion, observation of demonstrations, practice, and feedback in protected conditions, as well as in real school settings, about cognitive approach/prescriptive teaching method/reproductive style/exercises, to promote physical exercise for health and well-being.

Did Beijing 2022 achieve the sport participation goal?

Purpose: The Olympic culture "Sport for All" (IOC, 2021) propagates the shared vision of previous, present, and future hosts to increase sport participation. Beijing 2022 successfully engaged over 346 million people in winter sports (BOCWOG et al., 2021), while Milan-Cortina 2026 envisioned "Games for All" emphasizing sport participation. This study aimed to determine what Milan-Cortina 2026 can learn from Beijing 2022 regarding sports participation legacy.
Methods: Our investigation took a quantitative approach to scrutinize the longitudinal data and selected indicators from people, facilities/equipment, and market perspectives based on the goal of engaging 300 million Chinese in winter sports.
Results: The preliminary findings suggest that individual researchers or research institutes need help examining the exact number of sport participation legacy. The main reasons involved the broad definition of "Motivate 300 million people to engage in winter sports" and this political mission's cultural and systemic context. Moreover, our study revealed that inspecting the legacy delivery process and promoters is more significant than figuring out the exact number. The three crucial facilitators that China used to achieve the sport participation goal included "Sports events, competitions and tourism, " "Integration and provision of sport and education, " and "Cooperation alliance with a shared vision and balanced interests."
Conclusions: Overall, our investigation diagnosed a need for more continuous studies after the Games with international comparative frameworks to examine sport participation, especially for winter sports. We suggest that future hosts learn from past experiences based on the international comparison study to create a sustainable legacy.
Acknowledgments: This work was supervised by Professor Sakis Pappous and Professor Samuel Marcora.
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…

Sport for nature -the Cammino Del Po: wellness, outdoor education, inclusion, territory, tourism and economy

Purpose: Bring students closer to the outdoor environment through the practice of physical activity in a natural environment in order to experience the resulting integral well-being of the person improve the man-nature relationship and make young people aware of issues related to the environment and sustainability create a new professional figure that combines motor-sports and environmental skills verify, through the Connectedness To Nature Scale questionnaire, the variations in the approach to nature of students of the Catholic University and of a high school after some outings along a stretch of the Po river.
Methods:

- On February 17, a full-day conference "WALKING TOWARDS A NEW FRONTIER OF WELL-BEING" in which all the peculiarities of the practice of walking were presented, both in developmental and adult age, and the positive effects that arise
- A university course "SPORT FOR NATURE COACH" was held in April with the aim of making students aware of environmental issues, with specific training on

· climate change and its consequences
· outdoor physical activity
· benefits deriving from direct contact with the elements of nature (green spaces, blue spaces, green activities).

Next September, a residential university course SPORT FOR NATURE COACH—CAMMINO DEL PO—DISCESA DEL PO will take place in which students will attend a basic course in canoeing and rowing, they will be the protagonists of the descent of the Po by choosing from four different methods—swimming, by bicycle, by canoe, walking—they will experience moments of reflection and discussion which will focus on the defense of the Po River and the floodplain lands.

A SPORT FOR NATURE advanced training course will be launched next academic year: holistic training of the person, physical and sporting activity in a natural environment and attention to sustainability.

In september scientific research through the administration of the Connectedness To Nature Scale questionnaire to university students during the descent of the Po and to a class of high school students before and after some outings along the Cammino del Po.
Results: Specific training on outdoor physical activity, slow and sustainable tourism, good environmental protection practices verification of changes in the approach to the natural environment and to sustainability after motor-sport experiences in contact with nature.
Conclusions: Sport for nature—Cammino del Po is a project that uses physical activity in a natural environment as a tool to convey a series of messages in line with the action program for sustainable development of Agenda 2030 wants to train a new professional figure with motor-sports, environmental and sustainability skills wants to verify the actual change in thinking after a course of physical activity in a natural environment.
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Assessing the accuracy of an accelerometer inclinometer sensor during a programmed plogging session

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Purpose: Plogging is an activity that combines jogging and picking up litter. The purpose of the study was to examine the accuracy of the inclinometer sensor of a triaxial accelerometer *ActiGraph GT9X Link* + (Pensacola, FL, USA) in assessing two different movements performed during a plogging session checked with the event counter app *Clickr 2.02* (rdq, Prague, CZ) for smartphones.
Methods: The participant, a healthy male volunteer, performed 10 min of a plogging session in a forest, wearing two accelerometers, one on the non-dominant waist and one on the upper back, initialized at 30 Hz frequency. An observer was behind him during the activity and checked every single movement using the event counter app. To record different angles of movement, in according to the participant, the movements were programmed performing alternatively squatting and forward bending movements while the participant picked the trash from the ground. Accelerometers data were downloaded using *Actilife v6.13.4* (Pensacola, FL, USA) software at 1 s epoch length and then compared with the counts recorded with the event counter using *Matlab R2022b* (The Mathworks Inc., Natick, MA, USA).
Results: The total number of the movements counted by the observer and checked using the event counter was 49 (i.e., 25 squatting movements and 24 forward bending movements). The squatting movement was detected ten times as lying and four times as sitting by the inclinometer of the accelerometer applied on the upper back, and 13 times were recorded as sitting by the inclinometer applied on non-dominant waist. Instead, the forward bending movement was recorded two times as lying and one time as sitting by the accelerometer applied on the upper back, and six times as sitting when worn on non-dominant waist. Furthermore, the inclinometer recorded only the first movement done when the movements were performed in quick succession.
Conclusion: These results suggest that both accelerometers, when applied on upper back and non-dominant waist, detect better squatting movements than forward bending movements. Secondly, the accelerometer on the non-dominant waist is more accurate than the one applied on the upper back. However, both body locations capture only a small part of the total events because they don't recognize very close events.

Achieving SDGS 4 and 5 through physical education: an overview on gender stereotypes in primary school

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Abstract
Purpose: Gender stereotypes (GS) are one of the main priorities on which educational policies have focused on recently, being included in Goals 4 and 5 of the 2030 Agenda. Physical education (PE) is one of the disciplines that traditionally reproduces the idea of hegemonic masculinity, leading to the exclusion of the female gender. Because the attitudes and lifestyles adopted by children influence choices and behaviors in adult life, it is necessary to work on GS starting from primary school, in view of the compulsory two hours of PE. The aim was to verify the presence of GS during PE, identifying the barriers that hinder female participation in movement activities.
Methods: The method was systematic literature review using the PRISMA 2020 guidelines. Web of Science, Scopus and Scholar databases were used to collect studies. Inclusion criteria were original English language articles and a cutoff date between 2012 and 2023.
Results: On a total of 64 articles, only 13 met the inclusion criteria. The main barriers related to pupils' personal beliefs toward sports activities, especially by the female gender and teachers, as well as the reproduction of GS in PE textbooks. Several interventions were conducted, focusing mainly on coeducational methodology, which proved effective in breaking down some GS.
Conclusions: The results demonstrated the persistence of GS in the school setting during PE. There is a need to improve teacher training, which is perceived as inadequate to work on the phenomenon of GS starting from primary school.
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Sustainability and sport between education and management. an Investigation involving sport science students at Parthenope University

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Purpose: The aims of the present research were to investigate the level of knowledge and awareness on the topic of sustainability and sustainability in sport among students of the three-year and master's degree courses of the Department of Sport Science and Wellness of the Parthenope University of Naples.
Methods: A purpose-built questionnaire was created to assess the perception, knowledge, awareness and practices of sustainability and submitted to students in the Department consisting of 11 items with questions on a 5-point Likert scale. A total of 157 respondents (males: 57%; females: 43%;) were collected and analyzed. The sample consisted of students from the three bachelor's degree programs (78%) and the three master's degree programs (16% LM-67; 3% LM 47–68; 2.5% LM 50–93). Descriptive statistical analysis was performed using SPSS Office 365.
Results: The research results show that most students had no knowledge (32%) or limited (27%) of the definition of sustainable development. Only 31% knew that the 2030 Agenda on 'Sustainable Development' was adopted in 2015 and more than half of the sample did not know that Italy is among the countries that signed it. Only 28% of the sample is aware that sport is an important provider of 'sustainable development' and 36% that it contributes directly and effectively to most of the goals of the 2030 Agenda on 'sustainable development'. Almost half of the sample (49%) stated that lecturers do not cover the topic 'Sustainable Development' in their courses,

while almost all of the sample (92%) would find it interesting to include content on 'Sustainable Development and Sport' in their university education. 45% recognise that their university has implemented services/initiatives in the area of 'sustainable development', however 55% respond that they do not know or are unsure of the existence of such services/initiatives. Almost all of the sample (95 per cent) believe that more information on 'Sustainable Development' is desirable at their university.

Conclusions: The results show the need to implement educational and training actions in students' university curricula to enhance and/or develop the managerial and educational skills needed to answer the call of the 2030 Agenda for Sustainability and specifically in sustainable sport.

Psychophysiological responses to electrically assisted cycling

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Purpose: Walking and cycling are common forms of active transportation. Cycling with a conventional bicycle is faster than walking, but terrain is limiting. Other transport opportunities overcome such constraints, such as cycling with electric bicycles (e-bikes), which operate with modest motor assistance when the rider is actively riding. It is unknown, however, whether riders' psychophysiological responses to e-bikes are comparable to those of cycling with a conventional bicycle and are sufficient to elicit physiological stimuli adequate to promote health benefits (i.e., an exercise intensity between 40 and 85% VO2 reserve). The aim of this study was, therefore, to characterize the psychophysiological responses to e-bikes.

Methods: Seven physically active men (mean age: 28.4 $\pm$ 3.2 yrs; VO2max 40.0 $\pm$ 4.5 mlO2/kg/min) participated in this study. Initially, they performed an incremental ramp exercise test until volitional exhaustion. Then, on three separate occasions, they performed 40-min cycling bouts at a self-chosen intensity using an e-bike (Thok, Mig 2.0), attached to a wheel-on trainer and connected to a virtual-reality software, in three different support settings: no support (NO), light support (LIGHT), and high support (HIGH). Breath-by-breath pulmonary gas exchange and ventilation, cardiac output and heart rate, muscle oxygenation and hemodynamics were continuously measured. Perceived exertion (RPE) and affective valence (AV) during exercise were also assessed.

Results: Compared to NO (21.4 $\pm$ 2.7 km), the covered distance did not differ for LIGHT (20.5 $\pm$ 3.0 km) and HIGH (22.3 $\pm$ 2.8 km) ($P > 0.05$). Cadence, power, and all physiological responses remained unaltered between the three experimental conditions ($P > 0.05$). The mean intensity was also similar in all experimental conditions (NO: 44.6% to 69.0%, LIGHT: 52.0% to 78.8%; HIGH: 47.0% to 67.4%VO2R) ($P > 0.05$). While RPE did not differ between the experimental conditions ($P > 0.05$), affective valence was more positive in HIGH than in LIGHT and NO ($P < 0.05$).

Conclusions: This study evidenced that differences in e-bikes discretely affect psychophysiological responses. Motorized cycling resulted in sufficiently high physiological responses to meet adults' physical activity guidelines. Motorized cycling also leads to pleasant sensations, which may create a positive memory of the activity and increase motivation for future bicycle utilization. This research was partially funded by MUR and Thok E-bikes.

A call for a new heat stress index to better safeguard athletes from exertional heat illnesses and impaired performance

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Abstract:

Purpose: Given the current increase in the occurrence of heatwaves due to global warming, safeguarding athletes' well-being while optimizing their performance in hot and humid conditions is a matter of utmost importance. There is an urgent need, therefore, for International Federations (IFs) to develop thermal stress indices that can predict the athletes' risks of exertional heat illnesses (EHI) during competition. Therefore, the aim of this research was to review the indices currently employed by IFs and assess their relevance for athletes.

Methods: Thermal stress indices currently used were identified by examining the policies of 6 IFs: World Athletics, World Triathlon, International Cycling Union, International Tennis Federation, International Association Football Federation, and the International Volleyball Federation. In addition, a scoping literature search was conducted on PubMed, Google Scholar, and Scopus databases to identify and analyze the existing thermal stress indices for exercising individuals.

Results: All studied IFs are relying on the Wet Bulb Globe Temperature (WBGT) to assess thermal stress and risks of EHI, which follow the guidelines of the American College of Sport Medicine. However, the ability for the WBGT to characterize heat stress in exercising individuals has been questioned in the last decades. Indeed, this index does not account for the metabolic production and clothing of exercising individuals, and its accuracy is impaired in environment with high humidity and/or low air movement. As a result, it does not represent the thermal strain experienced by athletes. A more promising approach lies in the utilization of human heat budget models, which integrate heat generation and dissipation components during exercise (e.g., Universal Thermal Climate Index, modified Physiologically Equivalent Temperature). These indices are employed in Biometeorology to evaluate the general population's perceptual strain towards weather conditions. Still, the lack of studies involving exercising individuals do not currently allow the evaluation of their predictive power for exercising athletes.

Conclusions: The WBGT is currently used by all the IFs screened in this research. However, it does not accurately predict thermal strain of athletes. It is essential to evaluate the validity of more recent indices based on heat budget model, and then assess the value of combining the best features of each model to predict EHI in athletes.

Effect of outdoor coastal walking and virtual reality indoor walking on psychological and physiological parameters: a crossover RCT

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Purpose: The COVID-19 pandemic and the shift to remote work have contributed to sedentary lifestyles, emphasizing the importance of physical activity (PA) for individuals' well-being. Outdoor exercise offers benefits for social, psychological, and physical health, helping prevent various illnesses. Technology such as exergames, augmented reality (AR) and virtual reality (VR) exercises, can boost motivation and enhance performance. VR has shown promise in increasing training sessions, improving strength, and alleviating chronic pain. However, limited studies have compared outdoor and VR indoor activities, especially in coastal settings. Therefore, this study aimed to evaluate the acute effects of a brief walking session outdoor and indoor using VR on psychological and physiological outcomes.
Methods: In June 2023, twenty-six subjects (14 M and 12F; age 25.2 ± 2.5 years; BMI 23.1 ± 2.4 kg/m^2) voluntarily participated in this crossover randomized controlled study and were allocated under three conditions: standard indoor walking (IN), indoor VR walking (INVR) and outside walking (OUT). IN and INVR were performed on a treadmill (speed 4.5 km/h) and the OUT was performed on a seaside pedestrian road. The same outdoor environment was displayed in the visor during the INVR. Heart rate (HR) (mean and max by Polar®), Physical Activity Enjoyment (PACES), and State of Mindfulness (SMS) were assessed at the end of each condition.
Results: The OUT condition showed significantly greater enjoyment and HR_{mean} than IN and INVR ($p < 0.001$) and greater SMS and HR_{max} than IN ($p < 0.01$ and $p < 0.05$, respectively). No significant differences were found between OUT and INVR regarding SMS ($p > 0.05$).
Conclusions: Results suggest that incorporating VR into indoor exercise sessions doesn't provide similar mood benefits as outdoor exercise. However, individuals may experience similar positive effects of outdoor exercise on their emotional well-being when engaging in indoor PA activities through VR technology. This suggests an opportunity for individuals who are unable or unwilling to engage in outdoor activities due to various constraints such as inclement weather, lack of access, or time limitations.
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Design study: artificial intelligence-driven exercise prescription based on acsm guidelines to improve cardiovascular fitness in elderly population with poor cardiorespiratory fitness

Purpose: This design study aimed to investigate the efficacy of employing artificial intelligence (AI) for exercise prescription based on the guidelines outlined by the American College of Sports Medicine (ACSM) in order to optimize cardiovascular fitness in older adults with compromised cardiorespiratory function. The primary objective was to determine the most effective exercise regimen capable of attaining a target heart rate of 120 beats per minute (bpm), considering parameters such as mean heart rate, standard deviation, and statistical significance.
Methods: A cohort of n = 10 older individuals (aged 56 years and above) with impaired cardiorespiratory function participated in a Pilates matwork program consisting of ten distinct exercises. Initial mean resting heart rate was recorded at 96.375 bpm, exhibiting a standard deviation of 10.865 bpm. The exercise program encompassed a progressive intensification strategy, featuring two sets of twelve repetitions for each exercise.
Results: The exercise program elicited a substantial and statistically significant increase in mean heart rate ($p < 0.05$). Upon completing two sets of twelve repetitions, the mean heart rate reached 94.5 bpm. To achieve the desired mean heart rate of 120 bpm, an additional twelve repetitions were required for the third exercise. Consequently, the mean heart rate subsequently reached the target value of 120 bpm, accompanied by a standard deviation of 10.865 bpm.
Conclusions: This design study demonstrated the efficacy of an AI-driven exercise prescription based on the ACSM guidelines in improving cardiovascular fitness in older individuals with impaired cardiorespiratory function. The implemented progressive exercise regimen, guided by AI algorithms, yielded a noteworthy increase in mean heart rate, effectively aligning with the objective of achieving a target heart rate of 120 bpm. These findings underscore the potential of AI as a pioneering approach for refining exercise prescription tailored to the unique needs and safety considerations of the elderly population with compromised cardiorespiratory function. Future research endeavors should aim to validate these outcomes across more expansive and diverse cohorts, thus accentuating the manifold benefits and applicability of AI-driven exercise prescription based on the ACSM updated guidelines.
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Virtual reality versus traditional training: a 5-week study on balance and flexibility in women

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Purpose: Balance and flexibility are fundamental skills for daily activities. Reduced flexibility can affect stability while decreased balance can increase the risk of falls. Different types of training appear useful for the development of these skills; however, the effectiveness of virtual reality training (VR) compared to traditional training (TR) is not yet clear. Additionally, decreased flexibility represents a fall risk factor, particularly in women who appear more likely than men to fall. Therefore, this study aimed to evaluate the effectiveness of a VR protocol on balance and flexibility compared to a TR protocol in women.
Methods: Twenty-one female adults (age, 49.81 ± 2.99 years; BMI, 24.25 ± 3.76 kg/m^2) were recruited and randomly assigned to three groups: VR group (n = 7) that performed a 5-week exergame training protocol using D-Wall (H-Sport); TR group (n = 7) that performed a 5-week specific training protocol on balance, lower limbs and abdominal strength; and control group (CG; n = 7) that continued their daily activities without any type of structured physical activity. All participants were healthy, not involved in any training protocols in the past six months, had no history of major fractures and/or

injuries, and were not taking any medications that could affect balance. Static balance was assessed by the ellipse area and statokinesigram parameters (Romberg test), dynamic balance was evaluated by the star excursion balance test, and flexibility was assessed by the sit and reach test.

Results: After the intervention, VR and TR groups showed a significant improvement in static and dynamic balance and flexibility (all $p < 0.001$) compared to the CG. Also, there was a significant difference for flexibility in favour of the VR group ($\Delta_{pre\text{-}post} = -3.33 \pm 0.67$ cm; $p < 0.001$; ES = 0.95) compared to the TR group ($\Delta_{pre\text{-}post} = -2.10 \pm 0.63$ cm; $p < 0.001$; ES = 0.60).

Conclusions: Findings suggest that a 5-week VR protocol may significantly improve static and dynamic balance and flexibility in adult healthy women. However, the VR protocol appears more effective just for increasing flexibility than TR, whereas static and dynamic balance variables may take longer. Further longer-term research is needed.

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Developing and enhancing body literacy to mitigate the negative effects of social media and promote a positive body image: a research intervention study with 9–10-year-olds children

Purpose: Social media use is widespread among adolescents and preadolescents despite the age limits imposed by law. Social media platforms often portray stereotypical beauty ideals that are far from reality; users are continuously exposed to unrealistic body models, with which they are constantly confronted. Failing to meet these idealised standards can lead to feelings of body dissatisfaction. This study represents the theoretical framework of a qualitative research-intervention project aimed at investigating the impact of an educational intervention on the development of children's body image. To develop a positive body image, it is necessary to work on the early reinforcement and enhancement, since childhood, of a personal dimension that can be defined as body literacy. Body literacy encompasses a multifaceted construct comprising several dimensions, including self-awareness, positive body development, gender differences, emotional literacy, Body Dysmorphic Disorder, and body acceptance.

Methods: The intervention consists of three phases: focus group discussions, educational intervention implementation, and post-intervention assessment. The analysis of the qualitative data will be carried out through a management, organization and analysis tool of the qualitative data named NVivo. The intervention aims to promote body awareness, body interoception, body perception, and body comprehension through age-appropriate educational activities and interactive sessions in a sample of 50 children aged 9–10 years.

Results: The focus group aims to investigate the habits of social media use and the mental representation of one's body in the reference sample. The intervention consists of a total of seven sessions each of which involves a combination of educational presentations, interactive exercises, group discussions, and hands-on activities designed to engage the children and enhance their understanding of body image-related concepts. The post-intervention assessment aims to verify the effectiveness of the interventions.

Conclusions: This intervention protocol will be implemented and aims to develop and maintain a positive body image in children; moreover, it aims to mitigate the potential negative impacts individuals may encounter as they navigate the digital world. Therefore, it is proper to work on the development of body literacy from the first years of life, going to enhance all the constituent factors of this complex and multifaceted construct.

Exploring the relationships between emotional intelligence and social media use in pre-teens. A longitudinal study

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Purpose: Adolescence is a period marked by significant physical, cognitive, social, and emotional changes. During this phase, emotional intelligence may play a crucial role in shaping social-emotional development. While emotional intelligence has both biological and psychological foundations, it is also subject to the influence of various sociocultural factors. However, with the widespread use of social media among pre-teens, concerns have arisen regarding its impact on emotional intelligence development and overall well-being. This study examines the relationship between emotional intelligence, social media activity, and the tendency towards social media addiction during adolescence. By investigating these factors, we aim to gain a better understanding of how social media engagement may influence emotional intelligence and potentially impact adolescents' psychological well-being.

Methods: A longitudinal study was conducted with a sample of 538 students ranging in age from 11 to 14 years. The data collection took place during school hours, and participants completed anonymous, self-administered questionnaires. The questionnaires used in this study included the Instagram Image Activity Scale (IIAS), which measured the frequency of image-related activities on social networks, the Trait Emotional Intelligence Questionnaire, and the Bergen Social Media Addiction Scale.

Results: A total of 537 preadolescents (49% girls, 49% boys, 2% non-binary; mean age: 12.12; SD: 0.89) were included. The most used platforms include WhatsApp (95%), YouTube (86%), TikTok (74%) and Instagram (68%). The participants carried out more activities on social media based on images of celebrities, followed by images of peers and, finally, by self-images. Correlational analysis shows a negative association between emotional intelligence and risk of problematic social media use (-0.263, $p < 0.01$), while a positive association emerged between the Bergen scale and the IIAS (0.556, $p < 0.01$).

Conclusions: This study highlights the extensive use of social media and suggests that excessive or problematic engagement in social media activities may negatively influence the development of emotional intelligence, as pre-teens may spend less time and energy understanding, expressing, and experiencing their emotion. Furthermore, it could be hypothesised that pre-teens with lower emotional intelligence may show greater susceptibility to becoming over-involved or addicted to social media. These findings underscore the need for further research and interventions to promote healthy social media use and support the development of emotional intelligence among preadolescents.

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Social media and body image in preteens: investigating the role of online platforms in shaping body perception. A longitudinal study

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Purpose: In recent years, the use of social networks has increased, exposing users to content based on beauty standards and thinness. Social networks have changed the way young people perceive themselves, often leading to distorted notions of beauty. The building of preteens' body image starts from this stage of life and the comparison with the beauty ideals proposed by social media might have an impact on their body satisfaction. Despite the age restrictions settled by many platforms, preteens can easily access and subscribe to social networks. In this perspective, the critical stage of identity formation, their vulnerability to societal pressures and the influence of online platforms cannot be underestimated. The present study shows the results of a survey aimed at investigating the association between the use of social networks and body image in preteens.
Methods: A longitudinal study involved 538 preteens aged 10–14 years through an anonymous and self- administered questionnaire aimed at investigating: the main activities conducted on social networks, the average daily time spent on social media, the addiction to social networks risk and the body satisfaction. Participants indicated the amount of time spent on each social network per day (15 min to + 4 h). The risk of addiction to social networks was calculated with the Bergen Social Media Addiction Scale (BSMAS). The study used the Instagram Image Activity Scale (IIAS) to investigate the main activities carried out on social networks by preteens. Finally, body satisfaction was assessed with the Sociocultural Attitudes Towards Appearance Questionnaire-4-Revised (SATAQ-4R).
Results: Of the total sample analysed, 85, 5% declared using social media and 98, 3% messaging apps. The average number of social networks used is 5, 52 (SD 2.9). Preteens tend to spend more than one hour per day using social media (78%). Correlational analysis showed a positive correlation between time spent on social media, body dissatisfaction (r = 0, 417) and addiction to social networks risk (r = 0, 517). The study found a positive association between the type of social media engagement and body satisfaction (r = 0, 512).
Conclusions: The current study has revealed that the types of activities and time spent online is related to body dissatisfaction and risk of social networks addiction. It is necessary to develop intervention strategies based on a positive development of body image and on media literacy programs. Therefore, an integrated and targeted approach between schools and families might be the ideal solution to counter the negative effects deriving from the use of social media.

Toward the era of digital physical literacy education. A literature review

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Purpose: To review the literature regarding the development of the digitalization of education in the post-humanism era.
Methods: a literature review was conducted on Google Scholar, Web Of Science and Pubmed databases using the keywords *digital literacy, education, posthumanism.*
Results: Digital literacy (DL) encompasses the competencies and skills required for navigating a fragmented and complex information ecosystem. DL development led to the era of the posthumanism, the movement in which humans are not intended anymore as an individual, but as as entity connected to the society and the environment. From a phenomenological perspective, the body has been identified as a point of contact between individuals and the society, representing a unicuum embedding many characteristic traits, reflecting its interactions with the society, personal experiences, etc. Nevertheless, a reflection should be made concerning how the use of the body has changed in the posthumanism. For instance, in the immersive virtual reality the virtual body can be different from the real body, affecting their perception, attitudes, and behavior. With this experience of embodiment, an individual might live the world from a different point of view characterized by interactivity, virtuality, information processability, presence and body ownership. In this perspective physical education (PE) teachers should identify the emerging needs of new generations and readapt their educational approaches toward a new culture of the physical literacy (PL). PL is widely described as *'the motivation, confidence, physical competence, knowledge and understanding to value and take responsibility for engagement in physical activities for life'*.
Conclusions: Digital technologies are continuously developing and evolving leading to the advent of new real and virtual worlds increasingly interconnected. Therefore, PE teachers should understand how these new realities are influencing the growing processes of new generations and how to adopt those new technologies for developing new strategies to live within the body and the society. It is maybe time to thinking about a digital physical literacy?

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Physical activity and fitness smartphone apps use in healthy people: an exploratory analysis within the dare project

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Purpose: A huge number of smartphone applications (apps) is currently available that offers support for physical activity (PA) and fitness. However, scientific quality and complete framework of these apps have not been addressed sufficiently. The purpose of this study is to explore the existing smartphone apps aimed at increasing PA/fitness level in healthy populations. This review is performed within the DARE (DigitAl lifelong pRevEntion) Project, a recent initiative financed within the PNRR, CUP B53C22006460001, that has the objective of developing digital tools to monitor lifestyles (including PA) and implement interventions for supporting primary prevention.
Methods: A systematic review (SR) was conducted on the scientific database Pubmed/Medline, targeting SR and meta-analyses (MA) that investigated stand-alone smartphone apps used and with PA/fitness measures as primary or secondary outcomes.
Results: N.31 papers were included, published between 2015 and July 2023, of whom 13 were both SRs and MAs. Most articles (N = 27) explored the effectiveness of the app; only 1 SR assessed the accuracy and reliability of the tool. Most studies were targeted to adults (N = 18). The number of studies describing only stand-alone apps ranged from 1 to 8 in each paper, with the most recurrent being Accupedo Pro, ActiveLifestyle app, Analytic app, ATLAS, bActive, Get Running, Moves, Strive app, TXT2BFiT, UOIFit, Zombies, run!. The PA/fitness-related outcomes were mainly steps (or minutes) per day, weekly PA, moderate-to-vigorous PA, metabolic equivalents. Other outcomes included mainly BMI, sleep or dietary-related outcomes. Sixteen studies confirmed the effectiveness of the used app, 2 studies were inconclusive, 3 papers reported no effect. The other apps were mostly associated to wearable devices.
Conclusions: From this first exploratory analysis, few stand-alone apps targeted to general population aimed at increasing PA/fitness levels were evidenced, and they were mostly effective. There is a need of increasing validation studies for these kinds of apps against gold standard tools. A discrepancy can be seen by the fact that the most downloaded apps (i.e. in the Google Play and iTunes stores) are not validated or effectiveness is not assessed in the scientific literature. Further searches in other databases are envisaged to catch other valuable apps, and a deeper analysis is needed to detail characteristics of the single apps, such as user ratings/usability or technical features.

Testosterone/Cortisol ratio as a biomarker to predict podium results: evidence from adolescent and master rowers

Purpose: In young and master amateur rowing athletes very little is known regarding testosterone/cortisol ratio and its possible role as a predictor of performance beyond the classical use to determine adequate recover after training. In elite sportsman**,** this ratio has been already used as a predictor of performance, thus in this investigation the podium results were correlated to testosterone/cortisol in a sample of adolescent and master non-elite rowers to understand if these biomarkers may have a role also in these peculiar types of athletes.
Methods: : Athletes (adolescents 12–18 yrs vs masters 35–55 yrs) have been tested for determining saliva content of performance biomarkers, cortisol and testosterone, before and after competitions. Specifically, samples have been taken in the morning, before and after the race.
Results: : A substantial change in the levels of both cortisol and testosterone has been observed throughout the sampling time in young and master athletes, suggesting a different adaptation to the stress of the race. Interestingly, also a correlation between podium results and the testosterone/cortisol ratio was observed in these two categories of rowers.
Conclusions: Although age differences, the two sets of subjects used in this study show some similarities in the ability to cope with stressors, as a rowing race. As a matter of fact among rowing athletes, either juniors and masters are not considered as elite competitors and most races are at amateur level, this may explain the changes observed in their hormone levels. Nonetheless, at least in these categories, a different profile of response to stress and motivation characterized by an altered testosterone/cortisol ratio could predict performance more accurately than the training level.

Factors determining the playing time based on coaches' subjective perception of players' performance levels. preliminary results of a cross-sectional study

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Purpose: Soccer, is a team sport with the most significant number of young participants worldwide (Junge and Dvořák, 2015). For this reason, professional clubs usually invest lots of money to identify talented players and to provide them high quality training schedules, school education, transportation and residence facilities. Nevertheless, skills and abilities that determine the talent are commonly estimated considering the coaches' subjective perception (Unnithan et al., 2012). Thus, this preliminary study aimed to investigate the factor that determine the player's level based on coach's personal feeling and the influence of this evaluation on the playing time during league's matches.
Methods: Forty-five (45) young élite soccer players, two head coaches and two assistant coaches were recruited for this study. Players, coaches and their assistant belonged to the U15 and U16 team of a youth academy of a professional club. Each coach and his assistant filled in The Questionnaire for the Assessment of Soccer Player Quality by the Coach (QASPQC) (Jukic et al. 2019) to assess their subjective perception of each player's level of performance. Data analysis was run using a Pearson's Correlation and a linear regression model.
Results: Results showed that the domain "understanding of the game and position on the field" was the most correlated with the playing time during the season ($r = 0.652$; $p < 0.0001$). In addition, the results of the linear regression indicated that the model explained 45% of the variance and that the relationship between this domain and the playing time is very strong $F = (1, 669) = 25, 092$, $p < 0, 0001$; $R^2 = 0, 447$. Meanly, a player can increase his playing time of almost 160 min if the coach increase of 1 point his subjective perception of the performance level.
Conclusions: This preliminary study identifies the domain "understanding of the game and position on the field" as the most related with the playing time during the season. However, future studies are needed to improve the knowledge of the mechanisms that rules coaches' subjective perception of players performance.

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The energy cost between flat versus simulated mountain trail walking in trained elderly: a preliminary result

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Purpose: For the elderly people, a good level of training and, consequently, a high value of oxygen consumption, allows to maintain the activity of daily life (ADL). Walking both on a flat or on a variable surface can help these people stay fit. The aim of this study was to compare the energy cost of walking (Cw) in relation to the effects of perceived exertion and pleasure-displeasure/arousal-sleepiness in healthy elderly people across three speeds and in two different conditions: flat condition (FC) and with unpredictable roll variations (URV)[1].
Methods: 18 participants (W = 10; M = 8; 69 ± 6 yrs; 72.3 ± 16.9 kg) participated in the study. Subjects visited the laboratory twice, once for the familiarization and, after 48 h, for the test session which consisted of walking at three different randomized speeds (3, 4 and 5 km/h) in two different conditions (FC and URV) for six minutes for each speed.Cardiopulmonary data were continuously recorded by a portable metabolimeter (K5, Cosmed Srl). Furthermore, the Rating of Perceived Exertion (RPE), the Affect Grid scale[2] and capillary blood lactate concentration were evaluated at the end of each block. Shapiro–Wilk was used to check the normality distribution and a repeated measure ANOVA test was used to detect significant differences in all the variables considered.
Results: ANOVA showed a significant difference between conditions and speeds for Cw ($F(1.31,20.95) = 9.13$; $p = 0.004$; $h2 = 0.028$). Post-hoc comparisons indicated a statistically significant difference at 3 km/h ($p < 0.001$), while at 4 km/h and 5 km/h did not show a significant change ($p = 0.422$, $p = 1.000$ respectively). Regarding RPE ($F(1.98, 33.64) = 0.50$; $p = 0.608$; $h2 = 0.001$) and Affect Grid Scale ($F(1.90, 32.26) = 0.47$; $p = 0.619$; $h2 = 0.004$) there were no significant variation. For Cw at 3 km/h there was a percentage increase of 9.5% between the two conditions, at 4 km/h of 3.9% and at 5 km/h of 2.0%. Considering RPE, at 3 km/h there was a percentage increase of 65.5%, at 4 km/h of 17.0% and at 5 km/h of 14.0%. Finally, for Affect Grid scale, a percentage increase of 5.0% was recorded at 3 km/h, 0.8% at 4 km/h and 0.4% at 5 km/h.
Conclusion: Since the energy cost of walking between the two conditions HR vs URV was found to be similar, incorporating walking on an unstable surface into the stable walking routine may be equally effective in promoting healthy living for the elderly population. However, this result does not appear for all speeds, so an evaluation for each subject is appropriate.

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Assessment of athlete's performance: effect of listening to music on repeated-sprint performance in a sample of male basketball players

Purpose: Many athletes nowadays listen to music before a competition because listening to their favourite music (FM) helps them improve their sports performance. The current study aims to investigate the influence of listening to FM on performance in the Repeated Sprint Ability test.
Methods: In a single group pre-test post-test study design, fourteen male senior basketball players (age: 21.4 ± 2.9 years old; weight: 83.6 ± 10.3 kg; stature: 191.5 ± 4.6 cm; BMI: 22.9 ± 2.5 $kg.m^{-2}$), playing in the C-silver series in the 4 Torri club (Ferrara), performed seven 30-m sprints with two 180° directions changes interspersed with a 25-s passive recovery period in two modes: without listening to music and after listening to FM during the pre-test warm-up in two separate experimental sessions. Each athlete personally selected a playlist lasting 15 min and with a tempo of music > 120 bpm. In both test modes, several parameters were collected for each sprint: time with a stopwatch, perceived exertion with the Borg CR-10 scale, and pulse rate with a pulse rate monitor. Then the average sprint time, the best sprint time, the total sprint time, the fatigue index, the percentage decrement score (Sdec %), maximum and average perceived exertion, and maximum and average pulse rate were calculated for each subject. The mean values of all variables obtained without listening to the music were compared with those obtained after listening to the FM.
Results: The comparison revealed a significant ($p < 0.05$) improvement in all time parameters after listening to the FM; no significance was reached in perceived exertion and pulse rate.
Conclusions: Basketball players seemed to benefit from listening favourite music during repeated sprint exercise, confirming the ergogenic effect of the music on sports performance.
Acknowledgments: We would like to thank all the basketball players who voluntarily joined the study.
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Effect of sports practice on gross motor coordination in italian children

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Purpose: To assess whether the practice of different closed-skill sports may affect children's gross motor coordination level.
Methods: A total of 288 children aged 8–11 years were involved in the study and divided into 5 groups in relation to the sport they practiced: gymnastics group (n = 67; 51F, 16 M), cycling group (n = 64; 15F, 49 M), athletics group (n = 40; 21F, 19 M), swimming group (n = 35; 20F, 15 M), and control group (n = 82; 42F, 40 M). The four sub-tests of the Körperkoordinations Test für Kinder assessed children's gross motor coordination level.
Results: Children practicing gymnastics performed better walking backwards sub-test than all other children's groups (gymnastics 107.0 ± 12.5 score *vs* athletics 92.8 ± 10.9 score *vs* swimming 92.5 ± 15.4 score *vs* cycling 92.3 ± 15.9 score *vs* control group 87.5 ± 19.2 score, $p < 0.0001$, respectively). Children of control group performed worse jumping sideways sub-test than children of gymnastics and athletics groups (99.0 ± 18.0 score *vs* 108.4 ± 14.5 score *vs* 111.6 ± 12.9 score, $p < 0.05$, respectively). Children practicing gymnastics performed better moving sideways sub-test than children of cycling and control groups (98.1 ± 25.4 score *vs* 87.3 ± 19.2 score *vs* 78.7 ± 14.9 score, $p < 0.01$, respectively); moreover, children of control group performed worse that children of gymnastics, athletics and swimming groups ($p < 0.01$). Children of control group performed worse hopping for height sub-test that children of all other groups (control group 82.6 ± 19.5 score *vs* gymnastics 103.8 ± 13.3 score *vs* athletics 98.3 ± 13.9 score *vs* swimming 94.4 ± 14.6 score *vs* cycling 98.8 ± 14.5 score, $p < 0.01$, respectively); moreover, children practicing gymnastics performed better than children of swimming and control groups ($p < 0.05$). Finally, children of control group had the lower motor quotient (MQ) than children of all other groups (control group 83.0 ± 16.7 score *vs* gymnastics 105.5 ± 14.5 score *vs* athletics 97.9 ± 12.5 score *vs* swimming 95.2 ± 16.4 score *vs* cycling 93.6 ± 15.8 score, $p < 0.001$, respectively), while children practicing gymnastics had the higher MQ than children of cycling, swimming and control groups ($p < 0.05$).
Conclusions: The differences in gross motor coordination level among different sports disciplines could be associated with the sport-specific performance model and training. Thus, coaches should plan individualized interventions and choose activity contents to support children's motor coordination development.

Front vs. back lat pulldown: an electromyographic and kinematic analysis, and implications for resistance training

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Purpose: The lat pull-down strengthens back muscles, but variations provide different stimuli to each muscle. This study compared muscle excitation using surface electromyography (sEMG)and ROM through kinematic analysis during lat pull-downs with the bar in front (front-LM) or behind the head (back-LM).
Methods: Fourteen men performed front-LM or back-LM lat pull-downs. sEMG root mean square (RMS) of the latissimus dorsi, middle trapezius, pectoralis major, biceps brachii, triceps brachii and posterior deltoid was recorded during ascending and descending phases. ROM was assessed in the frontal and sagittal planes.
Results: In the descending phase, front-LM showed higher excitation of the latissimus dorsi (ES = 0.97) and pectoralis major (ES = 1.17), while in the ascending phase, back-LM exhibited higher excitation of the latissimus dorsi (ES = 0.63), and front-LM showed higher excitation of the biceps brachii (ES = 0.41) and posterior deltoids (ES = 1.77). Centroids of muscle excitation differed between exercises: the latissimus dorsi centroid (ES = 0.60) in front-LM was more lateral during the descending phase, while the middle trapezius centroid (descending: ES = 0.58; ascending: ES = 0.85) was more medial in front-LM for both phases. The pectoralis major centroids (descending: ES = 1.58; ascending: ES = 0.88) were more cranial in front-LM for both phases. Biceps brachii and triceps brachii centroids also varied, with back-LM showing a more medial positioning in the descending phase centroid for biceps brachii (ES = 0.63) and triceps brachii (ES = 0.98). Kinematic analysis revealed a higher starting angle of the humerus (ES = 1.32) in front-LM in the frontal plane, with greater ROM (ES = 1.10) in front-LM. In the sagittal plane, front-LM had a larger angle between the pectoral line and the L5 perpendicular line (ES = 0.97) at the beginning of the repetition, resulting in superior ROM (ES = 1.49) for front-LM.
Conclusions: Front-LM and back-LM exercises modified muscle excitation. Front-LM elicited greater excitation of the latissimus dorsi, pectoralis major (during the descending phase), posterior deltoid, and biceps brachii (during the ascending phase) compared to back-LM. ROM was also greater in front-LM. Different spatial excitation patterns were observed in the latissimus dorsi, middle trapezius, pectoralis major, biceps brachii and triceps brachii, indicating that both exercises can be used to stimulate different muscles in a training program.

Evaluation of agility and reaction times in children participating in the multisport project: differences between boys and girls

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Purpose: A 72-dimensional meta-analysis of the effect of 21 studies (n = 15, 003) over a period of 73 years reports that the male advantage in reaction times to visual stimuli is decreasing. Physical activity and sports may be correlated with improvements in motor reaction times and agility. However, reaction time is the crucial initial step in performing agility tasks efficiently. Children engaged in multisport activities exhibit higher levels of motor coordination compared to children involved in single-sport activities. This study aims to examine whether multisport activity performed for several years has created significant differences in agility and reaction times to visual stimuli between 11–12-year-old males and females.
Methods: The sample consists of 96 children, 49 girls (age: 11.52 ± 0.51 years) and 47 boys (age: 11.48 ± 0.51 years), who have been participating in the multisport program Centri CONI Puglia (Italy) for 3 years. Agility was assessed through the Agility T-test.

Measurement of reaction times to visual stimuli for the upper and lower limbs was performed using the Choice reaction Upper Limb and Choice reaction Lower Limb tests utilizing a mobile equipment with LED light disks wireless. The independent samples t-test was used to determine if there was a statistically significant difference between the means of the two independent groups in each administered test.

Results: In the analyzed sample, the independent samples t-test demonstrates that based on the obtained data, there are no significant gender differences in reaction and agility tests. However, girls had slightly lower reaction times for the lower limbs.

Conclusions: Within its limitations, this study seems to support the hypothesis from the literature that girls are gradually closing the gap in reaction times to visual stimuli compared to males. It can be hypothesized that long-term adherence to multisport programs may have contributed to achieving this performance milestone. This result may have also influenced the gender balance in agility performance since it is demonstrated that reaction and decision-making times account for 3.6% of the total time in an agility task, and both are correlated. Long-term multisport training programs should be considered and encouraged among youth training professionals.

Is it possible to improve the quadriceps' rate of force development after acl reconstruction? the reathletization as intervention strategy

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Purpose: After anterior cruciate ligament (ACL) reconstruction many studies have pointed out how rate of force development (RFD) is a key parameter to highlight the neuromuscular deficits and how it remains altered even 6–9 months post surgery. It has been suggested that the persistence of this deficit can be also blamed on the lack of specific exercises to restore neural drive and rapid force within rehabilitation pathways. The aim of this pilot study is to test the possibility of positive influencing the recovery of RFD-affected neuromuscular capabilities by adding specific strengthening exercises into the standard rehabilitation program.

Methods: 10 male amateur sport subjects who underwent ACL reconstruction with DGST technique and did not have other concomitant injuries (age: 28aa ± 3aa; weight: 71 kg ± 13 kg) have been selected. The protocol included isometric dynamography tests of the quadriceps on leg press (QUAD_CKC) and clinical tests. The parameters of maximum voluntary isometric force (MVIF) and the rate of force development at 30, 50 and 90% of MVIF (RFD_{30}; RFD_{50}; RFD_{90}) have been assessed. The tests were performed at 3 and 6 months post surgery (3PS—6PS). The results were reported as mean and SD as well as side-to-side asymmetries. The data were compared using Student's t-test for paired data ($p < 0.05$). Patients followed a modified rehabilitation protocol with the following key point for the reathletization purpose: at 6 weeks PS we early introduced exercises in OKC; at 8 weeks PS we introduced 1) submaximal exercises, 2) training session with moderate loads accelerated with maximal effort, 3) whole body vibrations, 4) deceleration/landing drills; at 12–14 weeks PS we introduced plyometric and ballistic training. The patients were instructed to perform the exercises with the intent to produce force as fast as possible.

Results: The results show a statistically significant difference in all parameters investigated for the QUAD_CKC tests performed at 3PS and at 6PS. The Side-to-side asymmetries are as follows: QUAD_CKC test at 3PS (MVIF: -23%; RFD_{30}: -29%; RFD_{50}: -31% RFD_{90}: -35%); QUAD_CKC at 6PS (MVIF: -5%; RFD_{30}: -9%; RFD_{50}: -10% RFD_{90}: -13%). At the clinical follow up all the test's results are good or excellent.

Conclusions: Although significant differences remain between the two limbs in the RFD's parameters investigated at 6 months PS, the percentage differences recorded show a general improvement over the percentage data in the literature, that indicate the persistence of deficits between 20%-37% at 6 months PS. Even though further studies are needed to confirm its efficacy, this depicts the possibility of effective supplementing normal rehabilitation programs with specific reathletization pathways to be included early in the recovery program.

The role of posture in the soccer player: prevention is better than cure

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Purpose. It is from this scientific evidence and starting from the hypothesis that postural vices or defects affect the performance and gesture of the football player that the purpose of the study was identified. The aim of the study was to identify postural defects (excluding knee varus) and understand how these affect performances.

Methods. In the 2015/2016 season, 29 professional football players were recruited, aged between 18 and 35. For the evaluation, 3 evaluations were performed. Initially, the sports doctor subjected the athletes to anamnesis, then the posturologists dealt with postural analysis and podogram. Posturography can be defined as a group of methods and techniques used for the assessement of the postural control status and identifying the source of balance and postural stability disorders. In the intermediate phase, the kinesilogists were involved, who, in synergy with the posturologists, dedicated themselves to the treatment of the postural deficits found.

Results. The results demonstrated that the professional athletes involved were unaware of the postural deficits found. Furthermore, with our training program (it included postural, proprioceptive and compensatory exercises), performance has improved, the number of traumas and injuries suffered during the season has been reduced and only 10 out of 29 players declared that they had not found any difference in performance security.

Conclusion. In conclusion, we can state that the relevant role of the kinesiologist and the athletic trainer emerged from the results obtained. It is also evident the importance of teamwork also and above all in the sports field. The kinesiologist should develop intervention strategies and athletic preparation, focusing on the athlete's health in favor of correct lifestyles and motor activity as a useful, effective and low-cost means of prevention and therapy. Furthermore, it would be preferable for sports clubs, at all levels, to include postural control and treatment in training and to invest in prevention, because it is better to be safe than sorry.

Differences between individual and generalized regression models using first and second-degree polynomials on back squat in males and females

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Purpose: The use of velocity as a parameter for monitoring resistance training sessions is becoming more and more common and allows to monitor daily fluctuations in performance, overcoming some of the limitations of the traditional method (Weakley et al., 2021). Additionally, it is possible to create load-velocity profiles that remain stable over time, without the need to periodically repeat incremental tests. However, there is a lack of information in the literature regarding the appropriate regression model for creating load-velocity profiles with the least margin of error (Marston et al., 2022). The aim of this study was to investigate the most appropriate regression model in back squat for both males and females.
Methods: Thirty males (age: 28 years ± 6.4; body weight: 80 kg ± 11.99; height: 179 cm ± 6.70; 6.9 years of experience ± 3.7) and twenty-seven females (age: 24.2 years ± 3.45; body weight: 57.11 kg ± 5.1; height: 164 cm ± 4.50; 4.29 years of experience ± 3.7) performed an incremental 1RM test on the back squat. Barbell velocity was registered with a linear position transducer (LPT). Load-velocity profiles were created for each subject using a first and second-degree polynomial. In total, eight regression models were developed: two individual models for each subject, two generalized models by sex (both for men and women), and two generalized models regardless of sex. The quality of the regression model was evaluated using the Standard Error of Estimate (SEE). Differences between the various models were compared using repeated measures ANOVA.
Results: The repeated measures ANOVA reported significant differences between the regression models f (1.442) = 118.256, p = 0.00; $\eta^2 = 0.825$. Specifically, significance was found between the individual and the generalized regression models. All individual regression models, both first and second degree, had lower SEE compared to the generalized models. No statistically significant differences were found in the use of first- or second-degree polynomials.
Conclusions: No significant differences were found between male and female samples or between first- and second-degree polynomial models. In conclusion, individual regression models have less error, and both polynomial models can be used for back squat exercises. Sex-specific models have an acceptable level of error, while non-sex-specific models perform worse for women showing an increase in SEE.

Trends in means and distributional characteristics of speed performance for Italian children from 1990 to 2010

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Purpose: Speed is a general term that refers to the ability to move rapidly. The aim of this study was to examine the temporal trends of speed performance (30-m, 60-m and 4 × 5 m sprint) for Italian children between 1990 and 2010.
Methods: a sample of 3884 Italian subjects of both gender (F = 1716 [44%]) aged 11–13 years were recruited across the period 1990–2010 using a repeated cross-sectional study design, from a single middle-high school in northern Italy. Speed was measured using 30 m sprint, 60-m sprint test, 4 × 5 m run tests. With adjustments for BMI, temporal trends in means were estimated using linear regression, with trends in distributional characteristics described visually and estimated as the ratio of coefficients of variation.
Results: When adjusted for BMI, there were large increases in mean 4 × 5 m shuttle run time (trend [95%CI]: 0.69 s [0.74, 0.64]; 9.15% [9.80, 8.50]; 1.36 ES [1.46, 1.26]); a negligible trend in mean 30 m sprint test time (trend [95%CI]: 0.00 s [0.03, -0.03]; 0.01% [0.63, -0.62]; -0.01 ES [0.06, -0.07]) and finally a negligible trends in mean 60 m sprint test time (trend [95%CI]: -0.10 s [-0.01, -0.11]; -0.90% [0.03, -1.83]; -0.07 ES [-0.01, -0.07]).
Conclusions: According to the current analysis, independently of BMI, a decrease in performance over time was observed only in the 4 × 5 m shuttle run for both girls and boys and in every age group. The results obtained in the 4 × 5 m sprint test were in accordance with previous studies that underlined a decrease in nonlinear sprint performance across years. In point of this, it becomes important to insert in the annual plan coordination the skills practice.
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Reactive strength, anthropometric and body composition features in young female volleyball players: implications for training

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Purpose: Specific role-based training in volleyball is a complex process that requires careful consideration of multiple factors. The purpose of this study is to investigate the differences in physical attributes and performance outcomes among young female volleyball players in various roles and provide valuable insights to coaches for designing tailored training programs to optimize player performance.
Methods: A cross-sectional study was conducted on 20 young female volleyball players (age: 15.4 ± 1.2 years). All the participants played on a competitive regional level. Anthropometric measurements were obtained using standard procedures (height: 1.69 m ± 4.5; BMI: 22.2 ± 3.5). Body composition was assessed by bioelectrical impedance analysis (BIA) with a multi-frequency analyzer and the following variables were considered: Fat-Free Mass (FFM), Fat-Free Mass Index (FFM index), Fat Mass (FM) and body fat percentage (BF%). After a standardized warm-up, participants were asked to perform three Squat Jumps (SJs) and three Countermovement Jumps (CMJs) to evaluate their explosive (leg) power, and seven maximal hoppings (MHs) as a measure of reactive strength, with maximal jump height measured by a photocell system (Optojump). Handgrip strength was evaluated using a digital dynamometer. To highlight possible role differences, performance outcomes were

also compared according to the player role: spikers (outside hitters, opposites, middle blockers) and others (setters, liberos).
Results: Exploratory regression analyses performed in the whole sample showed that FFM significantly predicted handgrip strength ($p = 0.013$), height was a significant predictor of reactive strength ($p = 0.022$), and FM is negatively associated with jump height in both SJ and CMJ ($p = 0.003$). Furthermore, analysis of variance (ANOVA) showed higher levels of MH in spikers respect to the other roles ($p = 0.030$).
Conclusions: Our findings suggest a significant difference in reactive strength among player roles. Additionally, the study underscores the influence of anthropometric characteristics and body composition on volleyball performance. These findings highlight the importance of these physical features for customized training programs in young female volleyball players. Coaches may utilize this information to make informed decisions and enhance the performance of their athletes. Future studies should examine these variables' relationships and long-term consequences.

Validity of a manual reaction test in basketball

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Purpose: Reaction time is of paramount importance for performance in team sports. Recently developed specific tests using LED technology can measure reaction time in basketball (1). The aim of this study was to evaluate the validity of a specific reaction time test by replacing the LED stimulus with manual gestures.
Methods: 52 basketball players and 38 active subjects performed the pre-planned and non-planned test previously designed (1) with both the LED and human manual stimulus of raising a hand in random order. The Pearson correlation coefficient was used to assess the validity of the tests, and non paired t-tests were used to assess the differences between the groups. The dominant side was defined as the faster side in the pre-planned test.
Results: Both dominant and non-dominant sides showed moderate correlations between LED and hand tests ($R^2 = 0.4175$ and 0.4189, respectively). The small delay caused by the human error in raising the hand was 30.2 ± 98.1 ms. Basketball players were faster than active players in all tests ($p < 0.001$, results in ms). Non-planned LED dominant side: 1985.2 (133.1) vs. 2120.6 (168.8); Non-planned LED non dominant side: 1986.6 (125.2) vs. 2133.8 (148.1); Non-planned HAND dominant side: 1910.8 (146.3) vs. 2082.9 (179.5); Non-planned HAND non dominant side: 1933.4 (146.7) vs. 2067.3 (198).
Conclusions: The reaction time test with the hand can discriminate between basketball players and active subjects, but its validity is very limited by the human inconsistency raising the hand. This resulted in a moderate validity of the test.
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Concurrent validity of a new sensorized top tank for the assessment of accelerometry-based external load indicators

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Purpose: To examine and compare the concurrent validity of different accelerometry-based external load indicators from *ActiGraph GT9X Link* and a new sensorized wearable top tank (YouCare—AccYouRate Group SPA).
Methods: Five young participants wore a sensorized top tank and Actigraph accelerometers on their upper back, non-dominant waist, and non-dominant wrist, recording data at 250 Hz, 100 Hz, 30 Hz, and 30 Hz. The participants engaged in a 6-min treadmill session, consisting of slow walking (4.8 km/h), fast walking (6.4 km/h), and jogging (9.7 km/h), followed by five minutes of rest for each condition. The ActiGraph accelerometers data were extracted as a text file using ActiLife software, while the sensorized top tank data were downloaded using a custom-made program. To account for high-frequency motion artifacts, the raw signals were corrected based on the signal's envelope. The corrected signals were utilized to calculate the Vector Magnitude Unit (VMU) and the Player load (PL) serving as external training load indicators. To evaluate the agreement between the devices, Pearson's correlation, the student's unpaired t-test, and Bland–Altman plot were employed. The data analysis was performed using *Matlab 2022b*.
Results: The correlation analysis revealed a very strong correlation between the PL ($r = 0.96$; $p < 0.001$) evaluated using the top tank and the accelerometer applied on the upper back, and between the PL ($r = 0.89$; $p < 0.001$) evaluated using the accelerometer applied on the non-dominant wrist and the sensorized top tank. In addition, the VMU computed using the signals acquired on the non-dominant wrist ($r = 0.69$; $p < 0.001$) and on the upper back ($r = 0.77$; $p < 0.001$) showed a strong correlation with the top tank data. When the accelerometer was applied on the non-dominant waist, the correlation was moderate for both PL ($r = 0.63$; $p < 0.001$) and VMU ($r = 0.61$; $p < 0.001$). Student's unpaired t-test revealed significant differences ($p < 0.001$) between the two devices when considering the PL on the different body sites, and when evaluating the VMU on the non-dominant waist ($p = 0.007$). The Bland Altman plot indicated a moderate systematic error when comparing the PL computed using the signals from the top tank and from the ActiGraph accelerometers.
Conclusions: Our preliminary results indicate good correlation between the *ActiGraph GT9X Link* and a new sensorized wearable top tank, especially concerning the PL, although the latter underestimates higher accelerations.

Effects of the playing surface on heart rate and playing tactics during simulated matches between fitp second category tennis players

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Purpose: Modern tennis is classified as an intermittent sport based on both anaerobic and aerobic components. Among the factors that affect tennis performance, playing surface is more relevant since it influences ball bouncing, and thus rally duration and physiological response. The present study aimed to evaluate the effects of two surfaces (synthetic grass and clay) on heart rate and tactics during simulated matches between FITP second category tennis players.
Methods: 4 male agonist athletes (23.3 ± 4.4yrs; 1.81 ± 0.07 m; 75.8 ± 9.98 kg) with similar training levels participated in the study. The experimental protocol included simulated matches among the athletes organized in two round-robins (one for surface). Subjects wore a band around the chest (Polar®, Kempele, Finland) to monitor their heart rate (HR) and the distance covered during the matches. The signal from the band was synchronized with the video of the match.
Results: The average rally length was higher on clay than synthetic grass (5.1 ± 1.3 strokes/point vs 3.4 ± 0.8 strokes/point). The match analysis demonstrated significant efficacy of the service on synthetic grass and that the return was less vulnerable on clay. Finally, the time spent on HR zone 2 and 3 was higher on synthetic grass, while the time spent on HR ZONES 4 and 5 was higher on clay.
Conclusions: Our findings indicated that the physical effort was higher on clay than synthetic grass because the slower playing dynamic of clay increases the rallies' length. Furthermore, heart rate values seemed unrelated to the winner of points and matches.
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Acute effects of wbv on isometric knee extensors peak torque and rate of torque development in adult males

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Purpose: Different studies have shown that WBV may improve muscle strength. To date, only one study evaluated the effect of WBV on isometric knee extensors endurance. However, knowledge on the effects of WBV on isometric strength remains unexplored. Therefore, this study aims at investigating the acute effects of WBV on isometric knee extensors peak torque (PeakT) and rate of torque development (RTD) during a maximal isometric lower limb task.
Methods: Thirty healthy males (Age: 41.2 ± 9.4 yrs; BMI: 26.3 ± 4.8 kg/m^2) attended the laboratory in three separate sessions. Participants performed a maximal voluntary contraction (MVC) of the knee extensors of the dominant lower limb after being exposed randomly to three different warm-up. Specifically, after 10 min cycling and three minutes of lower limb stretching exercises they performed static half squat plus WBV (30 Hz; WB), static half squat without WBV (HS), and control condition (CC). In WB and HS conditions, participants performed five sets of 60 s, interspersed with 60 s rest, in a static half squat position (HS). In the CC no exercise protocol was performed after cycling and lower limb stretching. An isometric dynamometer connected to MuscleLabTM 6000 Ergotest Innovation system was used to record knee extensor strength. PeakT was identified on the force signal while RTD was computed in the 0 to 50 ms time-window.
Result: PeakT was significantly ($p < 0.01$) higher in CC (166.5 ± 40.1 Nm) than in WB (131.1 ± 35.6 Nm) and in HS (144.8 ± 34.1 Nm). PeakT was significantly higher in HS than in WB (144.8 ± 34.1 Nm vs 131.1 ± 35.6 Nm, $p = 0.014$). RTD was significantly higher in CC (1090.6 ± 730.5 Nm/s) than WB (799.3 ± 566.4 Nm/s, $p = 0.014$).
Conclusions: WBV stimuli during a warm-up superimposed to a static squat do not improve PeakT and RTD in adult males. Moreover, the best muscular performance was observed in CC condition. Future studies are needed to investigate the chronic effects of WBV on muscle strength during an isometric contraction.
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A novel static stretching exercise to improve the flexibility in older adults

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Purpose: Although a deficit in flexibility affects several kinetic chains (KC) in older adults, the posterior KC are generally most affected. Flexibility training represents an important strategy to improve the quality of life of these people's by increasing the range of motion of joints and thus reducing the risk of falling. Static Stretching (SS) is the most appropriate typology of stretching for sedentary, and older adult subjects. We aimed to assess the effect of the two training programs by adding a novel SS exercise in both. The SS exercise was similar to the trunk bending required in the toe-touch test; the participants placed their hands on their thighs to reduce the trunk weight and to minimize the action of compressive-shearing forces on the lumbar vertebrae segments.
Methods: Thirty-one healthy older adults were randomly in three groups: the Flexibility Group I (FGI) performed strength and SS exercises; the FGII performed dynamic and SS exercises; and the control group (CG) maintained a sedentary lifestyle for the entire period of the study. The flexibility was assessed acutely (T0: pre–post the first training session; T1: pre-post the last training session) and after 12 weeks of training.
Results: The flexibility acutely increased in FGI, in the two testing sessions ($\Delta T0 = 7.63 \pm 1.26\%$; ES = 0.36; $p = 0.002$ and $\Delta T1 = 3.74 \pm 0.91\%$; ES = 0.20; $p = 0.002$). Flexibility improved significantly also in FGII ($\Delta T0 = 14.21 \pm 3.42\%$; ES = 0.20; $p = 0.011$ and $\Delta T1 = 9.63 \pm 4.29\%$; ES = 0.13; $p = 0.005$). The flexibility improved significantly over 12 weeks in the FGI ($\Delta T0 - T1 = 9.03 \pm 3.14\%$; ES = 0.41; $p = 0.020$) and FGII ($\Delta T0 - T1 = 22.96 \pm 9.87\%$; ES = 0.35; $p = 0.005$). The acute and chronic effect between the two FG were not significant ($p > 0.05$).
Conclusions: The results of the present study suggest that the novel stretching exercise, combined with dynamic stretching exercises or resistance training exercises, can improve the posterior KC's flexibility in older adults.
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Relationship between ventilatory threshold-based approach and submaximal exercise in exercise prescription: preliminary results

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Purpose: The process of individually tailored prescription of exercise following exercise testing in healthy adults is currently debated, and more frequently an approach based on ventilatory thresholds extrapolated from a cardiopulmonary test to exhaustion (CPET) has been proposed [1,2]. However, exercise professionals often rely on submaximal exercise tests (SUB) to assess cardio respiratory fitness because maximal exercise testing is not always feasible in the health or fitness setting. Therefore, the aim of this study is to understand how the workloads derived from the CPET can be equated to a workload derived from a submaximal test, in particular referring to oxygen uptake reserve ($\dot{V}O_2R$).
Methods: Subjects included seventeen healthy adults (10 M, 7 F; age: 23.2 ± 3.1 years; BMI 22.1 ± 3.0 kg/m^2). Oxygen uptake ($\dot{V}O_2$), heart rate (HR) and rate of perceived exertion (RPE) were measured at rest and during SUB and CPET, both performed using a cycle ergometer and a calibrated metabolic cart. The mechanical load ($Load_{CPET}$) at halfway between first and second ventilatory threshold (VT1 and VT2) was calculated, and $\dot{V}O_2$max ($\dot{V}O_2max_{CPET}$) was obtained at the end of the CPET ramp protocol. $\dot{V}O_2$max ($\dot{V}O_2max_{SUB}$) was obtained by submaximal test, based on YMCA protocol, via linear regression of $\dot{V}O_2$ and HR, and extrapolated to predicted maximum HR (HR_P), using $208 - 0.7 \times$ age formula. $\dot{V}O_2R$ was calculated considering resting $\dot{V}O_2$, and $\%\dot{V}O_2R$ corresponding to $Load_{CPET}$ was extrapolated from the $\dot{V}O_2$/Load relationship.
Results: No significant differences were found between estimated or measured variables ($\dot{V}O_2max_{SUB}$ 2239.6 ± 849.5 ml/min, $\dot{V}O_2max_{CPET}$ 2997.6 ± 717.3 ml/min, p = 0.831; HR_P 191.8 ± 2.2 bmp, $HRmax_{CPET}$ 189.4 ± 10.7 bpm, p = 0.365), except, as expected, for the RPE recorded at the end of each test (RPE_{SUB} 4.9 ± 2.1, RPE_{CPET} 9.2 ± 1.6, $p < 0.001$). The workload at midpoint between VT1 and VT2 (145.1 ± 33.9 W) corresponds to 76.8 ± 14.0% of $\dot{V}O_2R$, and may be considered vigorous (60–89% $\dot{V}O_2R$)[3].
Conclusions: To our knowledge, this is the first study which attempt to compare workloads in percentage of $\dot{V}O_2R$ from direct submaximal test with workloads based on ventilatory thresholds from CPET. This approach is important to enhance trainers and physicians' ability to understand, interpret, and customize exercise prescription.
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Energetic and neuromuscular impact of running on even and uneven surfaces in standardized laboratory condition

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Purpose: We aimed to examine the energetic and neuromuscular impact of running on an even (E-T) or uneven (UE-T) terrain, by recreating smooth or rough conditions on a same standardized circuit.
Methods: Ten adult subjects, 5 men and 5 women (age 34 ± 7 and 31 ± 8 years, body mass 69 ± 4 and 58 ± 4 kg, body height 1.71 ± 0.04 and 1.65 ± 0.02 m) run on an ''iterative-8-shaped'' path. The circuit was created in the lab with a perforated plastic carpet on which hemispheres of different dimensions were fixed (resembling stones—UE-T) or visible signs replaced hemisphere' position to guide foot support during smooth running (E-T). Two trials of six minutes were performed for both the conditions in a counterbalanced order, by running the paths with the same self-selected speed, maintained through the use of a metronome to determine step frequency. 10-min of rest was guaranteed between trials. Cardio-metabolic data were collected continuously during the trials with a portable metabolic chart as well as EMG data from 4 leg muscles.
Results: Cardio-metabolic parameters, perception of effort and energy expenditure were significantly higher in UE-T than in E-T ($p < 0.05$), respiratory frequency showed a 7% increase, oxygen consumption rose by approximately 20%, heart rate 10% while RPE more than 50%. Similarly, mean muscle activation of the tibialis anterior (+ 27%), peroneus longus (+ 11%) and gastrocnemius medialis (+ 24%) rose significantly in UE-T than in E-T.
Conclusions: Running on UE-T elicits elevated neuromuscular and metabolic responses compared to E-T, highlighting the substantial impact of terrain variability on the physiological and neuromuscular aspects of off-road running. These findings underline the importance of considering the unique characteristics of outdoor terrains where off-road running competitions are held, including their unevenness and variability, becomes crucial in designing training programs and injury prevention strategies for runners.

Perception-Awareness in heuristic learning for jump development in volleyball: testing a teaching model

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Purpose: The aim of the study is to demonstrate the effectiveness of the new perception-awareness paradigm applied to volleyball, limited to the development of jumping, by measuring the levels of perception, understood as the first acquisition of feedback, and awareness, understood as knowledge acquired through personal experience. It should be placed within the theory of the dynamic ecological approach, through heuristic learning with the productive style of execution of the specific movement that is routinely used for learning technical skills.
Methods: The sample consisted of 12 young female volleyball players from a single volleyball team based in Rome. A 2-month training protocol centred on plyometrics was applied. The Vertec Test

was used to measure the vertical jump pre and post training protocol. Subsequently, a perception questionnaire and an awareness questionnaire were administered to test the relationships between the 2 types of responses correlated with the pre- and post-measurements with $p\ value \leq 0.05$.

Results: The difference in jumping between pre and post had a 10% increase and there is a significance level of *p value = 0.0098*. The responses to the perception questionnaire show a positive correlation between satisfaction with the results of the tests performed and the intensity of the training sessions; satisfaction with the results of the tests performed and believing that performing jump tests is an important tool for improving training protocols. There is also a good correlation in believing that they have improved their jumping differential and believing that jumping skills are a key element in volleyball. From the awareness questionnaire, it was found that female athletes believe that the training protocol used was effective in improving jump development, in terms of percentages, it was found that 100% agreed with this statement.

Conclusions: The results show that there have been remarkable improvements in jump development. These improvements are not only focused on the upcoming performance, but projected into a broader view, defining through perception and awareness, the dynamic ecological approach, resulting in heuristic learning, which is fundamental in the development of athletes' abilities.

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Comparison of physical and technical abilities of young soccer athletes belonging to different age categories

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Purpose: Early identification of talent is fundamental for the professional growth of young soccer players. The description of physical and technical ability levels of athletes belonging to different age groups is crucial to understand whether an athlete shows superior performance compared to his peers. Therefore, the aim of this study was to assess physical and technical performance in young soccer players of different age categories, in order to detect the rate of changes of these parameters over a competitive season.

Methods: One hundred and seventy athletes of 5 age categories (group, number of subjects, mean age, and year of birth respectively: group A = 35, age = 12.3 ± 0.3yrs, 2010; group B = 42, age = 11.3 ± 0.3yrs, 2011; group C = 39, age = 10.4 ± 0.3yrs, 2012; group D = 31, age = 9.4 ± 0.3yrs, 2013; group E = 23, age = 8.2 ± 0.3yrs, 2014). All groups trained an average of 4, 5 h/week 3 times/week in addition to a match each week. Athletes were assessed before (T0) and after (T1) the competitive season in Counter Movement Jump (CMJ) and CMJ with Arm swing (CMJA), 15 m Linear Sprint (LS) and LS with Ball control (LSB), 15 m Agility Test (AT) and AT with Ball control (ATB), and Sit and Reach test (SeR). Repeated Measures (RM) ANOVA was used to analyse significant differences among groups ($p < 0.05$).

Results: RM ANOVA revealed significant changes over time in all tests excepting for LS and SeR. Significant differences among groups were found in SeR test, while a significant time x group interaction was observed in CMJ, CMJA, AT, and ATB. Post-hoc analysis revealed that the oldest groups (group A and B) showed at both T0 and T1 significant higher scores of CMJ, CMJA, AT and ATB compared to the youngest groups (group C, D, and E). However, while no differences between groups were observed at the end of the competitive period in LS, the oldest groups showed better scores in both T0 and T1 for LSB compared to the youngest categories. Finally, the youngest athletes (group E) showed at both T0 and T1 the highest scores of SeR test.

Conclusions: During developmental age phases, athletes showed improvement of both physical and technical performance, excepting for flexibility(SeR). In particular, the age-dependent effect is more evident when the complexity of the task increases (introduction of ball control). Using physical and technical tests, with and without ball control, could help in managing soccer athletes development, while supporting talent identification process.

Pre and post sport season analysis of physical condition in professional female soccer player

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Purpose: Periodic physical assessments during the sport season are necessary to investigate the improvement of motor skills and the players' physical status in response to training. Therefore, aim of this study was to monitor the physical response and body composition status to training during the competition period in professional female soccer players in order to manage their fitness and health status.

Methods: Thirteen professional female soccer players competing in B Italian league and belonging to S.S. Lazio (age 25 ± 4, BMI 21 ± 2) were included in the study. Fitness (Squat Jump, Countermovement jump (CMJ) with the hands akimbo, CMJ with arm swing, Single leg CMJ, 20 m sprint, 60 m sprint, 10 + 10 m sprint and Yo-Yo IR1) and body composition status (Weight, BMI, Fat Free Mass, Fat Mass and Total Body Water) data were collected at the beginning (T0) and at the end of the season (T1; 8 months later). External (GPS data) training load were monitored daily during the sport season.

Results: The external load data of the team (weekly average of the whole sports season) were: Total Distance 6028 m ± 1132, High Speed running (> 15 km/h) 1644 m ± 546, Acceleration Distance (2 m/s^2) 146 m ± 38, Deceleration Distance (-2 m/s^2) 133 m ± 40. In T1 vs T0 analysis, paired student T-test showed in T1 an improvement of the data in CMJ with the hands akimbo ($p = 0.041$), CMJ with single right leg ($p = 0.004$), CMJ with single left leg ($p = 0.032$) and Yo-Yo IR1 test ($p = 0.025$) but not in the other parameters, if compared to T0. Fat Max, Free Fat Max and Total Body Water were in the optimal range for most of the athletes at T0 and maintained at T1.

Conclusions: In conclusion, the training of the sport season improved the physical condition in professional female soccer players.The aforementioned parameters, which suggest an improvement of elastic-explosive strength and aerobic capacity at the end of the season, must be taken into account in order to identify the optimal training load for the individual athlete.

Effects Of training status on autonomic nervous system recovery influenced by different maximal tests

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Purpose: It has been reported that the time required for the autonomic nervous system (ANS) to recover delays after overcoming the lactate threshold during increased exercise intensity. Conversely, physical training status might influence a faster recovery of this system into baseline values following different submaximal exercises. However, little is known about this recovery after exhausting protocols in which the load changes, nor about the influence of training status as a cofactor. Thus, we aimed to compare the ANS stress/recovery by incremental and all-out exercises in power-based athletes compared to a control group.
Methods: ECG was recorded in 14 semi-professional rugby players (TG; male) and 11 untrained healthy subjects (UG; 4 females and 7 males) who accomplished two tests on the cycle ergometer, randomized and separated by at least 72 h. One was an incremental test (INC) till exhaustion; the other was an all-out effort (AOU) against the subject's maximal cycling load. Tests were preceded by a 10 min resting period and a 10 min recovery period. In the last 5 min of each period, the sympathovagal balance was assessed by measuring heart rate variability (HRV) power in the low (LF) and high-frequency (HF) bands and by time domain through RR interval and the root mean square of successive differences between heartbeats, lnRRMSSD, as well as its heart rate (HR).
Results: An ANCOVA confirmed a *test*time* interaction with higher HR values in both groups at the recovery phase after the INC test compared to the AOU test ($p = 0.022$). The same interaction was found for lnRMSSD ($p = 0.003$), with a significant decrease measured at recovery condition after the INC protocol for both groups (*time factor*, $p < 0.001$). Still, the UG presented lower values for this variable than TG (*group factor*, $p = 0.009$). The ratio LF/HF increased similarly for both groups after each protocol ($\pm$ 8 and 21% for AOU and INC tests, respectively; *time factor*, $p = 0.006$), but the UG presented higher values at each condition ($\pm$ 12 and 26% at rest and recovery, respectively; *group factor,* $p < 0.001$).
Conclusions: Although the TG has a higher parasympathetic tone at rest conditions represented by lower HR, higher lnRMSSD, and lower LF/HF, the training factor did not influence a faster vagal reactivation after two different approaches to reach maximum intensity compared to UG. It may indicate that a power-based training group needs a similar time to recover after maximal efforts as an untrained group to return to baseline values of HRV (i.e., $>$ 10 min).

A comparison between flat-back and arched-back bench press techniques on the load-velocity profile and muscle activation in strength and power athletes

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Purpose: Powerlifters and practitioners can choose between two main variants of the bench press exercise: the flat-back (FL) and the arched-back (ARC) bench press that are characterized by a different lumbar and scapular positions. The present study was conducted to compare the FL and the ARC technique on 1 repetition maximum (1RM), bar displacement, force–velocity profile and muscle activation in strength and power athletes.
Methods: Fifteen highly trained individuals (13 men and 2 women) participated in the present study (Age: 29.0 $\pm$ 6.6 y; body mass: 87.5 $\pm$ 15.3 kg; height: 176.8 $\pm$ 8.0 cm). In separate days, they were tested for FL and ARC bench press 1RM. Then, participants were assessed for average power, bar speed and bar displacement, at 50, 70 and 90% of the FL and ARC 1RM, respectively. During submaximal lifts, electromyographic activation of pectoral muscle and triceps muscle were registered.
Results: A significantly higher bench press 1RM was obtained in ARC compared to FL (125.0 kg and 121.7 kg in ARC and FL, respectively). Significantly higher average and peak bar velocity were registered at 50% of 1RM in FL compared to ARC (+ 0.06 m sec–1). Significantly shorter bar displacements were registered in ARC compared to FL, at 50% (–4.7 cm), 70% (–3.7 cm), and 90% (–2.9 cm) of 1RM. No differences in power were noted at any loads ($p > 0.05$). No differences were also detected between bar velocity at 70% and 90% of 1RM. Pectoral activation did not show significant differences between FL and ARC at any loads, while triceps muscle showed a significantly higher activation in ARC compared to FL at 50% (+ 10.2%) and 90% (+ 14.1%) of 1RM.
Conclusions: Results of the present study indicated that ARC technique may be more productive to maximize strength while FL technique may be more suitable for explosive strength and speed at submaximal loads. Both techniques can be equally used to stimulate hypertrophy of the pectoral muscles.

A new load and performance score to assess training and match on professional soccer players: a machine learning approach

Purpose: Monitoring of training load in soccer requires multiple indicators derived from both external (provided Electronic Performance and Tracking Systems [EPTS]) and internal loads (i.e., related to HR or RPE scale). Therefore, the aims of this study was: to identify the key external load indicators through principal component analysis (PCA); 2) to implement both a total training/match load score and an athlete's physical performance score; 3) to detect the scores differences within the weekly microcycle and players' playing positions.
Methods: 24 professional soccer players (age: 18, 7 $\pm$ 0, 5 years, height: 177 $\pm$ 6 cm, weight: 67, 5 $\pm$ 7, 7 kg) competing in the U19 Italian Championship were analysed during the competitive season from August to February (2022–2023). External Load (EL) Data were collected through a wearable inertial sensor (TalentPlayers TPDev, firmware version 1.3), while Internal Load data were collected through RPE scale. A principal component analysis (PCA) was used to reduce the feature dimension space to aggregate features to summarize the training workloads performed by soccer players during training and matches. Based on the PCA scores and the internal loads (RPE), 2 metrics were computed. One metric reflects the players performance (PERF—Eq. 2), while the second one is focused on workload (WORK—Eq. 3). Spearman Rho's correlation using a repeated measure model with autoregressive approach (for time series analysis) was applied. Two-way ANOVA RM was used to detect differences among Game Day and playing position.
Results: 3 main components were detected by PCA: i) volume metabolic related component, ii) intensity mechanical stimuli component, and iii) intensity metabolic/mechanical component. Spearman Rho's correlation coefficients showed that Scores (i.e., PERF and

WORK) are low correlated (r = – 0.20), suggesting that they are independent. Autocorrelation analysis showed that a weekly microcycle is detectable in all the scores (i.e., 7 days and multiple of 7 indicating that a similar pattern is repeated every 7 days). Two-way ANOVA RM showed a statistical difference among game day (GD) and playing position for the 3 PCA components and PERF Score.

Conclusions: Trought our innovative analysis we have provided a deeper understanding regarding training load and players performance in soccer by computing two Scores from EL and IL data. We have better identified the workloads training microcycle or official match along with player's performance. PCA analysis allows the selection of EL indicators more appropriately than a subjective approach. Therefore, it is possible to understand the differences between training and official matches or between Game Days, also considering each player's playing position. In this way, practitioners could prescribe the training drills in the microcycle considering the results provided by two Scores.

Acknowledgments:
This work is supported by the European Community's H2020 Program under the funding scheme INFRAIA-2019–1: Research Infrastructures grant agreement 871, 042, www.sobigdata.eu, SoBig Data. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

What about the relationship between training load and recovery ability in U19 professional soccer players? a machine learning approach

Purpose: The main purpose of soccer training is enhancing players' performance while minimizing the possible negative effects induced by fatigue such as injuries. The load which the players are subjected to induces a certain degree of neuromuscular, metabolic, and mental fatigue. Monitoring training load (TL) and recovery is necessary to avoid overload and injuries. Given the controversial results found in literature, this study aims to better investigate the complex relationship between internal training load (using rating of perceived exertion—RPE) recovery and availability (i.e., subjective players' readiness status).

Methods: 32 professional soccer players (age: 18.5 ± 0.4 years, height: 177 ± 6 cm, weight: 67 ± 6.7 kg) competing in the U19 Italian Championship were analysed. Data was collected through RPE scale. Internal TL was calculated multiplying training durations and RPE value. To estimate the players' state of recovery the TreS scale, that includes both Global Quality Recovery (GQR) and Training Intensity Availability (TIA), was used. The autocorrelation analysis was conducted to detect similarity between observations among the variables (i.e., TL, Recovery, and Availability) time series as a function of the time lag between them. A cross-correlation analysis was conducted to detect correlations between two time series. Mediational analysis was conducted to detect the mediators that affect the relationship between TL and Recovery of the next day.

Results: Autocorrelation analysis showed a repeated pattern with 7 days lag (weekly microcycle pattern) for all the variables considered, Recovery, and Availability). For Recovery ($r = 0.64$, $p < 0.001$) and Availability ($r = 0.63$, $p < 0.001$), the best lag for both of them is 1 day. It indicates that Recovery and Availability are related to the past day value. Moreover, TL was found to be negatively affected by Recovery and Availability of the current day (lag = 0 day). The cross-correlation analysis indicates that TL is negatively affected by Recovery ($r = 0.46$, $p < 0.001$) and Availability ($r = 0.42$, $p < 0.001$) of the current day (lag = 0 day). Lower Recovery and Availability will result in following lower TL. Furthermore, we found that TL negatively affects Recovery ($r = 0.52$, $p < 0.001$) and Availability ($r = 0.39$, $p < 0.01$) of the next day (lag = 1 day). In fact, the higher the TL in a current day is, the lower the Recovery and Availability in the next day will be.

Conclusions: There is a relationship between TL and Recovery and these components influence each other both on the same day and on the next one. The use of RPE and TreS scale to evaluate TL and Recovery/Availability of players allows practitioners to better adjust and schedule training within the microcycle to enhance performance while reducing injury risk.

Acknowledgments:
This work is supported by the European Community's H2020 Program under the funding scheme INFRAIA-2019–1: Research Infrastructures grant agreement 871, 042, www.sobigdata.eu, SoBig Data. The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Amplifying physical activity in primary schools: unleashing the potential of multistation exercise approach

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Purpose: Nowadays, it is recognized that physical activity is crucial for children's well-being. Despite this, many children do not meet the recommended levels (Carrel et al., 2005). While interventions promoting physical activity in primary schools exist, they often focus on time rather than quality (Errisunz et al., 2018). This observational study aimed to identify how different exercise set-ups affect the real "active time" of children's movement during a 60-min physical activity session.

Methods: Twenty third-grade students participated, and their active time of motion was recorded across three exercise formats. Each format was 10 min long and a 5-min break was ensured between each activity.

Results: The results revealed that the one-station format resulted in an average active time of 50.75 ± 6.46 s, the two-station design had 100.13 ± 10.78 s, and the four-station format had 148.71 ± 7.26 s. Data analysis demonstrated a significant difference among the forms ($p < 0.001$), with the four-station design yielding the most active time ($p < 0.001$; + 193%).

Conclusions: In conclusion, this study suggests that implementing a multistation exercise approach can enhance physical activity interventions in primary school children. Increasing the number of exercise stations leads to a substantial increase in active time spent by children during physical activity. By considering the exercise set-up, interventions can be tailored to optimize the amount of time children spend actively engaged in physical activity. These findings contribute to improving strategies aimed at promoting physical activity and overall health among young children.

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Could bia-derived phase angle be considered as a proxy of health-related musculoskeletal fitness? a cross-sectional study in young adults

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Purpose: Few evidence is available on the relationships between body composition and health-related physical fitness = HRF, in particular musculoskeletal fitness. Bioimpedance index = BI-index and phase angle = PhA (bioelectrical impedance analysis = BIA raw variables) are candidate predictors of HRF, being proxy of fat-free mass = FFM and body cell mass, respectively. We evaluated body composition, raw BIA variables and HRF in young adults and investigated their mutual relationships to identify predictors of muscle strength.
Methods: Two-hundred twenty-nine young adults (115 men and 114 women; 24.2 ± 3.0 years; body mass index 19–30 kg/m^2), participated in the study. Anthropometry was measured with standardized procedures. Whole-body BIA was performed (50 kHz) for impedance e PhA. FFM and percentage body fat = %BF were estimated by predictive equations, while BI-index was calculated as stature^2/impedance. Musculoskeletal fitness was assessed by handgrip strength = HGS, standing broad jump = SBJ, squat jump = SQJ and counter-movement jump = CMJ.
Results: In both sexes HRF showed stronger associations with BC compared to those with stature or weight. HGS was related to FFM and BI-index, while an inverse association with %BF emerged for SBJ, SQJ and CMJ. PhA directly correlated with HGS, SBJ, SQJ or CMJ. In multiple regression analysis PhA was an independent predictor of all HRF tests along with FFM (or BI-index) for HGS and with sex and %BF for the three jump tests.
Conclusions: The present study provides consistent information on the relationships between body composition and HRF in young adults. PhA emerged as a significant predictor of all HRF measures and might be useful for a more consistent assessment of musculoskeletal fitness.

Using force or enveloped emg feedback to modulate motor control output

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Purpose: The motor control system can modulate the muscle action level using both the generated output tension (force feedback, FF) or the global EMG activity (neural feedback, NF) as a visual feedback. In this study, muscle neuro-mechanics was investigated during triangular varying static contraction presenting two consecutive up-going ramp (UGR) and down-going ramp (DGR). The aim of this study was to evaluate the possible influence of FF or NF in different muscles.
Methods: In 20 subjects (21.8 ± 2.26 yo), in both first dorsal interosseous (FDI) and tibialis anterior (TA), the envelope of EMG (eEMG) and the force signal (F) were detected. For FF the signal driving the motor control system was the F while the trailing signal was the eEMG. The opposite for NF. Each of the consecutive UGR and DGR lasted 7.5 s. The vertices of the effort triangles were 50% and 100% of F (FF) or eEMG (NF) measured during individual maximal voluntary activity. Each subject performed four different tasks for each muscle: FF50, FF100, NF50, and NF100. The areas beneath the F and eEMG signals were computed for UGR and DGR. Electro-mechanical coupling efficiency (EMCE) was calculated as the ratio between the F/eEMG area ratio during both UGR and DGR. Data from the different tasks were compared using a linear mixed model with Kenward-Roger's methods for post hoc analysis.
Results: DGR/UGR area ratio. *FDI*. FF50 data: eEMG = 0.84 ± 0.15. FF100 data: eEMG = 0.73 ± 0.17. NF50 data: F 1.18 ± 0.13. NF100 data: F = 1.17 ± 0.23. *TA*. FF50 data: eEMG = 0.88 ± 0.11. FF100 data: eEMG = 0.91 ± 0.17. NF50 data: F = 1.17 ± 0.21. NF100 data: F = 1.07 ± 0.19. The area ratio of the driving signals were always close to 1. The trailing signal area ratios were statistically different when NF and FF data were compared. The comparison between DGR-EMCE and UGR-EMCE indicated that the first one was always significantly higher in all the four tasks in both muscles.
Conclusions: The greater EMCE during DGR, caused by previous muscle increasing activity, may play an important role in the non-symmetrical behaviour of the trailing signals during triangular varying static contraction. With this in mind it can be concluded that the two types of feedback for investigating or training the motor output modulation capacity must be carefully chosen according to their specific features: FF or NF when the mechanical output accuracy or the global motor unit pool activation strategy are under study, respectively.

Motor unit discharge pattern of the hand extrinsic flexor muscles changes between fingers flexion and synergistic finger-thumb flexion tasks

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Purpose: Movement of the fingers requires a highly coordinated interplay of the hand extrinsic and intrinsic muscles, demanding complex control by the central nervous system. For instance, while the fingers do not flex in complete isolation, the opposable thumb has a high level of individuation and control. This suggests that there are potential differences in neural control between flexion of the fingers (fingers flexion task) and synergistic finger-thumb flexion (grasp task). In this study, we aimed to investigate the mean discharge rate of motor units recorded from the hand extrinsic flexor muscles during these two tasks using high-density surface electromyography (HDsEMG) signals.
Methods: HDsEMG signals were recorded from the distal and proximal parts of the extrinsic flexor muscles in 15 healthy subjects. Two different tasks were performed: fingers flexion task, involving simultaneous flexion of the four fingers, and grasp task, involving synergistic flexion of the four fingers and the thumb. Both tasks were performed at a submaximal isometric level of 5% of maximal voluntary contraction. HDsEMG signals were decomposed into motor

unit spike trains using a convolutive blind-source separation algorithm, and motor units were tracked between tasks. The mean discharge rate (DR) of motor units was then calculated and compared between the two tasks. In addition, to assess force steadiness, the coefficient of variation (CoV) of force was computed.
Results: The analysis revealed significant changes in both force and motor unit mean discharge rate between fingers flexion and grasp tasks. The grasp task showed a reduction in force CoV ($p = 0.006$), reflecting an enhanced force steadiness. This improvement was accompanied by a reduction in mean DR of motor units located at the distal region of the hand extrinsic flexor muscles ($p = 0.001$), while no significant differences were observed at the proximal region ($p = 0.505$).
Conclusions: Our findings indicate distinct neural control patterns between fingers flexion and grasp contractions. Importantly, our results suggest region-specific alterations in mean DR of hand extrinsic flexors, as differences were observed at distal motor units but not proximal. Moreover, our study demonstrates the feasibility of tracking and analyzing the same motor units in these specific tasks, offering methodological insights for future research.
Acknowledgments: European Research Council Consolidator Grant INcEPTION (no. 101045605).

Compressive garments and local muscle oxygenation kinetics during submaximal cycling exercises

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Purpose: Oxygenated hemoglobin (O_2Hb) level in active muscles depends by the local mismatch between O_2 supply and metabolic demand. Microvascular adaptations may determine the extent of this mismatch as well as in exercise induced muscle swelling. This last can be indirectly monitored by ultrasound (US) measurement of the muscle thickness. This study aimed to investigate the potential influence of wearing a compressive garment (CG) on the kinetics of [O_2Hb] and US estimated thickness of the muscle (USMT) during submaximal cycling.
Methods: Subjects: 9 males and 11 females, age 26 ± 4.5 yo. NIRS probe was placed over the distal 1/3 of the vastus lateralis (VL). Each participant visited the laboratory twice for CG or sham fabrics (SF) exercises. After 5' warm-up the subject performed 4' at 50, 100 and 150 W of cycling at 60 rpm. The time needed for basal heart rate recovery was allowed after the warm up and each exercise. The O_2HB dynamics during exercise and recovery periods was interpolated with an exponential decay or an exponential increment, respectively. VL USMT was measured in supine position before cycling and immediately after the recovery from the last effort. Values were reported as mean ± SD. The data from NIRS from CG and SF were compared using two ways ANOVA for repeated measures. Relative USMT changes were compared by paired T-test.
Results: The amplitude of [O_2HB] decrement from basal value was not influenced by CG or SF, but the requested wattage. Time constant for [O_2HB] decrease during cycling (τ_{on}) and increase during recovery (τ_{rec}) were significantly different among wattages (τ_{on}: $p = 0.003$, τ_{rec}: $p < 0.001$) and between trials performed with or without CG (τ_{on}: $p < 0.001$; τ_{rec}: $p < 0.001$). The τ_{on} and τ_{rec} always resulted shorter for CG trials being (in s): 50 W = τ_{onCG} 7 ± 8.6, τ_{onSF} 9 ± 6.9, τ_{recCG} 15 ± 10.2, τ_{recSF} 27 ± 20.7; 100 W = τ_{onCG} 7 ± 3.4, τ_{onSF} 12 ± 5.1, τ_{recCG} 18 ± 11.8, τ_{recSF} 39 ± 23.7; 150 W = τ_{onCG} 6 ± 2.9, τ_{onSF} 16 ± 7.4, τ_{recCG} 26 ± 12.7, τ_{recSF} 43 ± 14.9. The relative USMT changes resulted significantly larger ($p = 0.01$) after trials with SF (+ 5.3%) compared to CG trials (+ 0.3%).
Conclusions: Wearing a CG increases the rate of the [O_2HB] changes from basal to steady state value—and vice versa—indicating that the equilibrium between the O_2 request and availability is more rapidly reached. Smaller USMT changes when CG is used seems to link the above result to an effective support of microvascular function. Overall, wearing a CG improves the dynamics of O_2Hb, reducing local O_2 debt and potentially enhancing performance.

Anabolic steroid use among adolescent athletes: the soda survey results

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Purpose: The Survey On Doping Among Adolescents (SODA) investigates the phenomenon of doping among young professional, non-professional athletes and non-athletes students. To collect data, the SODA survey 2017 followed the standardized methodology of ESPAD®Italia (European school Survey Project on Alcohol and other Drugs), a nationally representative cross-sectional survey conducted annually since 1999 in Italy, to investigate tobacco, alcohol and drug use as well as other risk behaviors among high school students. Here we present the analysis of data about 7, 390 students aged 15–19 years (53.8% male) who performed sports at various levels and completed all the SODA modules. In particular, we focused on the propensity to use anabolic steroids.
Methods: We aimed to evaluate associations of individual features (sex; school performance; type of sport played—individual, team sports -; sport engagement—professional and non-professional) and lifestyle habits (drunkenness propensity and cannabis use) with the likelihood of using anabolic steroids, using a binomial logistic regression model. Additionally, we included other variables in the model, such as participation in sports competitions (yes/no), the student's perception of his parents' beliefs on his commitment to sport (excessive or too low commitment, not interested in sporting achievements, satisfied, unclear perception), and the student's perception on his coach's style (autocratic, democratic, disinterested).
Results: Among young athletes, being male (OR: 1.9; $p < 0.0001$), having experienced drunkenness (OR: 1.7; $p = 0.002$) and cannabis use (OR: 2.1; $p < 0.0001$) showed a positive association with anabolic steroids use. Other factors associated were the student's perception of having parents who consider excessive his commitment to sport (OR: 1.6; $p = 0.04$), compared to the perception of having parents who are satisfied, as well as perceiving their coaches as being too severe (OR: 1.6; $p = 0.04$) or disinterested in their athletes' training or sporting achievements (OR: 2.4; $p = 0.001$), compared to perceiving coaches as open to athletes' suggestions (democratic). Playing a team sport showed a negative association compared to individual sports, even though it is not statistically significant (OR: 0.7; $p = 0.058$).
Conclusions: Our findings demonstrate the multifactorial nature of the risk of doping use among young athletes, where personal habits carry equal significance alongside factors such as family influences (parents' beliefs) and community influences (coaches' approaches) in shaping adolescents' identity and development.

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In-Vivo muscle relaxation rate, but not contraction, differs for sex

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Purpose: The function of skeletal muscle can be influenced by various factors, including the activation of central motor units, excitation–contraction coupling, fiber characteristics, and contractile elements within muscle cells. These factors are subject to variations depending on age, sex, disease, and training status. Noteworthy among these influences are sex hormones, like estrogen, which exert an impact on the number and function of cross-bridges cycling within a single muscle fiber, ultimately resulting in contrasting muscle contraction and relaxation patterns between males and females. This study aims to understand the in vivo muscle contraction properties in males' and females' lower limbs, and we hypothesize faster contraction and relaxation velocities in males.
Methods: Single potentiated twitches on the femoral nerve were electrically delivered at rest to the dominant leg of 26 young healthy subjects (13 M + 13 F) to assess muscle contractile properties. The quadriceps' muscle extensors cross-sectional area (CSA) was determined from panoramic ultrasound scans.
Results: The force of the single twitch was higher in males (68 ± 14 *vs.* 43 ± 8 Nm, $p < 0.001$) until normalization for the muscle CSA (0.7 ± 0.2 *vs.* 0.6 ± 0.1 Nm/cm^2, $p > 0.05$). Males exhibit faster contraction (3.2 ± 0.6 *vs.* 2.1 ± 0.4 Nm/ms, $p < 0.001$) and relaxation (-1.9 ± 0.3 *vs.* -1.1 ± 0.3 Nm/ms, $p < 0.001$). When accounted for the muscle CSA, the results showed no difference in the contraction rate (0.03 ± 0.01 *vs.* 0.03 ± 0.01 Nm/cm^2/ms, $p > 0.05$), which is in accordance with the lack of difference in the contraction time (65 ± 4 *vs.* 69 ± 9 ms, $p > 0.05$). The normalized relaxation rate was still slightly faster in males (-0.020 ± 0.004 *vs.* -0.016 ± 0.004 Nm/cm^2/ms, $p = 0.05$), similarly shown by the half relaxation time (69 ± 7 *vs.* 80 ± 16 ms, $p = 0.05$).
Conclusions: Our data partially confirm our hypothesis and agree with earlier reports of significant sex differences in muscle contraction properties. Muscle CSA accounted for the initial differences in contraction rate, however, muscle relaxation was still faster in males. Indeed, like other investigations [1,2], females had slower relaxation rates and half relaxation times during the electrically-elicited contractions. This has been seen to be linked to the SERCA pump activity, with consequent slower Ca^{2+} ions re-uptake into the sarcoplasmic reticulum and lower Ca^{2+}-ATPase activity in females unfatigued muscle.
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Evaluation of 4-week of training during post-season period on aerobic fitness, maximal aerobic speed, and sprint endurance in adolescent women soccer players

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Purpose: In adolescent women soccer players, studies describing the effects of training on aerobic fitness and sprint endurance are still limited. This study aimed to investigate the effects of a 4-week post-season training program on aerobic fitness, sprint endurance, and perception of effort in adolescent women's soccer.
Methods: Fifteen adolescent women soccer players (age 14.9 ± 1.6 years; weight 56.5 ± 7.7 kg; height 163.7 ± 6.6 cm) were recruited from a professional team. The training program consisted of a combination of aerobic and sprint endurance training sessions conducted twice a week. Aerobic endurance training involved small-sided games (SSG) of various format, while sprint endurance training included linear and change of direction sprint drills. Before and after the intervention period, participants underwent three testing sessions: 1st) Yo-Yo intermittent endurance level 1 (YYIE1), 2nd) 45–15 Test, to assess aerobic fitness, and 3rd) 30-s all-out shuttle run (30 s test), to measure sprint endurance. Borg's CR-10 scale was used to evaluate the perception of effort after each test. Training outcome measurements included heart rate (HR), blood lactate concentration ($[La]^+$), maximal aerobic speed (MAS), muscular (RPEm) and cardiorespiratory (RPEcr) rating of perceived exertion.
Results: A significant improvement in both YYIE1 and the 30 s test ($p < 0.001$) performance was reported. No significant changes were found in the 45–15 Test. HR and $[La]^+$ values were significantly higher in YYIE1 ($p < 0.01$), but no significant differences were found in both the 45–15 Test and the 30 s test post training intervention. RPEm and RPEcr significantly increased in YYIE1 ($p < 0.05$), whereas only RPEm value was significantly higher in the 30 s test ($p < 0.01$). No changes in RPE values were found in the 45–15 Test.
Conclusions: These results may be of interest, as they showed that, in adolescent women soccer players, after 4 weeks of dedicated training in the post-season, both aerobic and anaerobic endurance paradigms significantly improved. This improvement could potentially help limit fitness impairments during the transition period and enable players to start the pre-season with a satisfactory level of aerobic and anaerobic fitness.
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Motor competence in sport during childhood: differences between open skills sport and closed skills sport

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Purpose: Motor competence, in particular gross motor coordination, is an important parameter to consider in children for monitoring their development because is important for its relations both healthy and performance factors. The aim of this study was to investigate the effect of the practicing different sports (athletic for closed skills sport CSS; football and volleyball for open skills sport OSS) in 9- and 10-year-old children practicing that current sport at least one year with continuity. The secondary objectives of this study was to find differences of GMC in biological sex, GMC-BMI correlation and GMC-physical activity correlation.
Methods: A sample of 103 children (M = 49, F = 54) were tested using the Körperkoordinationstest Für Kinder (KTK), the Physical Activity Questionnaire for Older Children (PAQ-C) and anthropometric measures (weight and height status). Groups were compared in statistics with deviation standards, T test, and R (Pearson) factor.
Results: In general, OSS group performed better than CSS group ($p < 0, 05$), boys practicing OSS typically showed values of GMC higher than CSS group ($p < 0, 01$) but no differences were relevant in girls.
We found a linear correlation between BMI-physical activity and a polynomial correlation were showed between GMC-BMI. In both case correlation are stronger in boys.
Conclusions: In KTK performance, the practice of open skills sport and closed skills sport seems relevant for differences in GMC. Looking at the results, it seems that closed skills sport is not as good as open skills sports in the acquisition of GMC in boys. We found an optimal interval of BMI (normal weight) for performing in GMC. This study also shows that the more people do physical activity, higher their GMC is.
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The role of preparticipation screening in detecting silent coronary artery disease in master athletes: a way to prevent exercise-related adverse cardiovascular events

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Purpose: Regular exercise reduces morbidity and mortality from cardiovascular diseases through cardiac and systemic adaptations including the increased coronary blood flow, an improved endothelial function, a slower progression of atherosclerotic processes as well as the stabilization of pre-existing lesions. However, long-term exercise is frequently associated with adverse cardiovascular events in 35-year older subjects because of a cardiac remodeling that predisposes to malignant arrhythmias and to an earlier atherosclerosis. Moreover, in athletes, ischemia is often silent with a higher risk of sudden cardiac death.The aim of our observational study was to evaluate the efficacy of preparticipation screening in identifying the presence of coronary artery disease (CAD) in a population of asymptomatic master athletes.
Methods: Between 2018 and 2019, 420 35-year older athletes (mean age: 55 ± 17) underwent a preparticipation screening at the University of Pisa. None of them reported cardiovascular risk factors or previous cardiovascular diseases. After a physical examination, all subjects were submitted to spirometry and ECG stress test.
Results: The ECG stress test demonstrated signs of myocardial ischemia (ST depression > 1 mm) in 41 subjects; 3 athletes showed a frequency-dependent left bundle-branch block; 24 subjects had exercise-induced premature ventricular complexes during the ECG stress test. These subjects underwent further evaluations (Tc-99 myocardial perfusion SPECT and coronary angio-CT) to detect the presence of perfusion defects or coronary abnormalities: 26 athletes had an important coronary atherosclerosis with significant stenosis in one or more vessels and later subjected to Percutaneous transluminal coronary angioplasty (PTCA) or to coronary artery bypass grafting (CABG). 5 athletes presented a coronary myocardial bridge and 1 subject was demonstrated to have an anomalous origin of the left coronary.
Conclusions: Preparticipation screening in 35-year-older athletes was able to detect the presence of obstructive coronary artery disease (CAD) in the 38% of suspected cases and anomalous origin or intramural coronary course in 8, 8% of cases that showed electric abnormalities during the stress test. Despite recent conflicting opinions about the scientific value of the preparticipation screening in young athletes, the present study demonstrated that it was fundamental to early detect silent conditions that could predispose master athletes to adverse cardiovascular events.

Cell free mtdna analysis and mild traumatic brain injuries in boxers

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Purpose: Several contact sports are characterized by mild traumatic brain injuries (TBIs) that could increase cell free mitochondrial DNA (cf-mtDNA) release in cerebrospinal fluid and plasma contributing to a state of systemic inflammation. Repeated mild TBIs lead to higher risk of developing dementia and chronic traumatic encephalopathy (CTE) in boxers. There is a strong association between high cf-mtDNA levels and a worst prognosis. Stressed or damaged mitochondria release mtDNA into the extracellular space, which activate the innate immune system, resulting in the release of pro-inflammatory cytokines and supporting the development of chronic inflammation. However, the role of cf-mtDNA in such sports is still poorly understood. Our study aims to investigate a possible correlation between mild TBIs, the release of cf-mtDNA, and inflammation.
Methods: Ten male non-professional boxers, aged 18-36 years, were selected to participate in one sparring match per week for three consecutive weeks. During all matches, we counted the blows sustained to the head and body by each boxer. Venous blood samples

were collected immediately before and after each match and processed following standard blood separation protocols to avoid platelets contamination (total mtDNA). Plasma firstly was centrifuged at 18, 000 g for 30 min (mtDNA1); then plasma was subjected to ultracentrifugation at 100, 000 g for 2 h to obtain naked DNA (mtDNA2). Nuclear DNA and mtDNA were quantified by Droplet Digital PCR (ddPCR). Light chain neurofilaments (NfL), pro-inflammatory cytokines (IL6, IL8, IL1b, TNFa) and anti-inflammatory cytokines (IL2, IL10, IL4, IL13) were quantified by ELLA.

Results: IL6 plasma concentration increased after each match and then returned to pre-match values. The other pro-inflammatory cytokines showed a similar trend, although not significant. The anti-inflammatory cytokines IL2 and IL10 showed a similar trend, although less pronounced, while IL4 and IL13 were below the detection limit. NfL concentration remained stable after each match. Total mtDNA, mtDNA1, and mtDNA2 concentrations increased after a match. Total mtDNA and mtDNA2 returned to baseline levels within the subsequent matches, while mtDNA1 progressively increased over the weeks.

Conclusions: Plasmatic mtDNA, regardless the form, increased after a sparring match, while NfL did not vary. The potential association between cf-mtDNA and mTBI could suggest the use of cf-mtDNA as a possible early marker of cell damage.

Acknowledgments: This work was supported by the UNIMORE project FAR Mission Oriented 2021 to Milena Nasi. The authors would like to thank all the boxers and coaches of the Boxe Academy Sassuolo SSD who partecipated to this study.

Proportionality comparison between young water polo and soccer players, according to the maturity offset

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Abstract

Purpose: (1) To describe the anthropometrical characteristics of young water polo (WP) and soccer (SOC) players, and (2) to compare the anthropometric proportionality, with the Phantom model[1], according to biological maturity and practiced sport.

Methods: Forty young SOC (age: 13.88 ± 0.60 years) and twenty-four young WP players (age: 13.30 ± 0.55 years) participated in the study. Body mass (BM), stature, sitting height, arm circumference, waist circumference (WC), triceps, and subscapular skinfolds were measured. The percentage of fat mass (FM%) was derived by Slaughter's Eq. [2]. According to the maturity offset by the Mirwald Eq. 3, each participant was classified as growth peak not-achieved (GPNA) or growth peak achieved (GPA). The Analysis of Variance (ANOVA) was utilized to compare groups. The Phantom was used to characterize 1) the anthropometrical proportion of players and 2) compare them according to biological maturity and practiced sport.

Results: The BM significantly differed between sport groups (SOC: 54.81 ± 11.32, WP: 58.07 ± 10.41, p = 0.020) and according to maturity offset (PGNA: 48.96 ± 8.21, PGA: 61.54 ± 9.77, p = < 0.001). Similarly, the arm circumference significantly differed between sport groups (SOC: 24.11 ± 3.15, WP: 27.42 ± 2.95, p = < 0.001) and according to the maturity offset (PGNA: 24.38 ± 3.37, PGA: 26.11 ± 3.37, p = 0.004). The WC (PGNA: 68.58 ± 6.73, PGA: 72.43 ± 7.17, p = 0.025) and triceps skinfold (PGNA: 15.33 ± 6.10, PGA: 11.28 ± 5.42, p = 0.009) significantly differed between maturity offset groups. The WP players presented higher values in triceps (SOC: 11.55 ± 5.22, WP: 15.55 ± 6.56, p = 0.019), subscapular skinfolds (SOC: 7.97 ± 4.45, WP = 11.80 ± 5.45, p = 0.005), and FM% (SOC: 16.50 ± 7.28, WP = 22.70 ± 8.44, p = 0.006) respect the SOC. The comparison through the Phantom model produced similar results.

Conclusions: The study suggests that biological maturity influences anthropometrical characteristics and that WP players are physically more structured than SOC players and have higher FM%.

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Sand vs. track. surface-based training integration enhances vertical jumping peak power in U-15 track and field female athletes

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Purpose: Exercising on sand surfaces holds unique beneficial characteristics for athletic performance, such as augmenting pre-stretch mechanisms and stability in the quadriceps and calf muscles, increasing motor unit recruitment, and improving postural control, ultimately leading to optimized jumping mechanics. The purpose of this study was to inquire about the promising yet underutilized inclusion of sand-based training to enhance bio-motor development of the lower-limbs in youth female athletes.

Methods: We recruited 15 female track and field competitors at the U-15 national level (age 14 ± 1.1 years, height 162 ± 3.8 cm, body mass 52 ± 4.8 kg, World Athletics scoring tables of 634 ± 61), randomly and equally dividing them in 3 groups (i.e., sand, track, and mixed). The training intervention consisted of 7 weeks (two sessions per week, 1 h per session) of supplementary training, along with the usual regime of training and conditioning which was the same for the whole sample of participants. The surface-based training intervention consisted in a periodized bodyweight circuit, focused on plyometrics and power development of the lower limbs. Relative peak power (RPP, W / kg) performed in the counter movement jump test (CMJ) was employed as a measure of pre-post training intervention, and was calculated with a novel approach using the Physics Toolbox smartphone app.

Results: Wilcoxon signed rank test for matched pairs indicated that the median RPP in CMJ was significantly higher post-training than pre-training for the sand group (48 (0.8) vs. 43.1 (2.3), W = 13, p < 0.05, effect size r = 0.74), and the mixed group (47.8 (4.8) vs. 41.2 (3.8), W = 14, p < .05, effect size r = 0.76), while no pre-post differences were found within the track group (43.7 (3.1) vs. 42.9 (1.4), W 0.5 = , p = 0.44, effect size r = 0.42). It is worth mentioning the narrower distribution (IQR) of the sand group from pre to post-training intervention. Kruskal-Wallis test indicated statistically significant differences among groups only post-training intervention (H (2) = 15.18, p < 0.05, effect size ε^2 = 0.66), further suggesting that

the whole sample had similar baseline levels of RPP. Post-hoc analysis with Bonferroni adjustment revealed that significant differences ($p < 0.05$) were present between the sand vs. track groups, 48 (0.8) vs. 43.7 (3.1) W/kg, and between the mixed vs. track groups, 47.8 (4.8) vs. 43.7 (3.1) W/kg, with no significant differences between the sand vs. track groups.

Conclusions: Even a relatively brief exposition to sand-based training may elicit profitable adaptations in maximal muscular power of developing female athletes. Integrating an exclusive training routine on sand also seems to "tighten" the power performance distribution across athletes of similar level. This information could be used in future research designs for both performance enhancement and injury prevention purposes.

Technical effects of the combined use of technology and feedback on nordic walking technique of breast cancer survivors and healthy women

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Purpose: Growing literature furnishes evidence concerning the positive effects of Nordic Walking (NW) on health and diseases. NW seems positively affect the health of breast cancer survivors (BCS), therefore, a good technique is fundamental to secure and exalt its positive effects. To reach the best practical competence, both the number of introductory workouts and the efficacy of feedbacks are important. Therefore, the study aimed to observe the effect of a standard NW teaching format and that of additional workouts, containing feedback based on a technological approach, on NW technique of BCS and healthy women (HW).

Methods: 31 BCS (54.34 ± 2.45) and 30 HW (49.67 ± 3.78) not practicing physical exercise have been recruited. Participants were introduced to NW through 8 technical lessons, according to the International Nordic Walking Federation scheme. Two kinesiologists, also being NW instructors, conducted the group lessons. At the end of the 8 lessons (T0), the participants were tested using the Gabel E-Poles G1 (Gabel, Italy), recording biomechanical variables concerning the use of upper limbs, hands and poles, during a 5-min test. After the test, half of the participants had 6 additional workouts including feedback based on their technique during NW practice. The remaining part had 6 workouts without supervision and feedback. After the additional workouts (T1), the test has been repeated.

Results: At T0, BCS showed lower poles alternation regularity ($p = 0.01$) and poles contact symmetry ($p = 0.04$) than HW. RM-ANOVA showed a significant time x group effect when we considered health condition (BCS vs. HW) ($F_{(4, 54)} = 5.259$, $p = 0.001$) and the presence of feedback (yes vs. no) ($F_{(4, 54)} = 18.806$, $p < 0.001$). BCS had best results in poles alternation regularity ($p = 0.01$), contact time symmetry ($p = 0.03$) and poles inclination symmetry ($p = 0.007$) than HW. Participants receiving the additional feedback had best results in poles contact symmetry ($p < 0.001$) and degrees symmetry ($p = 0.01$) than participants not receiving them.

Conclusions: In BCS, 8 workouts of introduction to NW seem to be not enough to guarantee the same technical results as HW. After the 8 workouts of introduction to NW, the presence of additional workouts with feedbacks seems positively affect the symmetry of both poles contact and degrees. The use of technology (i.e. Gabel E-Poles G1) with a longer supervised NW introductory program seems to be a best approach for BCS and HW.