

ABSTRACT

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Feasibility and efficacy of an adapted physical activity protocol during COVID-19 pandemic: lower limb functional and strength recovery in a young athlete affected by cutaneous melanoma

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Purpose: Adapted physical activity (APA) can improve psychophysical wellbeing and quality of life (QoL) in cancer survivors, a vulnerable population requiring a global management, especially during the recent pandemic. On this basis, we investigated for the first time the impact of a tailored APA intervention on a 18-year-old female athlete affected by melanoma in counteracting treatment sequelae and promoting lower limb functional and strength recovery.

Methods: The young competitive volleyball player was evaluated at baseline and post-protocol by a test battery focusing on mobility, muscle strength measured by dynamometry, and lower limb girths assessed at specific anatomical points. Moreover, health-related QoL, depression/anxiety, psychological distress and pain intensity were evaluated by FACT-M, HADS, distress thermometer, and NRS questionnaires, respectively. APA protocol, conceived as a symmetric total body training, was designed as a mixed supervised and self-administered session program focused on subject specific needs, aiming to promote autonomy, self-efficacy, body consciousness, and training environment safety.

Results: An almost doubled up increase in lower limb strength, along with hip mobility improvement, and post-surgical edema and pain reduction were observed following the protocol. Concerning the QoL assessment, although depression state worsened, an improvement in physical and emotional wellbeing was detected post-intervention.

Conclusions: Our findings show that a specialist-supervised structured APA protocol based on a patient-centered multidisciplinary approach may represent an effective strategy to recover functional and psychophysical efficiency, thus promoting a quickly return to daily life activities and offering a concrete chance of resuming competitive sport practice.

Three-dimensional modeling of an Achilles tendon rupture in a professional football Player

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Purpose: Achilles tendon rupture (ATR) is a rare but serious injury in football [1], inducing long lay-off times and serious concerns on returning to preinjury level. While in other football medicine domains knowledge on injury mechanisms has enormously grown in last decades [2], there is a lack of studies on ATR in football; focused case reports can firstly provide quantitative evidence on the injury mechanism. This study reconstructs the ATR injury occurred to Italy's 28-years-old left back Leonardo Spinazzola during the last UEFA Championship.

Methods: Videos of the game (Belgium vs. Italy, July 2, 2021) were deinterlaced and converted to uncompressed images (3840 × 2160 pixel); 9 keyframes (left/right touch-downs and push-offs) were obtained from four distinct views from 680 ms before to 640 ms after the left ground contact (lasting 100 ms) preceding injury.

A photogrammetric technique known as model-based image matching [3] was used to reconstruct the 3D joints kinematics within Blender (v. 2.90). A 39-segments rigged full-body skeleton model with a hierarchical structure was scaled based on the subject's height (1.86 m) and weight (75 kg) in the calibrated 3D space. At each keyframe, the model was matched with the camera views, taking the pelvis as the parent segment. Bezier curves interpolated poses between keyframes.

Results: Before injury, the player was accelerating and changing direction towards the injured side with a cross-over cut technique. The trunk was flexed (10°–23°), inclined and rotated (12°–40°) towards the injured leg during the ground contact phase. The pelvis was anteriorly tilted and inclined towards the left side. The hip was gradually extended from weight acceptance (left touch down) to push-off and externally rotated. The knee was extended (knee flexion: 24°) and internally rotated. When approaching the ground, the ankle was abruptly dorsiflexed (angular velocity: 330°/s), externally rotated (15°) and pronated (10°).

Conclusions: Combining acceleration at speed with a cross-over cut, this injury highlights the traditionally overlooked multiplanar nature

of ATR biomechanics: besides the established sagittal-plane trauma mechanism, the mediolateral moment arm of the ground reaction forces could have played a decisive role to excessively increase the ankle joint moments.

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Physical activity in menopausal women: a European project for the prevention and treatment of osteoporosis/happy bones: the Italian experience

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Purpose: Osteoporosis (OA) is an increasingly widespread disease with serious consequences for people’s quality of life and represents a huge human, social and economic burden. Finding prevention strategies for this pathology remains a challenge for public health institutions. In terms of health policies and prevention of chronic diseases, being able to develop physical activity protocols in the workplace can represent a focal point in the prevention, treatment and management of these diseases and to encourage the general health of workers¹.

The primary objective of the Happy Bones Project was to evaluate the effects on strength and Bone Mass Density (BMD) of a well-structured protocol, built to prevent osteoporosis, proposed to postmenopausal sedentary women in their workplace; moreover, balance, functional abilities, and quality of life were assessed to understand the effect of the protocol on overall health. The secondary objective of the study was to evaluate the compliance and dropout of the participants.

Methods: 30 postmenopausal women workers were recruited at the University of Rome “Foro Italico” and divided into Intervention Group (IG n = 15), who performed a specific combined Physical Activity (PA) protocol, and Control Group (CG n = 15), who continued the daily routine. All participants before and after 6 months intervention, underwent sports medical evaluation, DEXA, functional assessment (i.e. Six Minutes Walking Test, 1RM tests on the four machines required by the protocol), body composition analysis and psychological evaluation/assessment (QoL questionnaire). The training protocol provided 72 lessons to perform in a period of 24 weeks. The program included home training (5 days a week) and supervised training (3 days a week) performed in the university facilities.

Results: IG showed significant improvements in 1 RM (Leg Press, +58.98%, $p < 0.001$; Leg Curl, +16.98 %, $p = 0.026$; Leg Extension, +24.17%, $p < 0.001$; Gluteus Machine, +27.82%, $p = 0.004$). Bone health parameters indicated higher positive trend in IG than CG. The results showed a good participation in the proposed activity evidencing a higher compliance than similar studies of PA in the workplace² and no dropout.

Conclusion: This study was able to mark a positive trend in bone health of postmenopausal women, improving the general health of the

participants and generating good compliance with the proposed workplace training protocol.

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Training monitoring and neural cardiovascular regulation: from patients to athletes

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Purpose: to summarize how exercise training affects neural CV regulation as assessed by spectral analysis of HRV in the continuum from cardiac patients to elite athletes.

Methods and Results: Aerobic training is known to improve HRV and baroreflex sensitivity (BRS) in cardiac patients. A still unanswered issue, is the optimal “dose” of exercise, to administer to achieve a safety improvement in neural regulation. To this aim, CHF patients underwent two formats of aerobic training: continuous (ACT) and interval training (AIT), with the dose of exercise in the 2 protocols, being equated by the individualized TRaining IMPulses (TRIMPi) methodology, which makes it possible to integrate both the volume and intensity of exercise, the “dose”, in a single term expressed in arbitrary units. HRV and BRS, as well as R-R interval (RRI), increased significantly with both training protocols and were significantly and very highly correlated to the dose of exercise with a second-order regression model, resembling a bell-shaped curve in ACT and an asymptotic-shaped curve in the AIT groups. Hence higher doses of exercise do not lead to greater improvements in HRV and BRS. Differently from cardiac patients, athletes’ objective is to perform training that could result in optimal physical performance and success in competitions. In world-class rowers we reported a switch from vagal to sympathetic predominance in CV autonomic modulation, on going from submaximal to peak training load, as indicated by the marked increase in the LF component of RRI and BP variability and the marked decrease in vagal indexes. This was associated with medals won at upcoming World competition. This prompted the hypothesis that spectral analysis (SA) of HRV could be employed as a simple and valuable tool to predict athletic achievements, expanding its use for practical purposes.

In a group of marathon runners all ANS parameters were significantly correlated to the dose of exercise with a second-order regression model, with reciprocal shapes for parasympathetic and sympathetic indicators: HF, BRS, and RRI resembled a bell-shaped curve with a minimum at the highest TRIMPi, whereas LF, LF/HF and LFsap resembled a U-shaped curve with a maximum at the highest training load. Notably, LF assessed at the last recording session was significantly and inversely correlated to the race-time at the nearing marathon: the higher the sympathetic indicator the less the time to complete the race. Hence, ANS adaptations to training are dose-related on an individual basis also in athletes, showing a progressive shift toward a sympathetic predominance as training load increases. LF of HRV could predict athletic achievement.

Conclusions: assessment of ANS regulation through SA of HRV could be highly useful for monitoring and planning training, with a fully non-invasive approach, finding application in both clinical and sport field.

Forced migration and sport a sociological analysis of the role of sport in the context of the ‘refugee crisis’

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Purpose: Particularly between 2015 and 2016, the so-called ‘refugee crisis’ affected many aspects of European society, including the sport system. Therefore, the research question: ‘What role does sport play in the context of the ‘refugee crisis’?’ is here assessed.

Methods: This eight years long research programme applied separately or jointly qualitative methods (interviews, observations and document analyses) for data collection concerning (1) mass media, (2) sport clubs, (3) refugee sites and (4) athletes with refugee background. The results of these four projects are connected through an overarching sociological analysis based on Luhmann’s systems theory.

Results:

- (1) In newspaper articles, the sport theme is deeply embedded in the discourse on the ‘refugee crisis’, but is not bound to its development.
- (2) The implementation of sport offers for refugees is particularly dependent on human resources and, when it comes to organising support for refugees, sports clubs display an unexpected dynamic and a high capacity to mobilise resources.
- (3) In the setting of refugee sites, sport plays a relevant role despite being a leisure activity; it is guided by multiple meanings that rely on the logics of sport, health and education; and it reinforces the division of roles between staff and refugees
- (4) Forced migration is a critical life event, which at many levels represents an obstacle to sport participation. However, cases of dropouts but also of successful sport careers could be identified.

Conclusions: Over time, sport assumed different roles during the ‘refugee crisis’; this event and the sport system influenced each other profoundly and reciprocally; this relationship echoes and reproduces broader social phenomena of inclusion and exclusion, which are deeply entangled with power. Sport mirrored both feelings of intense solidarity and hate, which alternated and coexisted during the ‘refugee crisis’. The overall adaptation of the sport system was energetic and positive. However, many actions were naive, superficial, strategic, selective and racialised. Both in the external and self-representations as well in the considered organisations, the role and potential of sport were widely over-estimated and romanticised. This could have positive implications because this over-optimism can foster action and ambition. Nevertheless, the existing but rather scarce potential of sport should be unleashed and optimised instead of being exaggerated and (self-) celebrated.

Talent identification and development in an English premiership rugby union club: the perspectives of players and coaches

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Purpose: The path towards the senior professional status in sport is affected by a multitude of factors. An abductive examination of the talent identification and development processes at an English Premiership Rugby Union (RU) club was undertaken. *Part one* of this study researched the perspectives on the selection and development processes of a group of senior academy male players (split in PG1: n = 4; PG2: n = 4), whereas *part two* explored the perceptions of one group of male coaches (CG: n = 7).

Methods: A total of three focus groups were used.

Results: Three main themes were identified by players and coaches: task constraints, performer constraints, and environmental constraints. Although athletes and coaches believed that performer constraints were highly impactful on players’ career in RU, there was an inconsistency surrounding the task, and environmental constraints. Although there was an indication that three common themes affect an athlete path, this preliminary study shows an imbalance in the understanding of some of the key factors perceived to be important for talent progression in the present rugby academy.

Conclusions: More research using similar exploration qualitative methods is recommended, meanwhile, practitioners could implement holistic strategies to improve the progression process in English RU academies.

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Quantitative evaluation of muscle and tendon mechanical proprieties in-vivo using the “ultrasound radio-frequency technique”

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Purpose: In this study, we utilized a novel Ultrasound Radio-Frequency Technique to investigate the transient changes in muscle and tendon mechanical properties during in-vivo isometric contractions.

Methods: Eleven healthy participants (39 ± 11 years, 77 ± 9 kg, 176 ± 6 cm) were asked to perform a series of voluntary fixed-end contractions (20, 40, 60, 80 and 100% of the MVC) of the knee extensors. All contractions were repeated twice: (i) to record, simultaneously, the force generated by the knee extensors (FKE), the EMG activity of the vastus lateralis (VL) and the VL ultrasound images; (ii) to record the patellar tendon (PT) ultrasound images. The ultrasound images were acquired with a real-time combination of the B-mode and RF-mode; the Nagakami transformation was applied to the RF-data after log-compression and signal envelope (Hilbert transformation) [1]. For each contraction we determined/calculated (besides FKE), the root-mean-square of the VL EMG signal (RMSVL) and the Nagakami parameters derived from VL (VLN) and PT (PTN) ultrasound images in the plateau region (1 s time window) of the force signal. RMSVL, VLN and PTN data were expected to increase with increasing FKE: these relationships were investigated in terms of within and between- subject effects.

Results: Between-subject correlations showed very strong positive (linear) correlations between FKE and RMSVL ($r = 0.99$), FKE and VLN ($r = 0.94$), FKE and PTN ($r = 0.91$). Similar results were observed for the within-subject correlations ($r = 0.95, 0.91$ and 0.89 ,

respectively). The Pearson's correlation coefficient of the FKE—PTN relationship was significantly higher when using a polynomial (instead of a linear) fitting ($r = 0.96$ and 0.97 for within-subject and between-subject effect, respectively).

Conclusions: The strong (linear) correlation between FKE and VLN suggests that the Nagakami parameters are sensitive to changes in muscle stiffness, which increases linearly as a function of contraction intensity [2]. The polynomial fitting that better explains the FKE-PTN relationship suggests that the Nagakami parameters are sensitive to changes in tendon stiffness, which increases in a similar manner as a function of contraction intensity [3]. These (preliminary) results suggest that the Ultrasound Radio-Frequency Technique could be a new tool to investigate muscle and tendon mechanics in vivo.

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Dietary supplement for esports: creatine loading protocol on cognitive performance in experienced video game players

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Purpose: This is the first study to explore the effects of creatine supplementation on cognitive performance in eSport players. From a bilateral perspective, gamers require improved cognitive function, and secondly, cellular energy homeostasis in the brain highly depends on the ATP/CK/PCr system. Using the Attention Network Test (ANT) our objective was to inspect the influence of oral Cr administration on cognitive performance—as it may be relevant in providing energy to the central nervous system (CNS).

Methods: Six healthy eSport players (25.6 ± 3.7 years and 26.1 ± 4.1 BMI) took part in a 2-week crossover pilot study. All participants were blinded to the supplement content, pre-packed in small plastic bags. Subjects consumed one dose of 12.5 g of glucose (Gl) powder in 150 ml of water every 4 h for one week—placebo week (Gl). They repeated the same protocol in the second week with additional 5 g of creatine monohydrate (CrM) to the package. Players performed ANT on three occasions: (1) at baseline, (2) after the first (Gl) week, (3) after the second (CrM) week. An experienced psychologist instructed subjects on how to perform the test and supervised every trial. Each of the primary attention constructs—alerting, orienting, and executive were used for the analysis of the study results. The authors checked the normality of the distribution using Shapiro Wilk test and non-parametric tests to analyze the data using the Statistical Package for Social Sciences (SPSS). Friedman's test was used to establish significant differences and the post-hoc Wilcoxon Signed Ranks test to inspect differences between the individual sample pairs.

Results: Analysis indicated that 7-days of CrM supplementation positively affected reaction time compared to baseline values ($p = 0.046$), where no changes were observed in the placebo group.

Other attention composites (alertness and orienting) were insignificant, except for executive attention where improvements in executive function increased after both loading phases—Gl and CrM ($p = 0.043$).

Conclusions: Results from this pilot trial indicate possible implications of CrM supplementation among eSport athletes since competitive video gaming implies higher brain cognitive function and fast response from the players. However, in order to give more credible results, further research with a larger sample size is required to confirm the positive influence of high Gl and CrM loading protocols on reaction time among eSport athletes.

Mental and neuromuscular aspects of fatigue induced by a simulated competition in elite world-class fencers

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Purpose: Limited data are available to characterize fatigue in fencing, despite being one of the first sports admitted to the Olympic Games. The available literature suggests that fatigue induced by fencing competition, lasting usually ~ 9 h, induces limited neuromuscular impairment associated with a high perceived effort¹. In this study, we explored the etiology of fatigue induced by a fencing competition in elite world-class fencers by investigating both mental and neuromuscular aspects.

Methods: Changes in countermovement jump height, knee-extensors maximal voluntary isometric torque, rate of torque development (RTD), voluntary activation, and contractile response to muscular electrical stimulation were measured in 29 world-class fencers of the French national federation (12 epee, 11 saber, 6 foil; 11 females) during 5-matches (separated by 20–45 min of recovery) simulated competitions. Perceived fatigue and effort were evaluated with 10-cm visual analog scales, and the perceived workload was assessed with the NASA-TLX questionnaire. Statistical analysis was carried out using linear mixed models.

Results: During the competition, maximal torque and RTD decreased by 1.6% ($P = 0.017$) and 2.4% ($P < 0.001$) per match, respectively. Perceived fatigue increased (12% per match), reaching similar values following all matches (time:match interaction, $P < 0.001$). Perceived effort increased during the matches (10% per time, $P < 0.001$) and the competition (3% per match, $P = 0.011$). NASA-TLX score for mental demand was the only item increasing over time (2% per match, $P = 0.024$). The high NASA-TLX scores for effort, mental demand, and perceived performance were even greater (all $P < 0.05$), and frustration was lower ($P < 0.001$), if fencers won the match.

Conclusions: The limited alteration in neuromuscular compared to mental parameters suggest that elite fencers can adequately cope with the physical but not mental aspects of fatigue imposed by the competition. Strategies and interventions aiming to counteract fatigue induced by the mental demand of fencing and to cope with the emotional state of losing a match could improve performance in fencing.

Acknowledgments: This study was supported by the French national research agency with a grant for the *programme d'Investissements d'avenir* [ref. ANR-20-STHP-005].

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Prediction of soccer players' fatigue: a machine learning approach

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Purpose: Predicting the state of fatigue in soccer players is useful to design training and optimise performance on match day. Therefore, the aim of this study was to explore, using a framework of big data analytics, the most important predictors of fatigue in a group of sub-elite soccer players using inexpensive and practical data monitoring tools.

Methods: Four sub-elite professional soccer teams took part in this study. Team 1 and 3 competed in the Italian professional third division (Serie C), while Team 2 and 4 competed in the fourth semi-professional Italian division (Serie D). Within an hour after the end of each training session or match, the players provided their session ratings of perceived exertion (sRPE) to quantify, together with training or match duration, the internal training load of the previous day, week (acute) and month (chronic). Moreover, every morning, the players filled the Wellness Questionnaire which includes subjective measures of fatigue, sleep quality, muscle soreness, stress and mood. Finally, some contextual factors, i.e. next match difficulty, score difference of the previous match, distance to previous match, and distance to next game, were also recorded. Machine learning models were trained and tested in order to assess their ability to predict the players' fatigue status of the next day.

Results: Machine learning models can accurately predict the players' fatigue (accuracy 79–84%) using practical and inexpensive training monitoring tools. Specifically, muscle soreness, sleep quality, mood, and stress predict ~48% of the fatigue state with training load variables accounting for ~10%. Contextual factors related to matches add a further ~15% to the prediction of the fatigue state.

Conclusions: Sport scientists and coaches can use this framework of big data analytics to simulate the effects of different training programs in order to maximize players' readiness and reduce the potential drops in performance associated with fatigue.

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Mindfulness-based strategies in athletes and recreationally active people: effects on perceived stress, psychobiosocial states and mindfulness levels

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Purpose: The mindfulness-based stress reduction (MBSR) programme is gaining increasing attention in sport and physical activity domains. This programme comprises three meditation practices: mindful yoga, body scan, and sitting meditation. In this study, we aimed to examine the effects of a dynamic (mindful yoga) strategy

and a static (a combination of body scan/sitting meditation) strategy on psychobiosocial states (PBS), perceived stress (PS) and mindfulness levels in athletes and recreationally active (RA) people.

Methods: Thirty-four participants (athletes = 18; RA participants = 16) were assigned to a dynamic intervention strategy, and other 34 (athletes = 19; RA participants = 15) were assigned to the static intervention strategy. Before the intervention, after the intervention and three weeks later, the Italian versions of the PBS scale, the PS scale and the Mindful Attention Awareness scale were administered. To assess changes in participants' functional and dysfunctional PBS, PS and mindfulness scores from pre- to post-intervention and at the follow-up, and examine the effect of the two intervention strategies, two mixed between-within repeated measure analyses of variance were performed.

Results: RM-(M)ANOVAs revealed that intervention strategies improved functional PBS, reduced PS and enhanced mindfulness levels in both athletes and RA participants after the intervention ($p < 0.001$, $\eta^2 = 0.605$). However, improved functional PBS after the intervention ($p < 0.001$; $d = 0.62$) and stable PS levels at follow-up ($p = 1$) were observed mainly in athletes.

Conclusions: The findings reinforce the view of the importance of the body as a means to improve emotional and health processes, and support the use of mindfulness strategies in sport to enhance individuals' well-being. On note, since the effects of the mindfulness strategies seem to be less impactful and enduring in RA participants, long-term programmes are recommended.

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Effects of physical exercise on pain after mastectomy

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Purpose: Post surgery pain can become chronic in a broad spectrum of conditions. In cancer patients, the level of pain intensity can be used in pain management as a subjective indicator to be assessed as "interference of pain in activities of daily living". Interference is a key biomarker for adequate pain therapy. Pain intensity and interference are both measured using questionnaires/scales such as the Numeric Rating Scale, Brief the Pain Inventory. 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 and asthenia, 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 and biomarkers of pain in breast cancer patients underwent mastectomy.

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 or 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 at times 0 (before surgery), 3 and 6 months after the intervention. At the same timepoints information on analgesic drugs consumption was collected and biomarkers of pain such as IL-6, IL-8, tumor necrosis factor alpha (TNF-alpha) and c-reactive protein (CRP) were measured in the blood of patients. Pain was assessed by verbal administration of the following questionnaires: Questionnaire DN4 (Douleur Neuropathique 4), Numeric rating Scale, Brief Inventory Pain. Physical activity was measured with IPAQ (International Physical Activity Questionnaire).

Results: preliminar results show that higher physical exercise level reduces intensity of pain and its interference with quality of life; at the same time, in women with more motor activity, blood level of inflammatory biomarkers associated with pain and analgesic drugs use, are reduced in comparison with women with minor motor activity and lower physical exercise level.

Conclusions: physical exercise seems to reduce pain intensity and interference of pain in daily activities together with inflammatory biomarkers of pain and analgesic drugs use.

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The wild BLU project: enhancement of territorial resources through the promotion of active lifestyles

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Purpose: Aim of the project was to assess the effects of a 5-day intensive hiking/trekking/climbing event known as ‘Wild Blu Sardinia’ on anthropometric, cardiometabolic and functional domains. This demanding itinerary is 58 km long divided into five 8-h stages.

Methods: 12 healthy volunteers were recruited: 6 post-menopausal women aged 51–60 years and 6 age-matched men. Inclusion criteria were being healthy, not sport professionals, experienced in trekking/hiking/climbing. To assess each domain, 2 days before the start of the trek, a comprehensive battery test was performed including cardiopulmonary fitness, body composition analysis, isokinetic dynamometry, stabilometry and jump performance, and muscle-joint flexibility tests. Cholesterol and triglycerides were also measured.

Energy expenditure was continuously monitored throughout the 5-day event by the actigraphy and accelerometers.

Results: Mean total energy expenditure for the 5-day trek was 10776 ± 2702 kcals for women and 12868 ± 2287, kcals for men. At post, significant reductions in suprailiac fold in women (– 34%; p = 0.016) and men (– 22%; p = 0.011) were found. Body composition data showed significant reductions in extracellular water (– 3.5%; p = 0.002), fat mass (– 12.2%; p = 0.037), with significant increases in intracellular water (+ 3.3%; p = 0.002), and fat-free mass (+ 3.5%; p = 0.037) in women, while appendicular skeletal muscle significantly increases in both sexes (women: + 4%; p = 0.04, men: + 2.5; p = 0.032). Significant decreases in cholesterol values (– 14.5%; p = 0.047), and increases in VO₂ peak (+ 14%; p = 0.012) were found only in women, while the basal metabolic rate significantly increased in both sexes (women: + 3.1%; p = 0.001, men: + 2.1%; p = 0.004). Regarding muscle strength, knee flexors of men were found to generate greater isometric strength (+ 8.2%; p = 0.017) explosive force, as tested by squat jump on a force platform, significantly increased in both sexes (women: + 5.9%; p = 0.045, men: + 4.6%; p = 0.04).

Conclusions: The 5-day ‘Wild Blue’ experience significantly modified most of the anthropometric, metabolic, and functional domains tested. This was particularly evident among women, who were found to benefit to a greater extent than men from this type of activity. Regarding total energy expenditure, 5 days of this moderate to vigorous activity are comparable to a 6-week program of jogging or to a 10–12-week program of brisk walking, both performed with 1-h sessions with a frequency of 3 times/week.

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Effects and persistence on mobility and functional recovery of a 3-month structured home-based walking program compared to walking advice in patients hospitalized for severe covid-19 disease. A one-year prospective pragmatic trial

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Purpose: This prospective pragmatic trial in Covid-19 patients after discharge from intensive care unit aims to study the long-term effects on exercise capacity and quality of life of a structured in-home exercise program compared to a traditional walking prescription

Methods: During 2021 we enrolled hospitalized Covid-19 patients with the following criteria: capacity to walk for at least 20 m; absence of clinical conditions contraindicating exercise. Patients, 3-month after the first positive swab (T0), were evaluated with 6-min walking test (6MWT), 30-s sit-to-stand test (30STS) and SF-12 questionnaire (physical and mental components summary scores, PCS-12 and MCS-12). After evaluation, all patients were proposed to perform a home-based progressively-increasing interval walking (walk-rest ratio 1:1) for 10 min per day [1–2], or to perform the physical activity recommended by the guidelines (20 min per 6-day a week at moderate intensity). Both programs lasted 3 months, and they were followed by the same outcome measures session (T1, 26 weeks and follow-up at T2, 52 weeks). Patients were therefore classified upon their choice into home-based exercise (HB) or usual care (UC) groups.

Results: Eighty-four patients were assessed at T0, and 69 of them ($M = 44$, aged = 65 ± 11 years) completed the 1-year follow up (HB group $n = 34$, UC $n = 35$). At baseline, no differences were noted for demographics, clinical characteristics or exercise capacity. The HB group executed 89% (range 75–100%) of the prescribed sessions, while UC group attended the 55% (range 21–88%) of walking appointments between T0 and T1. The mean walking time was 60 and 85 min respectively; no adverse events related to training were recorded.

At the end of the programs, and also at 1-year of follow up, the between-group comparison highlighted significant differences in favor of HB group compared to UC over the three timepoints T0-T1-T2 for the 6MWT (288–399–437 m vs 316–355–398 m; $p < 0.01$), for 30STS (10–12–14 reps vs 10–11–12 reps; $p = 0.048$) and for PCS-12 (40–49–48 vs 42–46–44; $p = 0.039$).

Conclusions: an in-home low-intensity progressively increasing walking program was more effective at improving mobility than unstructured walking in patients after Covid-19 infection with prolonged hospitalization. The benefits obtained after the 3-month home-based structured training were also maintained at 1-year follow up.

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Tension reduction and re-lengthening of muscle-tendon unit in young and old tibialis anterior

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Purpose: During an alternating movement of a joint, the inversion of the rotational component of the joint movement happens for the contraction of the agonist muscle, and for the relaxation/re-lengthening of the previously active muscle that is now being configured as antagonist. Gait can be considered as a global alternating movement resulting by the combination of several joints alternating flex-extension sequences with an ordered sequence of agonist and antagonist muscles contraction/relaxation. The aim of the work is to compare young and old muscle-tendon unit deactivation/re-lengthening process which can affect the biomechanics of a daily life crucial gesture such as gait.

Methods: The static contraction of tibialis anterior muscle of 20 young (Y) subjects (age 21–33 years old) and 20 older (O) adults (65–80 years old) was studied. A 3 s train of supra-maximal electrical stimulations (35 Hz) was delivered on tibialis anterior motor point while recording the output torque (T) and the muscle transverse dimensional variation, mirroring the re-lengthening process, thanks the laser detected surface mechano-myogram (MMG). During the relaxation phase a delay (D) can be observed between the end of the stimulation and the beginning of signals (T and MMG) decay: DT and DMMG. Using a 20 ms moving window along the collected signals during the off phase the maximum rates of torque and MMG reduction were calculated (RRT and RRMMG). These parameters were calculated also on the normalized signals (NRRT and NRRMMG).

Results: DT in O and Y was 51.35 ± 15.21 ms and 22.51 ± 5.92 ms, respectively ($p < 0.001$). DMMG in O and Y was 61.41 ± 18.42 ms and 27.38 ± 6.93 ms, respectively ($p < 0.001$). RRT in O and Y was -52.72 ± 32.12 Nm/s and 110.4 ± 45.56 Nm/s, respectively ($p < 0.001$). RRMMG in O and Y was -13.76 ± 6.54 mm/s and -24.47 ± 10.95 mm/s, respectively ($p < 0.001$). NRRT in O and Y was $-1026.26 \pm 267.76\%/s$ and $-1256.16 \pm 333.36\%/s$, respectively ($p = 0.02$). NRRMMG in O and Y was $-710.35 \pm 178.84\%/s$ and $-867.79\%/s \pm 148.67$, respectively ($p = 0.004$).

Conclusions: These functional data, easy to be obtained during the relaxation phase after static contraction, suggest that the reduction of the tension and the re-lengthening process take place later and slower in O vs Y and provide biomechanical evidences that may contribute to explain the longer gait phases and the reduction of the walking speed typical of the elderly subjects.

The effect of a submaximal incremental running test on post exercise hypotension in normotensive and non-normotensive subjects

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Purpose: Arterial blood pressure is strongly influenced by exercise modality and intensity in both normotensive and non-normotensive subjects. Exercise can also contribute to the temporary decrease in blood pressure during the post-exercise period, a phenomena known as post-exercise hypotension (PEH), with vigorous intensity exercises having higher effects. The aim is to investigate the PEH response following a submaximal incremental running test on a treadmill and to compare the decrease magnitude in normotensive and non-normotensive subjects.

Methods: 15 young individuals (female = 5; male = 10) aged 24.8 ± 2.8 years were allocated in 2 groups based on their pre-test systolic blood pressure (sBP). Group 1 included subjects with $sBP \leq 129$ mmHg, whereas group 2 those who had pre-test $sBP > 129$ mmHg. Subjects' sBP was measured 15-min before and 30-min after the test. Volunteers completed a familiarization session and, after 48-h, one submaximal incremental running test. The tests were carried out on a treadmill and consisted of a 3-min warm-up at 1% gradient, fixed for the entire duration of the test, at a comfortable speed. Afterwards, the speed was increased by 1 km/h every 2-min until the end point of the test determined by their 90% estimated heart rate max. Means and standard deviations of pre-test and post-test sBP were calculated for both groups. Repeated measures mixed models were performed to examine the effects of the submaximal test on subject's sBP. Subjects were considered the random effect, whereas the groups (1 Vs 2) and testing time (pre Vs post) were treated as the fixed effect. Statistical significance was set at $p < 0.05$.

Results: Statistically significant ($p < 0.05$) reductions in sBP after the submaximal incremental test were evident in both groups. Group 1 reached an average reduction in sBP of 7mmHg (pre = 117 ± 7 ; post = 110 ± 5), while Group 2 had an average reduction of 13mmHg (pre = 139 ± 13 ; post = 126 ± 6). PEH thus occurred independently of pre-test sBP levels. However, the magnitude of the effect was higher in Group 2 with respect to Group 1.

Conclusions: Exercises of short duration and vigorous intensity, such as submaximal running incremental test, would seem to induce PEH in normotensive subjects and changes of greater magnitude in non-normotensive subjects. The incremental submaximal running test can elicit PEH, and therefore can be used to promote sBP reductions, by simulating the antihypertensive action of medications.

Hike and enjoy! adults' perceptions of mountain hiking with kids: a mixed-method study design

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Purpose: Outdoor activities lead to increased environmental responsibility and benefits for practitioners (Palmberg & Kuru, 2000; Xiong et al., 2017). Kids in particular may benefit from outdoor activities more than other age groups (Cross et al., 2019) and adults play a fundamental role in facilitating or hindering these activities. The present study was conducted in the Italian Alpine region of South Tyrol, where despite mountain hiking is a common outdoor activity, there is still the need to facilitate and increase children's participation. **Methods:** A mixed-method design was adopted. In a first qualitative part, 25 participants (40% men) took part in semi-structured interviews (60-90 min). The sample included professional (56%) and volunteer hikers (44%), the interviews focused on participants' experience with mountain hiking and their opinion about benefits and risks of such activity for kids. The second quantitative part of the study was built upon results from the first part, 202 Primary School Sciences university students (6.4% men), including Italian (n = 124), German (n = 61), and Ladin (n = 17) speaking participants, completed a questionnaire investigating frequency of mountain hikes, perceived enjoyment (PACES; Carraro et al., 2011), and benefits and risks for kids.

Results: Thematic analysis allowed identifying enjoyment as a common reason for practicing mountain hiking for both professionals and volunteers. Well-being, school competences, autonomy and social competences emerged as potential benefits for kids, with limited risks associated to well-organised hikes. Correlation analysis on quantitative data showed individual's hiking enjoyment to be positively associated with the belief that mountain hikes can be beneficial for kids and negatively associated with perceived risks for kids. Minimal differences (Mann-Whitney U Test) emerged between the Italian, German and Ladin culture groups, in terms of benefits and risks for kids. The Italian group reported to hike less frequently than the German/Ladin group (p = 0.001).

Conclusions: Results confirmed the hypothesis that the possibility for children to experience mountain hiking is strictly associated to adults' personal experience of such activity, so that searching and testing effective strategies to intervene on significant adults' (e.g. teachers) perceived emotions, beliefs and attitudes could represent a right strategy to increase kids' possibilities for regular hiking, to make this activity more available for more children.

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Walking training for people with Parkinson's disease: effects of different intensities

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Parkinson's disease (PD) is characterized by the dysfunction or death of dopamine-producing neurons, and physical exercise can reduce the progression of PD, reduce the amount of medication consumed, and

increases the effectiveness of the dopaminergic medication, as well as the gait, postural control, and mobility. However, it is still too much debate on which type of exercise, volume, and mainly the most adequate exercise intensity since the intensity may be the key factor for this population. Conventionally, due to the patient's difficulty in reporting their perceived exertion, the exercise for people with PD does not present an effective effort control, asking the elderly with PD that performs as much as possible. Load control during intervention with physical exercise is extremely important, even more in a heterogeneous disease like to DP. Thus, it is expected that an exercise with intensity control (i.e., at a target intensity) has an effect positive when compared to an exercise with self-determined intensity (i.e., non-target intensity).

Purpose: The objective of the present study was to compare the effects of target training (TT) and non-target training (NT) for people with PD. **Methods:** Ten patients (71 ± 7 yrs; height of 162 ± 9.0 cm; weight of 68.5 ± 14.0 Kg) complete the crossover randomized controlled clinical trial, composed of 8 weeks of training (6 patients TT and 4 NT), 3 weeks of rest, and other 8 weeks of training (4 patients TT and 6 NT). The TT group walked at the critical heart rate (CHR) speed, while the NT was self-determined intensity. Before and after each training period, the assessments included clinical characterization (MMSS, UPDRS-II, and UPDRS-III), functional parameters (Sit-to-stand, TUG, and six minutes walking test), and CHR determination. **Results:** The ANCOVA demonstrated significant group effects for MMSE (p = 0.017), without order effect (p = 0.817). No significant effects of the group (p > 0.783) or order (p > 0.763) were observed for UPDRS- II, UPDRS-III, functional assessments (p > 0.664), and CHR (p > 0.535). Pooled data revealed that the 30s sit-to-stand test improved regardless of the training stimuli. **Conclusions:** In conclusion, the TT was superior to NTG to improve the MMSE values and the resistance to the strength of lower limbs was increased regardless of the walking intensity.

Do trail running poles really “save the legs” walking uphill?

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Purpose: In sky and trail running competitions, many athletes use poles. It is reported that pole walking (PW) on steep incline improves the performance without affecting metabolic parameters. Authors reported that during PW plantar pressure decreases compared to conventional walking (W). However, it is not clear why performance was improved by using poles. Therefore, the aim of this study was to measure the force exerted through the poles (PF) and the force exerted on the feet (FF) at different inclines on the treadmill and on a mountain trail when poles were used or not. We hypothesized that PF would increase by increasing incline and that FF would be lower when athletes used the poles.

Methods: 15 trail runners participated in the study (age: 36.8 ± 6.8 years; maximal oxygen consumption: 62.7 ± 8.9 ml/kg/min). They completed four tests on different days. On the first two days, they performed two incremental tests on a treadmill, one day with poles (PWincr) and one day without poles (Wincr). On the following days, they performed submaximal (PW80 and W80) and maximal tests (PWmax and Wmax) outdoors, with and without poles on a trail course (350 m length, 150 m elevation gain, 23.2° average incline). We measured metabolic and biomechanical parameters. To determine

differences between conditions and intensities, we applied a 2-way ANOVA.

Results: In the treadmill test, we found no differences in maximal cardiorespiratory parameters and in vertical velocity achieved between PWincr and Wincr. Foot cycle time and foot contact time were lower in Wincr compared to PWincr ($p = 0.005$ and $p = 0.004$, respectively). Poling cycle time decreased by increasing the slope ($p = 0.002$) whereas PF and the duty cycle increased ($p < 0.001$). When athletes used poles, FF decreased, both on treadmill ($-2.4 \pm 3.3\%$) and outdoors ($-5.21 \pm 5.51\%$). The decrease in FF was correlated with the force applied to poles ($r^2 = 0.28$, $p < 0.0001$). Vertical velocity was faster at PWmax than at Wmax ($p = 0.025$).

Conclusions: We found that PF increased with increasing the slope and FF decreased when athletes used poles, under all conditions. The decrease in FF correlates with the PF, suggesting that more force is applied on poles, less force is expressed by lower limbs. During PWmax FF was $\sim 5\%$ lower when subjects used poles whereas it was $\sim 3\%$ lower in PW80 compared to W80. The use of poles leads to a reduction in FF probably because of higher involvement of the upper limbs. Thus, it is reasonable to sustain that the poles “save legs” during uphill walking at different intensities.

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Performance predictors in short trail running races: is there a role of sex?

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Purpose: The study aimed to assess the role of physiological variables (i.e. VO₂max and VO₂ at ventilatory thresholds and movement economy (running/steep uphill walking)), but also strength and anthropometric factors, in determining male (M) and female (F) short trail running performance.

Methods: A total of 57 trail-runners (14 F) participated for this study. During race season, each runner underwent a laboratory-based assessment to determine (1) VO₂max and ventilatory thresholds (VT1, VT2) through an inclined incremental treadmill test (25%); (2) level running economy (RE1%) and uphill walking economy on a + 25% slope (WE + 25%); (3) MVC force and RFD of knee and elbow extensors; and (4) anthropometric characteristics. Considering race results in very short races (XXS-ITRA SCORE = 0; mean 17 km, 1200 m D +), and short races (XS-ITRA SCORE = 1; mean 29 km, 1950 m D +), 11 F and 10 M and 9 F and 11 M matched by relative race performance¹ were considered for XXS and XS, respectively. Correlations and multiple linear regression analysis were used to find the determinants of performance for both sexes in each race distance.

Results: Average performance time was 124 ± 31 min and 151 ± 25 min ($p = 0.04$) in XXS and 226 ± 55 min and 250 ± 46 min in XS ($p = 0.3$) for M and F, respectively. Pearson correlations showed that VO₂max and VO₂ (relative to body mass, mL/kg/min) at ventilatory thresholds were linked to performance for both XXS and XS races in M and F. Age was associated with XXS and XS performance only in F (FXXS: $r = 0.65$, $p = 0.032$, FXS: $r = 0.68$, $p = 0.046$), and body

fat percentage was linked to performance only in F and XS races (FXS: $r = 0.87$, $p = 0.002$). Subsequent multiple regression analysis revealed that XXS performance was explained by VO₂max for both sexes (Adj $R^2 = 0.81$, $p < 0.001$ and Adj $R^2 = 0.74$, $p = 0.004$ in M and F, respectively). XS performance was determined by VO₂VT1 and WE + 25% in F (Adj $R^2 = 0.943$, $p = 0.001$), while VO₂VT2 was the only predictor for XS performance in M (Adj $R^2 = 0.87$, $p < 0.001$).

Conclusions: VO₂max remains the strongest predictor for XXS races for both sexes. XS performance is predicted by different physiological variables in men and women, and especially for the latter gait-specific testing procedures should be considered to better characterize short trail running performance.

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In memory of professor arsenio veicsteinas: aerobic fitness in female paralympic athletes with a locomotor impairment

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Purpose: To investigate cardiovascular health and aerobic fitness (oxygen uptake peak—VO₂peak) of female Paralympic athletes (FPA) competing in sports with different energy expenditure (EE).

Methods: Forty-seven FPA with a locomotor impairment and different health conditions -HC (31 with a spinal cord injury, 1 with spina bifida and 15 with other HC, e.g. lower limb amputation and poliomyelitis, etc.), selected to compete in 6 following Paralympic Games were submitted to the health and fitness evaluations (HFE) carried out in Rome (Institute of Sports Medicine and Sciences) on the basis of the agreements among Italian Paralympic Committee, Italian Olympic Committee and Sapienza, University of Rome. Data from the HFE were retrospectively analysed. The HFE included: 1) a comprehensive maximal incremental cardiopulmonary exercise test (CPET) carried out with an arm cranking ergometer with pulmonary, metabolic and electrocardiographic monitoring to assess VO₂peak; 2) two-dimensional and doppler echocardiography to assess end-diastolic and end-systolic left ventricular (LV) cavity dimensions, anterior ventricular septal and posterior free-wall thicknesses and to calculate LV mass also indexed to body surface area (LVM/BSA). The 47 FPA were divided into 2 groups (G) depending on the EE of the practiced sport. G1 included 35 FPA competing in lower EE sports (table tennis, fencing, archery, field events in athletics and alpine skiing). G2 included 12 FPA competing in higher EE sports (sitting nordic skiing, long distance track events in athletics and swimming).

Results: VO₂peak (mL/kg/min) measured in the FPA of G2 (39.04 ± 16.52) was significantly higher than that measured in FPA of G1 (24.1 ± 1.35). No difference was found in the LVM/BSA (g/m²) of the FPA of the 2 groups, 74.7 ± 15.17 vs 78.4 ± 9.62 , respectively in G1 and in G2.

Conclusions: VO₂peak, the synthetic parameter of the body’s overall ability to take in oxygen from the external environment, transport it in the body and have it utilised by working muscles, as well known, is determined by the maximal cardiac output (cardiac, central

adaptations) and the maximal arterious-venous difference of the oxygen. The differences in VO₂peak between the FPA competing in endurance sports are presumably determined by peripheral adaptations.

OP1—Impact of online physical activity combined with functional bars on CKD patients: a pilot study

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Purpose: Chronic kidney disease (CKD) is a public health problem because it is characterized by several comorbidities, including uremic sarcopenia, which affects quality of life and increases the risk of cardiovascular mortality¹. Literature data suggest that regular and adapted physical activity (APA), combined with dietetic- nutritional treatments are effective to counteract CKD progression and comorbidities². This pilot study aims to evaluate the potential beneficial effects of APA protocol, performed online for 12 weeks, combined with functional bars on the physical capacity and other related-CKD comorbidities.

Methods: 21 CKD patients, aged 62.7±5 years, were randomized into four groups: (A) Online APA protocol (3 sessions per week, lasting 1 h each) combined with daily intake of 2 antioxidant and anti-inflammatory functional bars, based on powders and micronized plant species, including kiwi, *Vitis vinifera* L. and *Olea europaea* L.; (B) Only online APA protocol; (C) daily consumption of the two functional bars; (D) Usual Care. Physical capacity (Short Physical Battery, Six Minute Walking Test, Handgrip), body composition (BIA), m. quadriceps femoris thickness, and laboratory parameters were evaluated at baseline (T0) and after 12 weeks (T1).

Results: At the end of the study (T1), Six Minute Walking Test reported an increase of walking distance, in Group A and C. BIA analysis showed a higher Fat Free Mass (%) and a decreased Fat Mass (%) in Group A and B. The thickness of the m. quadriceps femoris showed an increasing trend, particularly in groups A, B and C. We observed an improvement of blood pressure levels and lipid metabolism in A and B groups where APA was included, whereas Group D showed a significant increase in creatinine and azotemia values.

Conclusions: These preliminary data seem to confirm the effectiveness of APA and the additive role of the natural bioactive compound's assumption to improve physical capacity and other comorbidities in CKD patients. Further studies are needed to confirm these data.

Acknowledgments: (non obbligatorio).

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OP1—Road to TOKYO 2021: sleep characteristics, napping behavior and sleep hygiene strategies in Italian Olympic- level track and field athletes

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Purpose: The aim of this field-based retrospective study is (1) to assess sleep characteristics and napping behavior and (2) to evaluate the effect of sleep hygiene strategies on sleep behavior of Italian track and field athletes competing at the Olympic Games of Tokyo 2021

Methods: Sixteen athletes (mean age: 25.3 ± 2.8; n = 8 females; n = 8 males) filled in the Morningness–Eveningness Questionnaire (MEQ) and the Pittsburgh Sleep Quality Index (PSQI) and their sleep and napping characteristics were monitored by actigraphy (Actiwatch Spectrum, Philips Respironics, USA) and sleep diaries during a 3-weeks pre-season period (baseline). Following the baseline assessment and after one-on-one sleep education sessions, athletes adopted personalized sleep hygiene strategies (SHS) for three consecutive weeks. SHS to optimize sleep included approaches for expanding total sleep duration, reducing sleep onset latency and improving sleep environment. Athletes' sleep was assessed again at the end of the SHS period. A total of 702 nights were analyzed (baseline: 425 and SHS: 277) and the following sleep parameters were analyzed: Sleep Efficiency (SE), Total Sleep Time (TST), Fragmentation Index (FI), Wake After Sleep Onset (WASO), Sleep Latency (SL), Bedtime (BT) and Wakeup Time (WT). Given a non-normal distribution for all parameters, baseline differences between genders and sport disciplines were checked with the Wilcoxon signed-rank test and the Mann-Whitney test was performed to detect possible differences in sleep parameters between baseline and SHS.

Results: Male athletes registered delayed BT (p = 0.027) and worse SE (p = 0.003), TST (p = 0.029) and SL (p < 0.001) than females. Endurance athletes had higher MEQ scores (p < 0.001), early BT (p < 0.001) and WT (p < 0.001) than sprinters or jumpers. No PSQI differences were observed. Napping was a common practice among athletes: 281 naps were recorded with nap duration ranging from 12 to 98 min. Further, significant differences were observed between baseline and SHS in SE (87.8 ± 7.1% vs 90.6 ± 6.6%; p = 0.014), TST (429.2 ± 59.5 min vs 451.4 ± 61.1 min; p < 0.001), FI (23.3 ± 13.5% vs 29.2 ± 14.0%; p < 0.001) and SL (14.3 ± 20.9 min vs 10.7 ± 17.0 min; p = 0.016) whereas no differences were detected in WASO.

Conclusions: As expected, a high inter- and intra-individual variability in the athletes' sleep characteristics was observed. SHS had beneficial effects on athletes' sleep.

OP1—Large sided games and high intensity exercise in professional soccer players

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Purpose: Soccer is a high intensity intermittent exercise that is characterized by high-intensity activities (Haycraft et al., 2017). The use of Global Positioning Software (GPS) technology to measure

players' training loads has become prevalent in professional soccer (Wehbe et al., 2014). The technical staff use GPS to quantify specific sport exercises and to evaluate the high intensity training load. 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 intensity through external load deriving from LSG exercises during the 4vs4 and 5vs5 formats, with goalkeepers.

Methods: 22 professional soccer players (average age: 22.72 ± 3.57 years, weight: 76.4 ± 8.2 kg; height: 181.6 ± 5.4 cm). During the two LSG exercises, the players were monitored using GPS tool at 18.18 Hz (GPEXE@SYSTEM, EXELIO srl, Udine, Italy). The external load variables detected and examined are: peak speed (km/h), peak acc (m/s^2), peak dec (m/s^2), distance traveled in sprint (> 25.2 km/h). The LSG were carried out on a natural grass playing field. The 4vs4 + 2 goalkeepers format were performed on a field 60×54 m (324 m²/player) while the 5vs5 + 2 goalkeepers on 65×60 m (325 m²/player). After the warm-up, players began with LSG exercises: 4 sets of 5 min each (2 min passive recovery between each set).

Results: The speed peak ($p < 0.05$) and the sprint distance ($p < 0.005$) are greater and significant during 5vs5. The deceleration peak is also higher in the 5vs5 while the acceleration peak is higher in the 4vs4 although not significant.

Conclusions: From the analysis of the data, it emerges, how both exercises can be useful to be able to train the high intensity even if the format of the 5vs5 manages to obtain even higher speeds than the 4vs4. Instead, observing the values relating to accelerations and decelerations, it is evident that the two observed formats impose the same neuromuscular load.

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OP1—Wearable inertial sensors in swimming kinematics: intra-cyclic analysis of stroke, breath, and kick timing during front-crawl

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Purpose: Swimming performance is strictly related to the synergic action among the different body segments. In front-crawl, upper and lower limb kinematics was individually investigated using wearable inertial sensors, but a combined technique has not been explored. Therefore, the aim of the current research was to propose a comprehensive timing analysis of stroking, kicking, and breathing through an integrated approach. We supposed that IMU technologies would allow sufficient accuracy for the purpose; a comparison of timing

features collected by video analysis (TLC) was used to test our hypothesis.

Methods: Twelve male swimmers were randomly recruited for the study. The participants performed a single trial of 100 m front-crawl swimming at self-selected velocity. Comparative statistics were used to calculate differences between IMU and TLC for the following stroke temporal events (*t*): wrists entries into the water (tWRIST); kicks downbeats (tLEG); face exit (tHEADexit) and face entry (tHEADentry) from/into the water for breathing. The 3D acceleration and the 3D angular velocity were acquired using five triaxial IMUs (Cometa, Milano, Italy) fixed to the occipital zone, above the styloids and to the shanks. Specific algorithms were developed to detect *ts* through the kinematic variables, and the relative values within each stroke cycle ($t\% = [t/tstroke] * 100$) were used for timing analysis. The same *ts* identified by means 2D photogrammetric technique (one sagittal moving camera) were assumed as the gold standard.

Results: High reliabilities of each technique were provided by CVs (less than 0.209 s and 0.204 s for IMU and TLC, respectively) and TEMs (less than 0.240 s and 0.232 s for IMU and TLC respectively). All *ts* calculated by IMU produced reasonably accurate estimates. RMSEs and 90th percentile of AEs were less than 0.1% and 1.8% of the stroke cycle duration, except the critical values for tHEADexit (0.7 and 8.0%, respectively). Bland–Altman analyses presented a bias less than 0.5% (LoA ranged from -2.3 to 2.5%) except tHEADexit (bias = 4.1%; LoA = -3.1 to 11.2%).

Conclusions: The proposed protocol offers a stroke-by-stroke analysis of the swimming kinematics using an ecological and user-friendly setting. The results of comparative statistics suggest sufficient accuracy and reliability for temporal events detection in front crawl.

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OP1—Positive outcomes of physical activity practice in breast cancer patients: an umbrella review

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Purpose: Breast cancer patients and survivors are increasing in number such as their mean age. The increased age could comport the risk to present the presence of different comorbidities making important a proper intervention. Physical activity practice could be a feasible and positive complementary intervention to improve physical, psychological and social health, and decrease some disease symptoms. Consequently, the objective of the present umbrella review was to (1) analyze the studies published on this topic in which physical activity was adopted in breast cancer patients analyzing the effects of the intervention and (2) to analyze the protocols of different physical activity interventions and to eventually propose a standard operating procedure for possible exercise training in breast cancer patients.

Methods: Systematic review and meta-analysis of randomized controlled trials were searched on the electronic databases PubMed, Web of Science, and Scopus till 25 March 2022. A selection of the studies on the inclusion / exclusion criteria was adopted. The screened studies were analyzed narratively and evaluated with a scale to assess their quality.

Results: The studies presented heterogeneity in their population included in terms of disease stage and treatments; intervention protocols and outcomes evaluated making it difficult to synthesize the findings. Generally, physical activity interventions improve the physical (especially cardiovascular health), psychological (improve the quality of life and reduce cancer-related fatigue, anxiety and depression) and social wellness (in terms of relationships) of breast cancer survivors.

Conclusions: Physical activity intervention is useful for the improvement of the physical, mental and social spheres. A standard operating procedure was also proposed: combined training (aerobic and resistance training) with a component of a mindfulness intervention, with a moderate to high intensity, 3 times a week. The intervention should be supervised in the first period and then it could be home-based. Exercise training should be personalized to the patients treated.

Acknowledgments: (non obbligatorio).

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OP1—The impact of combined training program on physical and psychological side effects in cancer patients

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Purpose: Cancer patients bring with them physiological and psychological side effects and physical activity is emerging as a major tool to improve their quality of life and survival. Therefore, the purpose of this study was to investigate the effect of 8-week combined training program on perceived fatigue, lower back flexibility, balance and task-specific functional mobility in cancer patients.

Methods: Twenty participants (50.6 ± 16.1 years) were pair-matched based on age and then randomly assigned to an experimental group (n = 10) that performed a progressive training of cardiorespiratory, resistance, flexibility and postural education exercises (~ 60 min, 2d-wk-1), or a wait-list control group (n = 10). Measures pre-intervention and post-intervention included psychological and physiological measurements.

Results: After intervention, significant improvements (p < 0.01) were detected in experimental group for the perceived fatigue, trunk lateral flexibility test (right and left sides), stork balance stand test (right and left sides) and 30 s chair stand test.

Conclusions: Findings suggest that combined training program may improve physical fitness and reduce perceived fatigue in cancer patients providing important support to deal with physiological and psychological side effects. In addition, this combined approach may prevent physical inactivity, muscle wasting, and loss of energy in special populations.

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OP1—Psychological effects of rapid weight loss in judo athletes: a systematic review and meta-analysis

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Purpose: Rapid weight loss (RWL) is known to induce physiological perturbations and performance decrements in judo athletes, but less is known about the psychological impact of RWL in judo athletes.

Methods: PubMed, ESBSCOhost and Web of Science were searched for studies assessing mood via Profile of Mood States (POMS) questionnaire during RWL in judo athletes. Only original studies published in English in peer-reviewed journals were considered. Meta-analysis was performed to determine the overall effect sizes.

Results: Six studies were included in study present study. Overall, studies have showed that RWL lead to decreases in vigour, while noticeable increases in confusion and anger were noticed in both genders. In addition, both males and females showed significant increases in tension, depression, fatigue and total mood disturbance compared to controls.

Conclusions: Although these effects are transient, repetitive RWL cycles might lead to long-term psychological damage in judo athletes. Therefore, carefully and individually tailored RWL procedures should be implemented in order to prioritize of an athlete’s health and safety.

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OP1—Glucose control in adults with type 1 diabetes: hatha yoga versus aerobic cycling

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Purpose: Despite the well-known benefits of regular exercise in individuals with type 1 diabetes (T1D), most of them are not physically active due to the fear of hypoglycaemia. Therefore, understanding the effects of different aerobic exercises on glycaemic control and hypoglycaemic episodes plays a fundamental role. This study gives insight into the acute effects of Aerobic Cycling (AC) versus Hatha Yoga (HY) on glycaemia in individuals with T1D.

Methods: Fifteen participants (3 F, 12 M) with T1D (mean age: 36.7 ± 9.2 years; mean VO₂max: 34.5 ± 7.7 ml/kg/min) performed in a randomized order 50 min of two different aerobic exercises. AC protocol was performed on a cycle ergometer pedalling at 50 rpm at an intensity corresponding to 40.7 ± 5.4% of Heart Rate Reserve (HRR). The intensity of the HY lesson was 15.9 ± 9.9 of %HRR. Participants' glucose values and HR were constantly monitored and collected using continuous glucose monitoring system, and a standard HR monitor.

Results: Glucose values were significantly lower immediately post exercise then pre exercise in both protocols (AC: 178 ± 41 pre vs. 125 ± 52 post mg/dL, $p < 0.001$; HY: 170 ± 48 pre vs 146 ± 41 post mg/dL, $p = 0.014$). Five participants experienced low glucose values (< 70 mg/dL) during and/or after AC, while only 1 participant after HY. The percentage of glucose values > 180 mg/dL, expressed as Time Above Range (TAR), was significantly reduced ($p = 0.01$) in AC at 1 h (− 45 ± 48%) and 2 h (− 40 ± 48%) post exercise, while in HY at 1 h (− 39 ± 52%, $p = 0.01$), 2 h (− 33 ± 48%, $p = 0.04$), and 3 h (− 21 ± 38%, $p = 0.04$) post exercise. In the AC protocol, glucose variability (GV) was significantly higher at 3 h and 6 h interval than pre-exercise ($p = 0.04$ and $p = 0.05$, respectively), and higher than HY ($p = 0.05$) at the 3 h interval post-exercise. No significant differences in GV between pre and after HY protocol were found.

Conclusions: AC and HY significantly reduce glucose levels in acute condition in adults with T1D. HY has a safer profile than AC in terms of low glucose events and glucose variability during and after exercise.

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OP1—Whole body-electromyostimulation superimposed to exercise of Parkinson's patients: effect on growth factors, α -synuclein, motor performances and fatigue

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Purpose: Whole-Body Electromyostimulation (WB-EMS) could be a suitable training method for Parkinson's disease (PD) patients, unable or unwilling to adhere to conventional exercise programmes.

Electromyostimulation, altering the physiological recruitment patterns, favours the activation of fast motor units in addition to the slow ones, and entails advantage especially for elderly people. Aim of this randomised controlled study was to find the most suitable and effective WB-EMS training protocol for this population

Methods: Twenty-four subjects (age 72.08 ± 6.07) were randomly assigned to three groups: High Frequency WB-EMS strength training group (HFG), Low Frequency WB-EMS rowing training group (LFG), and inactive control group (CG). Serum neurotrophins (BDNF, FGF21, NGF), α -synuclein, physical performances and Parkinson's Disease Fatigue Scale (PFS-16) were assessed and analysed to evaluate variation over time and among groups.

Results: The analysis showed a significant difference over time in FGF-21 ($p = 0.015$) with no differences among groups. The comparisons of delta (post–pre) showed that LFG and HFG had a conservative effect on BDNF compared with CG that showed a significant reduction over-time. LFG and HFG induced an opposite effect on α -Synuclein that significantly decreased in LFG, whereas increased in HFG. Concerning the physical performance tests, LFG and HFG obtained significant improvements compared with CG, and LFG obtained better results than HFG. LFG and HFG improved PFS-16 scores compared with CG, and LFG obtained better results compared with HFG ($p < 0.05$).

Conclusions: These results could emphasize the strong effect of our protocols nevertheless, the aerobic based-intervention with low frequency WB-EMS stimulation resulted to be the best choice in improving or containing the physical performance and fatigue of PD patients. In agreement with previous data, we also noticed large variability in the changes of the studied variables, making it difficult to detect anytime significant changes. The WB-EMS addition, allows PD patients to reduce their time of weekly exercise. Moreover WB-EMS training is conducted in an individualized setting, crucial component for achieving results, considering the high heterogeneity of PD patients. WB-EMS efficacy is related to the abilities of a skilled trainer who monitors progression, offers feedbacks and encouragements motivating PD people, checking their condition so as to reject health risks.

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References: (non obbligatorio).

OP1—Effects of parmigiano reggiano cheese on muscle damage induced by eccentric exercise in healthy young and older adults

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Purpose: Eccentric exercise (ECC) is a model of resistance training that can be safely used with older adults, especially because it allows to produce greater amount of strength with a low energy cost. However, ECC cause greater muscle damage, which can impede daily activities, increase risk of falls, and discourage retraining. Apart from modulating the training progression to reduce this unseemly effect, several studies have tried to identify nutritional interventions that could help to relieve soreness and accelerate strength recovery. Parmigiano Reggiano (PR) is rich in bioactive peptide sequences and short chain fatty acids, which make it an excellent candidate to assist the recovery post exercise. The aim of this study is to investigate the effect of PR on acute response to ECC in older adults.

Methods: The study was designed as a cross-over study. Eight older adults (65.5 ± 4.3 years) and 8 young adults (23.3 ± 2.3 years) were randomized to receive a daily dose of either Parmigiano Reggiano (PR; 50 g/day) or whey protein (WP; 15 g/day) for 15 consecutive days with 10 days of wash-out between the interventions. An ECC leg extension protocol was performed on day 11 of each intervention. Muscle voluntary contraction (MVC) and soreness (DOMS) together with markers of cellular damage (i.e. CPK, Cholesterol, LDL) were assessed before and 48, 72 and 120 h after performing the exercise.

Results: In young adults, MVC significantly decreased at 48 h ($p = 0.01$) and DOMS were significantly higher compared to baseline ($p = 0.002$) with both supplements; however, MVC recovery was quicker with PR compared to WP ($p = 0.004$). Cholesterol and LDL significantly decreased with WP but were kept constant with PR ($p = 0.02$). Similarly, in older adults MVC significantly decreased at 48 h and DOMS were significantly higher compared to baseline, but MVC recovery ($p = 0.003$) and DOMS attenuations ($p = 0.03$) were quicker with PR. Cholesterol and LDL decreased during both interventions, but the reduction was less with PR ($p = 0.02$). Moreover, the rise of CPK following exercise was attenuated with PR supplementation compared to WP ($p = 0.04$).

Conclusions: The consumption of Parmigiano Reggiano helps to improve recovery after an intense exercise in both young and older adults, although the effects seem less pronounced than the young adults. Importantly, 10 days of daily supplementation of Parmigiano Reggiano do not increase blood cholesterol or other lipoproteins in healthy older adult.

OP1—A national COVID-19 survey on the return to play characteristics in Italian elite athletes: implications and recommendations

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Purpose: The spread of the SARS-CoV-2 continues to be a public health emergency with a huge impact on sports. Several complications can also occur and must be carefully monitored. Aim was to investigate the side effect during and after illness in a sample of elite athletes diversifying them by the severity of the symptomatology and the type of sport and their influence on their return to play.

Methods: Three web-based questionnaires were administered using censuses of the National Sports Federations; an informative questionnaire drawn up by the authors, General Health Questionnaire-12' and Fatigue Severity Scale. Data were collected from 204 self-selected athletes (age 24.96 ± 9.82). The sample will be analysed according to the variant of the virus was contracted (delta and omicron), the severity of the infection (mild, medium and severe), the symptoms (respiratory system, musculoskeletal system, both and none) and by type of sport (power and endurance).

Results: The prevalence of COVID-19 infection among athletes appear to be asymptomatic (18%) or have mild symptoms (42%). Only 2% have contracted the infection in severe form. Respiratory problems affected 33%, muscles skeletal problems 25%, and 24% both the two previous problems. 18% of the participants declared no consequences on health. Significant differences were found for

technical level, where high level athletes showed more fatigue than low level ($p = 0.030$). Regarding fatigue perception there are significant differences between males and females ($p < 0.001$) and depending on the infection severity: those who have had severe form have greater fatigue than those who have had mild form ($p = 0.011$) and those with moderate form have more fatigue than mild form ($p = 0.013$). Regarding the sport typology the athletes practicing alternating aerobic anaerobic sport more frequently reported health problems during the return to play (45%). Regarding the quality of life perception, significant differences between males and females ($p = 0.006$) and regarding the infection severity ($p = 0.016$).

Conclusions: The impact of the virus on the interviewed athletes resulted in mild or moderate suggesting that sport may have a protective effect. The most common symptom was the fatigue perception which was more severe in relation to the type of sport. The results of the survey may provide knowledge for coaches to better understand the course of COVID-19 among different athletes in order to individualize the planning of the training.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP1—Comparison between water running and water cycling

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Purpose: Water exercises offer a low-impact variety of movements on every axis. The selection of an appropriate physical activity and an individual exercise prescription are essential to obtain health and fitness outcomes.¹ The aim of the present study was to determine individualised relative exercise intensities at four speeds of motion (rhythms) for water cycling and running.

Methods: Fourteen active, apparently healthy females (23.2 ± 1.6 years) underwent a dry land maximal incremental protocol to exhaustion on a treadmill for VO₂max assessment; then they engaged in water running with ground contact (RC), water running suspended (RS) and hydrobike (HB) tests in a swimming pool at the rhythms of 30, 40, 50, and 60 cpm, submerged at the individual xiphoid level. Gas exchanges (VO₂), heart rate (HR), and blood lactate (bLa) were measured at each rhythm, for each exercise mode.

Results: Maximal treadmill tests results were 2621.3 ± 240.7 ml·min⁻¹, 45.4 ± 5.4 ml·kg⁻¹·min⁻¹ for VO₂max, 196.8 ± 10.6 bpm for HR max and 10.4 ± 0.9 mM·l⁻¹ for La peak. The four motion speeds of the three water exercise modalities ranged from 50 to 95% of maximal HR and VO₂, representing a moderate-to-vigorous training stimulus. RS compared to RC and HB elicited the significantly lowest VO₂, ($22\text{--}33$ ml·kg⁻¹·min⁻¹) at all exercise intensities, while bLa ($3\text{--}5$ mM·l⁻¹) and HR ($138\text{--}150$ bpm) were significantly lowest at 50 and 60 cpm only. HB compared to RC and RS presented the significantly highest VO₂ ($25\text{--}38$ ml·kg⁻¹·min⁻¹) and non-significantly highest bLa ($2.2\text{--}7$ mM·l⁻¹), reaching vigorous intensity at 50 cpm and near maximal intensity at 60 cpm.

Conclusions: Since RS running does not have fixed points to push from, subjects have more options for individualised motion amplitudes in comparison to HB.² Water running, offers the possibility for all the participants to regulate their individual metabolic requirement for each rhythm of exercise and could offer an effective practice for controlled physiological responses in heterogeneous groups. As HB elicits high VO₂ and bLa levels, it may be an exercise indicated for

athletes' training, whereas HS and HC could be more appropriate for health and fitness purposes.

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OP1—The European experts' views on the implementation of dual career policies and provisions at higher education institutions

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Purpose: To establish a convergence of European higher education institution (HEI) experts' opinion on possible implementation of dual career (DC) policies and provision at the university level as the last phase of a 'Delphi' multistage consensus method within the European partnership “More Than Gold” (MTG, 603346-EPP-1- 2018-1-LV-SPO-SCP).

Methods: Following previous Delphi phases encompassing focus groups with university student-athletes (SA) and a workshop with 21 European DC experts (Capranica et al., 2022), an online survey was administered to 71 HEI experts from 12 Member States, who rated the relevance and the feasibility of 32 DC items by mean of a 10-point Likert scale (lowest value = 1; highest value = 10). Then, a go-zone plot identified the most relevant and feasible DC policies and provisions to be implemented at the university level.

Results: The highest relevance and feasibility scores emerged for nine items, four belonging to the assistance/tutorship category (i.e., tutorship/mentorship; psychological support; integration of academic and sports services; and DC programmes adapted to the individual needs SAs), two to curricula requirements category (i.e., individual study plans; and distance learning), two belonging to the social support category (i.e., increased awareness/publicity of the enrolled SAs; and improved DC knowledge), and one belonging to the logistic support category (i.e., access to educational facilities).

Conclusion: Based on a phenomenological lifeworld-led approach, the present findings could be useful to inform practical directions for the implementation of DC policies and provisions at HEI level based on an expert's consensus. The present findings emphasize the current quest for DC progress and reinforce the need for a minimum standard for DC policies and provisions. In this respect, the MTG Team developed the Guidelines to Promote the Dual Career of Athletes-Students: Methodology for Universities and Manual for Authorities,

which are available at the European ERASMUS+ platform (<https://erasmusplus.ec.europa.eu/projects/search/details/603346-EPP-1-2018-1-LV-SPO-SCP>).

Reference: Capranica et al. 2022. <https://doi.org/10.1371/journal.pone.0264175>.

OP1—Promote multidisciplinary interventions to reduce work-related musculoskeletal disorders: adapted physical activity for employee at ergonomic high-risk for biomechanical overloads

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Purpose: Work-related musculoskeletal disorders (WRMDs) are injuries and/or dysfunctions affecting human musculoskeletal system, which has been demonstrated to have a causal relationship with physical exertion and psychosocial factors at work. Handling of low loads at high frequency (repetitive work) can cause pain and fatigue, which could lead to musculoskeletal disorders, reduced productivity, and deteriorated posture and movement co-ordination. From a socioeconomic perspective, WRMDs are cause of productivity losses and disability, and they imply considerable costs to the healthcare system. Adapted physical activity are able to reduce pain, reducing the relative workload via range of motion improvement. The aim of this study was to evaluate the effect of structured resistance and stretching exercises on physical fitness and pain of upper limb.

Methods: Sixteen women employed as packagers (age: 48.69 ± 5.88 years old; Check- list OCRA > 11) were recruited to participate to a 14 weeks work-based resistance and stretching program. Physical fitness was measured via the 2-min step test (2MST), the bask scratch test and the handgrip test (HG). To evaluate the level of pain in cervical spine, shoulder, elbow and wrist the Visual Analogue Scale (VAS) was used. Differences were verified with t-test. Physical exercise protocol consisted on 24 sessions of resistance and stretching exercise program, performed 2 times per week and lasting 60 min.

Results: After exercise intervention VAS score showed toward reduction, but only cervical spine (p = 0.02) and left wrist (p = 0.04) VAS decreased significantly. Handgrip strength increased significantly for both right (p = 0.01) and left (p = 0.01) hands, such as 2MST (p = 0.01). Participants who reported WRMDs in cervical spine experienced more symptoms than who did not at baseline; contrarily upper limb VAS did not differ between the two groups at the baseline. Moreover, the presence of WRMDs did not influence performance parameters at baseline, neither the change between baseline and post-training of all the variables considered.

Conclusions: The protocol improved the physical fitness of participants but showed a limited effect on WRMDs pain. The mean adherence was 86.2%, indicated that exercise performed in workplace is well accepted and could be proposed for pain management.

OP1—VALIDITY OF ISOINERTIAL RUFFIER TEST TO ASSESS CARDIORESPIRATORY FITNESS IN HEALTHY INDIVIDUALS

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Purpose: The aim of this study is to develop a modified version of the Ruffier test using an isoinertial machine to assess cardiorespiratory fitness with 10 squats in 15 seconds. The Ruffier test is a submaximal squatting test valid to estimate the maximal oxygen uptake; it consists of 30 squats in 45 seconds, which may result challenging for inexperienced subjects [1].

Methods: The classic and the isoinertial Ruffier tests were administered to thirty-five healthy young adults (20 men and 15 women), age 22.06 ± 2.13 years, BMI 23.87 ± 2.74

Results: The two one-sided test confirmed the comparability of the isoinertial Ruffier test with its classic version within equivalence bounds of ± 3.7257 . Sex, age, body weight, the difference between peak heart rate after isoinertial squatting and resting heart rate, and isoinertial Ruffier index were the coefficients of our best VO₂max prediction model with an adjusted R^2 of 0.937, sensitivity of 0.89, and specificity of 0.81.

Conclusions: This study evidenced the validity of the isoinertial Ruffier test to measure the cardiorespiratory fitness of healthy individuals through a short and safe squatting test easy to perform in fitness centers and primary healthcare clinics.

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OP1—Physical activity in residential care facilities and its effect on the health-related quality of life of the residents. Results from two Italian regions

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Purpose: Entry into residential care facilities (RCFs) represents one of the most sensitive events of older adult life, influencing their psycho-physical balance affecting their health-related quality of life (HrQoL). For these persons it is essential to maintain autonomy, a physical and mental health, and social inclusion, that is possible using a multidisciplinary approach. The World Health Organization (WHO) recommends for older adults to perform 150 min of moderate-intensity physical activity (PA) per week, or at least 75 min with a focus on mobility and balance 3 or more days per week. The study aim was to investigate differences on HrQoL on the basis of the frequency and the method of PA proposed within RCFs.

Methods: Six RCFs were included in the study, belonging to Marche or Emilia Romagna Regions (Italy). The PA performed in the RCFs was divided in individual and group lessons organized and managed by a kinesiologist. HrQoL was assessed through the Short-Form 12 questionnaire (SF-12). We performed statistical analyses to evaluate the impact of PA on Mental and Physical Component Scores of SF12 (MCS and PCS) of the participants.

Results: We enrolled 89 older adults (age: 84.33 ± 8.36 , 78.7% women). The MCS mean score was 47.32 ± 10.19 and the PCS score was 43.15 ± 9.00 . Only the 27% of participants ($n = 24$) performed 2 or more sessions of individual PA, the majority of the sample did not participate in individual sessions. In consideration of group activity, the 36.0% ($n = 32$) performed 3 or more sessions in a week.

Considering the HrQoL score, we obtained a general improvement of MCS from who carried out more group activity (> 2) than in those who practiced less (< 2 group PA: MCS = 43.68 ± 10.08 vs ≥ 2 group PA: MCS = 48.91 ± 9.90 , $p = 0.03$). Considering the individual PA, we obtained a trend of improvement of MCS (< 2 individual PA: MCS = 45.66 ± 9.21 vs ≥ 2 individual PA: MCS = 48.95 ± 10.92 , $p = \text{NS}$). On the contrary the PCS score remained unchanged based on PA frequency and modality.

Conclusions: These results suggest that in general group activity in these RCFs was offered more frequently than individual activity. Group activity had a beneficial effect on residents' mental well-being while for physical score we did not obtain significant results. The next steps of the study foresee the inclusion of the kinesiologist in RCFs that do not provide this professional figure and the increase of the PA especially individual one, where lacking.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP1—Injury incidence, injury burden, and movement quality in young elite soccer players: a seasonal prospective study

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Purpose: Maturation may have substantial effects on movement quality, which would result low or high in relation to an individual's age at peak height velocity (APHV) (Portas et al., 2016). Considering that the way an individual moves can affect the risk of injury, there needs to provide additional and extended knowledge on injury-related representative data along with movement quality in youth soccer. The aim of the present study was to examine the injury incidence rate (IR), injury incidence burden (IB), and movement quality in young elite soccer players during a competitive season.

Methods: One-hundred and forty-three soccer players voluntarily participated in the study and located into five groups: under-13 (U13, $n = 26$), under-14 (U14, $n = 41$), under-15 (U15, $n = 28$), under-16 (U16, $n = 26$), and under-17 (U17, $n = 22$). Total IR and IB were computed for each group. Maturity offset (MO) was derived by a somatic equation at pre, mid and at the end of the season and used to separate pre/circa ($\text{MO} < 1$) from post pubertal ($\text{MO} > 1$) participants by average values. Movement quality was assessed by the Functional Movement ScreenTM (FMS) for each time point. A cut-off score of 13 was adopted to detect "low" (≤ 13) and "high" (> 13) quality performers.

Results: IR (injuries per 1000 h) and IB (days absent per 1000 h) were 3.78 and 44.57 for U13, 3.27 and 32.23 for U14, 3.00 and 40.17 for U15, 2.69 and 38.25 for U16, and 3.67 and 45.93 for U17, respectively. FMS average score tended to increase in all groups across the season. Specifically, U13 and U17 exhibited the lowest and highest score, respectively. By controlling for APHV, FMS did not show any significant difference among the age-categories. Players with $\text{MO} < 1$ presented significantly higher frequent distribution in fractures & bones injuries ($p = 0.041$, $\phi = 0.16$) and lower joint & ligament injuries ($p = 0.015$, $\phi = 0.19$) than players with $\text{MO} > 1$. Players with FMS score ≤ 13 presented significantly higher frequent

distribution in fractures & bones injuries ($p = 0.034$, $\phi=0.17$) than players with FMS score >13 .

Conclusions: Practitioners should be aware about their athletes' maturation and level of movement quality due to the different injury distribution across the season. Of note, U13 and U17 would benefit from specific recommendations to implement injury prevention strategies aimed to mitigate IR and IB.

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OP1—Effects of age and training prescription on the acute responses to training in young Italian rugby union players

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Purpose: To understand the moderating effect of age on the acute responses to two different training prescriptions in young rugby union players.

Methods: We measured the acute responses to High Intensity Training (HI) and Low Intensity Training (LI) in three groups (U15 $n = 8$, U17 $n = 10$ and U19 $n = 9$) of young Italian rugby players. HI training consisted of breakdown and wrestling activity alternating with aerobic power exercise, with small-sided games at the end, while training LI consisted entirely of small-sided games with non-contact for technical and tactical objectives, both ninety minutes total. The two training workouts were part of the normal weekly training routine. The following validated questionnaires were used to monitor the acute training effects: Rating of Perceived Effort scale (RPE), Total Quality Recovery scale (TQR), Main and Grove (MG) questionnaire that monitors training distress in athletes, Fatigue (FAT) and Fatigability (FAB) scales. Repeated measure analysis of variance (2×3 ANOVA) was used to analyze RPE, FAT and FAB with respect to age and training type, while a $2 \times 2 \times 3$ mixed ANOVA was used for MG and TQR questionnaires to further analyze the interactions of time, age and training type. All post hoc analyses were performed following the Bonferroni correction procedure, setting the significance at a p value < 0.05 .

Results: Perceived effort in the U17 group was statistically different for both conditions, while in the U19 group was just near to the threshold. FAT and FAB scales results are statistically different for both conditions only in the U17 group. Only the Physical Symptoms variable of the MG questionnaire resulted statistically different for both conditions, in the U19 group.

Conclusions: The RPE, FAT and FAB scales can detect the difference in intensity between HI and LI training for the U17 group, while only the Physical symptoms variable of the MG was found to be statistically sensitive to different training intensity, for the U19 group. The Training Monitoring strategy used in the present research represents a valid approach to control training sessions and training recovery in young rugby union teams.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP1—Physical activity, its proximal determinants and related motivational factors in physical education in a sample of Italian students: results from the PE4MOVE project

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Purpose: Physical inactivity among youths is a public health issue, and national and international policies recommend the promotion of an active lifestyle. Physical education (PE) is a fundamental context where to promote positive behavioural changes among children and adolescents, in particular with regards to physical activity (PA). The purpose of this paper is to present PA levels and factors related to PA practice in a sample of Italian students.

Methods: At the beginning of the 2021/22 school year, lower and upper secondary school students ($N = 5307$) were recruited in the Marche Region, Italy, within the PE4MOVE project (Carraro et al., 2022). Participants were invited to fill in an online questionnaire package assessing different variables. In this paper gender, school type, PA levels, intrinsic motivation in PE and enjoyment in PE (psychological variables), self-monitoring, action planning and social support (behavioural variables) were measured. Bivariate correlations were performed to observe the relationships among the considered variables. Three 2×2 (gender \times school type) ANOVAs and one MANOVA were run to observe differences by gender and school level.

Results: The survey was completed by 4572 students (boys 47.7%, lower secondary school 46.5%). Positive correlations emerged between PA levels and intrinsic motivation ($r = .2$, $p < .01$), and between PA levels and enjoyment in PE ($r = .2$, $p < .01$). Similarly, PA levels were correlated with self-monitoring ($r = .6$, $p < .01$), action planning ($r = .5$, $p < .01$), and support ($r = .4$, $p < .01$). ANOVAs showed boys to practice more PA ($p < .001$) and experience more enjoyment ($p < .001$) and intrinsic motivation ($p < .001$) than girls. Lower secondary school students reported higher values on these variables than upper secondary school students. Additionally, a significant interaction emerged between gender and school type ($p < .05$). MANOVA highlighted similar differences by gender and school type in terms of self-monitoring, action planning and social support.

Conclusions: Findings from the present investigation highlight a gender gap and a decline of PA levels with age, confirming trends emerged in previous studies among children and adolescents (Papaioannou et al., 2020; Rohan et al., 2016). Results also suggest psychological and behavioural variables to have a relationship with PA levels, thus suggesting including these factors when developing interventions aimed at promoting PA in the youth population.

OP1—Determining voluntary activation in synergistic muscles: a novel mechanomyographic approach

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Purpose: Drawing on correlations between the mechanomyographic (MMG) and the force signal, we devised a novel approach based on

MMG signal analysis to detect voluntary activation (VA) of the synergistic superficial heads of the quadriceps muscle. We hypothesized that, after a fatiguing exercise, the changes in the evoked MMG signal of each quadriceps head would correlate with the changes in the level of VA in the whole quadriceps.

Methods: Twenty-five men underwent a unilateral single-leg quadriceps exercise to failure. Before and after exercise, VA was assessed by interpolated-twitch technique via nerve stimulation during and after maximum voluntary contraction (MVC). The force and MMG signal were recorded from vastus lateralis, vastus medialis, and rectus femoris. The MMG peak-to-peak was calculated and the voluntary activation index (VA_{MMG}), defined as the superimposed/potentiated MMG peak-to-peak ratio, was determined from the MMG signal for each head.

Results: VA_{MMG} presented a very high intraclass correlation coefficient (0.981–0.998) and sensitivity (MDC_{95%}: 0.42–6.97%). MVC and VA were decreased after exercise in both the exercising [MVC: –17(5)%, ES –0.92; VA: –7(3)%, ES –1.90] and the contralateral limb [MVC: –9(4)%, ES –0.48; VA: –4(1)%, ES –1.51]. VA_{MMG} was decreased in

both the exercising [\sim –9(6)%, ES –1.77] and contralateral limb [\sim –3(2)%, ES –0.57], with a greater decrease in VA_{MMG} noted only in the vastus medialis of the exercising limb. Moderate-to-very high correlations were found between VA_{MMG} and VA (R-range: 0.503–0.886) before and after exercise.

Conclusions: VA_{MMG} may be implemented to assess VA and provide further information when multiple synergistic muscle heads are involved in fatiguing exercises.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP1—Changes in postural control during the barbell back squat at different load intensities in powerlifters and weightlifters

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Purpose: In powerlifting and weightlifting, performance not only depends on power but also on the technique of athletes. Successful Barbell Back Squat (BBS) attempt has been also related to the displacement of the barbell that is related to the displacement of the Center of Pressure (CoP) of athletes. Although many studies have investigated postural control in powerlifters and weightlifters, no research have studied postural control outcomes during the execution of the BBS. This study aimed to explore postural control during the BBS at different load intensities in powerlifters and weightlifters.

Methods: For this cross-sectional study, 17 powerlifters and weightlifters (12 male, 5 female) were recruited. To be included participants had: (1) to engage at least 2 years in powerlifting / weightlifting; (2) at least a frequency of 3 workouts / week; (3) at least a relative strength of 1.5 of their body weight. Each participant performed 5 trials of a single-repetition BBS with load intensity of 60%, 70%, 80%, 90%, and 100% of the 1RM, respectively. All tests were performed on a posturographic platform in order to measure the displacement of the CoP during the execution of the BBS. The evaluated parameters were the following: sway path length (mm), sway ellipse area (mm²), sway mean speed (mm/s), CoP coordinates along X and Y planes.

Results: One-way repeated measures ANOVA showed a significant increase in sway path length as load intensity increased ($p < 0.0001$) and a significant decrease in sway mean speed as load intensity increased ($p < 0.01$). Tukey's multiple comparisons test showed significant differences in sway path length between BBS at 60% and 80% ($p < 0.01$), 60% and 90% ($p < 0.0001$) and 60% and 100% ($p < 0.0001$); between BBS at 70% and 90% ($p < 0.01$), and 70% and 100% ($p < 0.0001$); between BBS at 80% and 100% ($p < 0.01$); and between BBS at 90% and 100% ($p < 0.001$). As for the sway mean speed, Tukey's multiple comparisons test detected significant differences between BBS at 60% and 80% ($p < 0.05$), and at 60% and 90% ($p < 0.01$).

Conclusions: Our study revealed a different CoP displacement during the BBS at different load intensities with sway path length increasing and sway mean speed decreasing as load intensity increases. These findings suggest that increased exertion could affect postural control during BBS and therefore that postural control could be considered a factor for a successful BBS.

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OP2—The role of passive stiffness in determining voluntary activation: a novel mechanomyographic approach

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Purpose: Voluntary activation determined by interpolation-twitch technique (VA) could be affected by the characteristics of the in-series elastic components. To overcome this possible bias, a novel approach based on the mechanomyographic (MMG) signal to detect voluntary activation ($VAMMG$) has been recently proposed. We examined the changes in VA and $VAMMG$ after passive stretching to check the influence of neural and mechanical factors in the force output.

Methods: Twenty-six healthy men underwent an assessment of VA using the interpolated-twitch technique before and after (i) a passive stretching bout of the plantar flexors (five 45 s-on + 15 s-off; total stretching time, 225 s), or (ii) no stretching. In addition to the force signal, the MMG signal was detected on *gastrocnemius medialis*, *gastrocnemius lateralis*, and *soleus*. From the force and the MMG signal analysis, VA and $VAMMG$ were calculated. The MMG root mean square (RMS), mean frequency (MF), and the muscle-tendon complex passive stiffness were also defined.

Results: Passive stretching increased dorsiflexion [+18(10)% ($P < 0.001$, ES: 1.54)] and MMG RMS [+17(5)% ($P < 0.001$; ES: 1.10/1.23)], whereas it reduced MVC [–15(7)% ($P < 0.001$, ES: –0.87)], VA [–7(3)% ($P < 0.001$; ES: –2.32)], $VAMMG$ [–5(2)% ($P < 0.001$; ES: –1.26/–1.14)], MMG MF [–16(5)% ($P < 0.001$; ES: –1.31/–1.00)], and MTC stiffness [–22(8)% ($P < 0.001$; ES: –1.75)]. No change occurred in control. The stretch-induced changes in VA correlated with $VAMMG$ (R : 0.412/0.518) and with MTC stiffness (R : 0.503).

Conclusions: VA output is overall influenced by both neural and mechanical factors, not distinguishable using the interpolated-twitch technique. VAMMG is an alternative index to examine the changes in VA not influenced by mechanical factors.

Acknowledgments: (non obbligatorio).

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OP2—Correlation between nutritional habits, physical activity and bone mineral density in post-menopausal women: a retrospective observational study

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Purpose: Osteoporosis is a chronic metabolic syndrome, affecting both men and women, associated with debilitating consequences that represents one of the major non-communicable diseases and the most common bone illness¹. The aim of this observational study is to assess the relationship between the amount of physical activity, the nutritional intake, and the bone mineral density (BMD) in a group of postmenopausal women involved in a sedentary job².

Methods: Thirty postmenopausal women were recruited for the study. All women underwent a medical evaluation, a body impedance analysis to evaluate body composition (in particular fat mass, fat free mass, and body cell mass), and a dual-energy X-ray absorptiometry to analyse bone mineral density. Additionally, the 3-day food record questionnaire was utilized to assess their daily foods and beverages assumptions, as well as the International Physical Activity Questionnaire (IPAQ) to evaluate their physical activity level. Pearson correlation coefficient was used to evaluate the correlation between subjects' variables and BMD at both vertebral and femoral sites.

Results: IPAQ scores evidenced that most of the subjects perform a moderate activity. The 3-day food record analysis showed an inadequate calcium and vitamin D assumption compared to the recommended level. Positive correlation was found between phosphorus intake and femoral BMD, femoral T-score, and femoral Z-score ($p < 0.05$). A similar positive correlation was found between phosphorus intake and femoral neck BMD, femoral neck T-score, and femoral neck Z-score ($p < 0.01$). Moreover, BMD seemed to improve when level of leisure-time, domestic and transport activities are higher.

Conclusions: These preliminary data on the relationship among physical activity level, nutritional intake and onset of BMD in menopausal women employed in sedentary job need to be confirmed by subsequent studies on larger samples; however, it seems that menopausal women could counteract age-related BMD loss by introducing exercise and balanced diet into their lifestyle.

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OP2—Resistance training for resistant bones: how to slow bone mineral density loss in Parkinson's disease

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Purpose: This paper aimed to detect the effects of specific resistance training on bone metabolism and neuromuscular performance in people with Parkinson's disease (PD).

Methods: 13 subjects (age 64.83 ± 5.70) with the PD diagnosis were considered in our study. Neuromuscular battery tests, cervical ROM, body composition, and bone metabolism markers (from blood sample analysis) were analyzed before and after 11 weeks (T1) of training. The scores of the tests of our Neuromuscular battery are related to the risk of falls, dystonia, rigidity, and daily living functions [1–5] often impaired in PD. The training protocol was triweekly for 90 min with a progressively increased intensity.

Results: The results showed significant improvements in the Neuromuscular performance in the Timed up and Go ($p < 0.01$); Sit to stand ($p < 0.01$); dominant peg-board ($p < 0.05$); Dominant foot-reaction time ($p < 0.01$) and Functional reach ($p < 0.01$) tests. As regards, the static analysis we got a better pressure feet distribution after 11 weeks with the 40% of the weight load in the Left forefoot ($p \leq 0.01$) and the 60% of the load in the Left hindfoot ($p \leq 0.01$); The cervical ROM has improved significantly ($p < 0.05$) the right lateral bending angle. The blood sample analysis underlined statistically significant changes in the formations markers the osteocalcin ($p \leq 0.01$) and calcium concentration ($p < 0.01$) significant increase; the reabsorption markers PTH ($p < 0.01$) and the CTX ($p < 0.01$) increased significantly but the vitamin D decreased significantly ($p < 0.05$). This balanced increased activation of bone turnover is confirmed by the strong positive correlation between CTX and osteocalcin at T1 ($r = 0.73$, $p < 0.01$) markers of bone resorption and bone formation, respectively. No changes were found in the body composition analysis, this could be considered a positive result because the progression of PD is often associated with sarcopenia [6] and we have no reduction in free fat mass.

Conclusions: 11 weeks of resistance training improve manual dexterity, static and dynamic balance, reaction time, and cervical ROM with a consequent possible reduction in risk of falls, rigidity, and the improvement of daily living functions. In addition, this training

appears to slow the bone mineral density loss typical of PD by balancing the bone turnover. Therefore, resistance exercise could help drug therapy to reduce the side consequences of Parkinson's disease.

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OP2—Strength of quadriceps and hamstring muscles in adolescent and adult recreational athletes 6 months after anterior cruciate ligament reconstruction

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Purpose: The incidence of anterior cruciate ligament (ACL) injuries in the skeletally immature population has grown recently [1]. Whether the recovery progress of these patients is different from that of adults is however still unclear, making it difficult to define specialized return to sport criteria. The progress in motor recovery in ACL-injured patients is often evaluated in terms of quadriceps and hamstrings muscle strength using isokinetic tests [2]. Here we compare the outcomes of these tests between adolescent and adult patients after ACL reconstruction (ALCR).

Methods: Fifty-five adolescents (13–18 years old) and 76 adults (19–39 years old) who underwent ACLR with bone-patellar tendon-bone (BPTB), performed isokinetic tests 6 months after surgery. The outcomes of these tests were: (1) the maximum torque produced by hamstrings (H) and quadriceps (Q) muscles (i.e. muscle strength) during flexion and extension movements at 30°/s normalized by body weight; (2) the ratio of hamstrings to quadriceps strength (HQ ratio); (3) the ratio of muscles strength in the injured to the uninjured leg (limb-symmetry, LSI). Mixed models with repeated measures were used to compare the outcomes between adolescents and adults, and between legs within patients.

Results: Both adults and adolescents produced lower torque with the injured than with the uninjured leg using the quadriceps (Δ adolescents: -0.5 ± 0.8 Nm/kg; Δ adults: -0.8 ± 0.9 Nm/kg; $p < 0.001$), but similar torques using the hamstrings muscles (Δ adolescents: -0.1 ± 0.6 Nm/kg; Δ adults: -0.1 ± 0.6 Nm/kg; $p = 1$). In adolescents the torque produced with the quadriceps of the injured leg was higher than in adults ($p < 0.05$). As a result, in both populations the quadriceps LSI was lower than the hamstring LSI ($p < 0.001$). Yet, quadriceps LSI of adolescents was higher than that of adults ($p < 0.001$), with no significant difference between populations in hamstring LSI ($p = 1$). The HQ ratio in the injured leg was significantly higher than in the uninjured leg in both populations (adolescents: 0.66 ± 0.13 vs 0.53 ± 0.07 ; adults: 0.74 ± 0.15 vs 0.53 ± 0.08 ; $p < 0.05$). However, in adolescents this measure was lower than in adults for the injured ($p < 0.001$) but not the uninjured leg ($p = 1$).

Conclusions: There were significant differences in the recovery of muscle strengths in adolescents and adults. Since the hamstrings are synergistic and the quadriceps are antagonist to the ACL [3], the lower HQ ratio in adolescents suggests that in these patients the reconstructed ligament may be subject to higher loads than in adults 6 months after surgery. Adolescents may need a longer period of rehabilitation before returning to sport.

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OP2—Effects of gender on perceived possess and relevance of sport management competencies and skills: insights from the newmiracle project

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Purpose: As part of the EU's efforts to enhance gender equality in sport, the NewMiracle Project was funded to provide women with the necessary tools to succeed as sport managers. Hence, this study examined sport managers perceived possess and relevance of a set of knowledge, competencies, and skills (i.e., NewMiracle Card: NM-C) with respect to their gender.

Methods: Fifty-three Italian young sport management students (gender: 41.5% female, 58.5% male; age: 30.6 ± 9.2 yr; academic level: 34% Bachelor, 58.5% Master's Degree, 7.5% Other) voluntarily responded to an online anonymous questionnaire based on the NM-C, ranking 44 items divided in 5 clusters (Competencies (C, $n = 4$); Hard Skills (HS, $n = 3$); Specific Knowledge (SK, $n = 9$); Soft Skills (SS, $n = 10$); Additional Features (AF, $n = 18$)) on a 1-5 Likert Scale in relation to their perceived level of possess (P) and relevance (R). Descriptive and non-parametric inferential ($p \leq 0.05$) statistics have been computed. Furthermore, a bivariate go-zone plot was used to show the relationship between the mean ratings of the possess and relevance.

Results: Independently from gender, a general perceived higher R (range = 3.9–4.1pt) with respect to the P (range = 3.4–3.8pt) emerged for all the clusters. Although women showed both a higher perceived P and R for all the clusters with respect to men, a gender difference emerged only in relation to R-SS ($p = 0.047$; $F = 4.3 \pm 0.8$ pt; $M = 4.0 \pm 0.7$ pt). For individual items, in general the highest gap between R and P ($\delta \geq 0.7$ pt) emerged for Marketing knowledge, Ability to deal with policy/politics, Business/Entrepreneurship knowledge, Finance/Economy management, Accountability, and Legal knowledge. Furthermore, females reported higher values ($p \leq 0.05$) in relation to the P of Ethical commitment and behaviour skills, Adaptability/flexibility skills, and Creativity/Innovation skills. Finally, higher values ($p \leq 0.05$) for women emerged also in relation to the R of Foreign languages, Working autonomy skills, Legal knowledge, Social skills, Finance/Economy management, and Marketing knowledge.

Conclusions: Academic and vocational training in sport management should adopt a multidimensional approach, preparing future managers to cope with the complex issues of this working environment.

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OP2—The relaxation effect of virtual reality (VR) after stress induction in young adults: the role of novelty

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Purpose: Being exposed to a natural landscape induces relaxation, both real and through virtual reality (VR). The current study hypothesizes a relaxation effect after being stressed through a mathematical test, investigating potential novelty effects.

Methods: Twenty-nine participants (16 males, 13 females; mean age: 24.3; SD: ± 3.06), declared eligible, underwent the experimental procedure, consisting of both physiological (HRV, BP) and psychological measures (Perceived Stress Scale, Positive and Negative Affect Score, 1-item Stress), plus one novelty item (“have you ever tried VR before?”). Heart Rate Variability and 1-item stress were detected 5 times (baseline, stress phase, post-stress phase, VR, post-VR), while the psychological measures were detected 3 or 2 times. Stress was induced through a math test through Inquisit.

Results: A 5 \times 2 (conditions \times novelty) MANOVA was conducted on HRV parameters (MHR, RMSSD, SDNN, HF, LF, LF/HF), finding a significant main effect of the conditions ($F_{4,108} = 33.35$, $p < 0.001$) and of the novelty ($F_{4,108} = 3.74$, $p < 0.001$) on MHR. Concerning the psychological measures, participants who never tried VR before declared to be happier ($t = 2.39$, $df = 27$, $p = 0.02$) and prouder ($t = 2.58$, $df = 27$, $p = 0.016$), but also more stressed during the stress induction phase (RMSSD: $t = 2.41$, $df = 27$, $p = 0.02$; SDNN: $t = 2.44$, $df = 27$, $p = 0.02$; HF: $t = 2.10$, $df = 27$, $p = 0.04$).

Conclusions: The current study shows that virtual reality might reduce stress levels, but that a novelty effect exists that should be taken into account when planning a VR experiment.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP2—Effects of different approach to promote lifestyle change and psychophysical health of breast cancer survivors

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Purpose: Literature is increasingly suggesting the importance of multidisciplinary behavioural interventions to improve cancer recovery and to prevent cancer recurrence, in breast cancer survivors (BCS). The aims of the research were to study a) the effects of two different behavioural interventions aimed to improve/maintain physical activity (PA), sedentary behaviours (SB) and sleep (SL) characteristics, in BCS participating to 4-month standardized

workouts and nutritional support; b) the combined effects of behavioural intervention, standardized workouts and nutritional support, on their psychophysical health.

Methods: Fifty-two BCS (55.26 ± 6.44 years) were studied through blood tests (plasma lipids, glucose, insulin, glycated hemoglobin (HbA1c), aspartate transaminases (AST), alanine transaminases (ALT) and erythrocyte sedimentation rate (ESR)), psychological questionnaires (Hospital Anxiety Depression Scale, Brief Fatigue Inventory), body composition analysis, and both sleep (Pittsburgh Sleep Quality Index) and physical activity questionnaires (Global Physical Activity Questionnaire). Participants were randomly assigned to PERSONAL subgroup, receiving personalized feedbacks based on objective data (i.e. data coming from Polar Loop 2), with a fortnight cadence, or to GENERAL subgroup, receiving general advice at the end of each workout, concerning SL, PA and SB. All BCS had the same nutritional support (i.e. personalized advices with a monthly cadence) and workouts. The tests were repeated at the end of each month or just at the end of the research period.

Results: Both RM-MANOVA and RM-ANOVA showed that PERSONAL subgroup had a better self-reported SL, PA and SB trends, together with those of HbA1c, AST, ALT and ESR, than GENERAL one. In PERSONAL subgroup, post-hoc analysis showed that while SL have been improved after a 2-month intervention, PA and SB needed a 4-month intervention to fully positively improve. Anxiety, depression, fatigue, insulin, HOMA-IR, HDL cholesterol and total to HDL cholesterol ratio were shown improved independently from treatments. Correlation analysis, controlled for workout attendance, showed SB variation (Δ) positively correlated with Δ HbA1c, Δ Total cholesterol, Δ Total cholesterol to HDL, Δ AST and Δ ALT.

Conclusions: A workout programme accompanied by personal behavioural advice, also based on objective data, seems to be the best solution to determine behavioural and psychophysical improvements in BCS. A 4-month intervention seems to be the minimum dose to obtain a significant improvement of SL, PA and SB.

OP2—The effects of an online adapted training for children with obesity during COVID-19 restrictions

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Purpose: COVID-19 pandemic changed the whole world’s way of living and to reduce the spread of the virus several nations introduced restrictions, such as lock down and the stay-at-home campaign. Due to these measures, sedentary behavior increased, while physical fitness and physical activity levels dramatically decreased, contributing to weight gain and facilitating the risk of developing obesity, especially in the young population. Since physical fitness is strongly related to health and since training and sports facilities were closed, sport specialists started to deliver physical training and promote physical activity through tele-exercise. In fact, many online training programs were developed and enhanced in these years. Therefore, the aim of this study was to evaluate the effects of a 12-week online supervised training program in children with OB on different PF components and PA levels.

Methods: 40 Caucasian children (9F/31 M; aged 11 ± 1.9 years) with obesity (BMI-z score ≥ 2 according to World Health Organization) participated in a 60-min exercise program on the online platform Zoom. Waist Circumference (WC) and Waist-to-height ratio (WHtR) and BMI z-score were assessed before and after the training protocol. Standing broad jump, 6'MWT and 5×10 m tested the physical fitness level before and after the training protocol. The PAQ-C questionnaire evaluated the weekly amount of physical activity while the CERT scale assessed the perceived fatigue after completing the 6'MWT and the 5×10 m sprint test. The training protocol consisted of three 60-min sessions per week over 12 weeks for a total of 36 sessions always supervised by two trainers. Every training session consisted of a 5–10 min warm-up, 20 min of aerobic interval training, 20 min of strength circuit, and 5–10 min of cool-down. To calculate the training protocol efficacy, a paired t-test was conducted on all the outcomes before and after the training.

Results: 37 children with OB completed at least 24 training sessions and were included in the analysis. Our results showed an improvement in all the physical fitness tests' performance, a reduction of the BMIz-score, WHtR and the WC, and an increased level of PA after the training.

Conclusions: Our study, with a low dropout rate ($< 10\%$ of the initial sample), demonstrated the effectiveness of an online training program in improving the physical fitness and health of children with OB. Tele-exercise encourage an active lifestyle.

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OP2—Video analysis and evaluation of human motion: the back handspring on different stages of gymnastic

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Purpose: Aim of the study was evaluate the role of video analysis and biomechanics factors on basic acrobatic movement among different stages of artistic gymnastic exercise in two modality, slow and fast, and high technique execution of performance.

Methods: A 14-year-old and 16-year-old women athletes were examined athlete with video analysis software (Kinovea 0.9.5®) to evaluate biomechanics factors on basic acrobatic movement among different stages of artistic gymnastic exercises. Different tests at several velocity are taken in count focused on the back handspring. Each angle degree in each part of the body during the performance, was recorded to compare differences and to appreciate the movement of the back handspring.

Results: Data showed the positive value of the correct execution and the incorrect execution of the back handspring ($p < 0.05$) in three different comparison of the performance between body movement without tools and body movement with a tools.

Conclusions: Our study suggest that Kinovea 0.9.5® are useful to improve the body perception of the body for athletes. Furthermore the software is not invasive and help trainers to understand the problems can be occur during training and fixed with correct execution of exercise.

Acknowledgments: (non obbligatorio).

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OP2—Does anaerobic test type matter? a comparison between the anaerobic intermittent kick test and Wingate anaerobic test in taekwondo athletes

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Purpose: The specificity of sport training as well as the specificity in monitoring the training process are believed to be fundamental keys to plan and carry out efficient athlete preparation and performance, influencing all the stages of the training planning. Consequently, the monitoring process, that accompanies all training stages and allows to organize long and short-term programs, should be also as specific as possible in any phase. The Anaerobic Intermittent Kick Test (TAIKT) is a sport- specific field test used to evaluate the Taekwondo athlete anaerobic profile in a specific manner. Aim of this study was to verify if TAIKT and the Gold Standard Wingate Anaerobic test (WAnT) are both efficient in optimally determining the anaerobic power and anaerobic capacity of Greek Taekwondo athletes of middle-high technical level.

Methods: Fifteen athletes, 10 females and 5 males mean age (23.4 ± 4.14 years) were recruited from different Taekwondo Greek clubs and underwent two-day testing sessions in order to verify the efficiency of TAIKT, compared to the WAnT, in determining the anaerobic peak power, anaerobic capacity and the blood lactate peak.

Results: The two tests showed a moderate correlation with r value ranging between 0.353 and 0.4288 (excluding fatigue index), if applied to a sample of middle-high technical level. Regarding the peak blood lactate, data indicated 40% concordance between the two tests with a coefficient of variation of 12%. Consequently, the two tests are correlated even if not interchangeable depending on the different type of exercise required in these assessments.

Conclusions: The main result showed only a partial correlation between the Gold- Standard WAnT and the specific TAIKT for this sample. This result suggested that there is not a high magnitude of agreement between the two methods of evaluation and that athletes can have different performances in the two tests. Probably in the TAIKT, as fatigue arises, the coordination and balance were affected in performing alternated kicks with the two legs, consequently the athletes decreased the frequency of execution showing an average power and blood lactate value lower than those in the WAnT. In conclusion, to discriminate against anaerobic performances and physiological characteristics of Taekwondo athletes, independently of their technical level, the WAnT resulted suitable, while to better

detect functional performance and specific demands of Taekwondo, the TAIKT is more indicated.

OP2—Qubone: a new useful and multi-integrated tool for the assessment of low bone mineral density risk in adults

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Purpose: Many questionnaires have been proposed by international literature as pre-screening tools for osteoporosis (OP) exposure and fracture risk. Though, they are addressed to specific population groups (especially post-menopausal women) and don't consider some risk factors such as body composition or physical exercise (PE). We now propose a new, validated questionnaire -QuBone- addressed to Mediterranean adults of 20–80 years, that quantify the risk of onset for osteopenia and OP by considering several intrinsic and extrinsic risk factors.

Methods: 434 Italian volunteers fulfilled the questionnaire; 174 of them underwent anthropometric and bone mineral density (BMD) assessment. 38 volunteers repeated the questionnaire for internal consistency and repeatability. Items included questions concerning personal details, reproductive and family history, sports practice, and lifestyle. Anthropometric parameters included: BMI, WHR, WHtR, upper arm muscle and fat areas, Fat Mass, and Fat Free Mass. BMD was scanned by quantitative ultrasonometry. Statistical analyses included: internal consistency, repeatability and strength of agreement evaluation; univariate and multiple linear regression models; receiver operating characteristic (ROC) curve analysis.

Results: Reliability and repeatability tests reported optimal values (Chrombach's Alpha = 0.62; Landis & Koch strength of agreement class = Almost Perfect/Substantial). Beside female sex, aging and comorbidities, negative predictors for BMD resulted overweight and obesity, controlled nutritional regimen, and citrus consumption. Positive predictors were activity levels (active, athletic), PE (static), and red meat consumption. Subjects performing static/resistance PE and mixed high-intensity training exhibited the highest BMD rates. Women -post-menopausal especially- are more prone to adopt unhealthy habits. Post-menopausal women also displayed the highest fat mass rates and lowest muscle mass/strength.

Conclusions: QuBone is a new intuitive tool aimed to quantify a subject's risk of diminished BMD according to their intrinsic characteristics and lifestyle habits. The application of multivariate analysis and ROC analysis allowed to quantify a risk score from bone density data with optimal reliability and repeatability. The questionnaire can be administered as part of a preventive screen or in a research context.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP2—Evaluation of immune system in competitive athletes affected by COVID-19

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Purpose: Intense exercise and strenuous training sessions expose athletes to an increased risk of contracting infections, particularly of the upper respiratory tract (URTI). In the past two years, a new virus hit the whole world causing what is known as coronavirus disease or COVID-19 responsible for numerous cases of infections even in athletes. An infection with severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) could cause acute respiratory distress syndrome (ARDS), but it could also involve the cardiovascular system with an increased risk of mortality. In this scenario, we investigated the effects of COVID-19 infection on the immune system of competitive athletes in terms of variation in serum levels and gene expression of defensins and interleukins.

Methods: For this study, 15 COVID-19 positive and 15 negative water polo athletes were recruited. We have evaluated human alpha and beta defensins (HNP1 and HBD1), IL-6 and IL-8 by ELISA assay. Furthermore, gene expression levels of IL-2, IL-6, IL-8 and IL-10 were analyzed by RT-PCR experiments.

Results: Data obtained by ELISA assay showed that in COVID-19 positive athletes there is a statistically significant increase in all analytes analyzed compared to negative athletes, outlining a very marked raise in HBD1, IL-6 and IL-8. Similarly, RT-PCR experiments showed an increase in IL-2 and IL-8 expression in covid athletes if compared to COVID-19 negative athletes, and this is especially evident in IL-6 and IL-10.

Conclusions: Although the immune system of a competitive athlete is already on the alert for exercise-induced stress resulting in an increase in serum levels of HNP1 and HBD1 and pro-inflammatory cytokines, it is capable of counteracting Covid-19 infection thanks to an increased expression of IL-10, main anti-inflammatory cytokine. Therefore, monitoring the health of athletes has a key role to guarantee a safe return to play without the symptoms of long-Covid-19.

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OP2—Physical activity levels in patients with cancer: alert for triaging patients to engage in exercise

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Purpose: Physical activity level (PAL) is associated with a higher survival rate and a lower risk of recurrence in patients with cancer [1]. Although international studies report that most patients are insufficiently active, few data are available for the Italian context. The aims of the study were to (i) understand the size of the problem (i.e., the prevalence of insufficiently active patients) and (ii) investigate Sports Science University students' knowledge, perception, and expectations regarding exercise oncology.

Methods: (i) PAL was evaluated by the SenseWear armband activity monitor (BodyMedia Inc., Pittsburgh, PA) or questionnaire (Godin's Leisure Time Exercise Questionnaire). A total of 624 patients with cancer were included in this analysis. The most prevalent cancer sites were breast (n = 357) and upper-gastrointestinal tract (n = 143), 42% of patients were still on active anticancer treatment. (ii) A total of 854 students attending Sports Science Universities in Verona, Urbino, Chieti, and Rome completed an online survey, investigating the knowledge and perception regarding exercise oncology.

Results: (i) 30% and 10% of patients undergoing anticancer treatment achieved the recommended amount of aerobic and strength exercises, respectively. The daily PALs of patients with breast cancer who completed the anticancer treatment were on average 1.3 METs, ranging from a minimum of almost 0.8 to a maximum of almost 2.5 METs. (ii) Regarding Sports Science students, 44% and 54% of them correctly identified the amount of aerobic and strength activity, respectively, proposed by the American College of Sports Medicine's guidelines for patients with cancer. Almost all the students (84–99%) recognize the importance of exercise along the cancer continuum, but only a small percentage (22–35%) felt confident in providing counseling or prescribing exercise for patients with cancer.

Conclusions: Most patients with cancer are insufficiently active both during and after anticancer treatment. Although kinesiology students are aware of the benefits of exercise in cancer settings, they do not feel confident in prescribing an exercise program. Therefore, Sports Science Universities should meet the expectations of the students. In this regard, implementing their academic offerings, including dedicated internships, could represent the solution able to adequately support patient to switch to and maintain an active lifestyle.

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OP2—Children's physical activity and performances are weakly correlated

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Purpose: The present cross-sectional study is part of a project financed by the Minister of Education, Universities and Research (PRIN-2017) entitled "Is active lifestyle enough for health and wellbeing?" (ACTLIFE; University of Verona, Torino, Roma "La Sapienza", Napoli "Parthenope", Parma, and Padova), and aimed to evaluate the impact of physical activity (PA) level on physical performance controlling for individual characteristics in Italian children.

Methods: Three-hundred-twenty-nine children (girls n = 155, 42.6%; from five primary schools, 17 classes; Turin province) aged 8–10 filled the Physical Activity Questionnaire for Older Children (PAQ-C)

to assess their PA level. Participants were anthropometrically measured (stature and body mass) for quantifying BMI, and performed physical tests for measuring sprint ability (20 m-sprint), aerobic endurance (shuttle-run-test), upper-limbs strength (handgrip), lower-limbs muscle power (standing-long-jump; countermovement squat jump), and balance (single-leg-stance) and flexibility (sit-and-reach) skills. A series of linear mixed-effects models (LMM) was applied to determine the relationship between physical performance and PAQ-C score controlling for individual characteristics (i.e., gender, age, BMI).

Results: Results reported significant relationships between PAQ-C-It score and 20 m- sprint, shuttle-run, standing-long-jump, and sit-and-reach (all p < 0.001). All considered physical tests depended on gender (p < 0.05), age (p < 0.05), and BMI (p < 0.001), except for sit-and-reach on BMI. The variance in gender, age, BMI, and PAQ-C score accounted altogether for 36% of the variance in shuttle-run-test, 34% in 20 m-sprint, 31% in standing-long-jump, 31% in counter movement squat jump, 30.0% in handgrip, 26% in sit-and-reach, and 23.0% in single-leg-stance.

Conclusions: The relationship between PA level and physical skills is not absolute and depends on the test type and children's characteristics. Specifically, and coherently to literature (Miguel-Etayo et al., 2014; Sacchetti et al., 2012), boys showed higher aerobic endurance, sprint ability, and upper- and lower-limb strength than girls. On the contrary, the opposite picture emerged for balance and flexibility skills. Older children showed a higher level of physical functions compared to younger ones. Finally, children's BMI was positively associated with upper-limb strength and negatively with aerobic endurance, sprint ability, balanceskills, and lower-limb muscle power.

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OP2—On-field biomechanical assessment of competitive goalkeepers dive through wearable sensors and principal component analysis

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Purpose: Effective trainings of diving skills are fundamental in football academies to improve goalkeepers' saving performance. In particular, the assessment of preferred (PS) and non-preferred (nPS) side differences is critical to improve trainings. Few biomechanical investigations have been proposed in this field, none in a sport-specific environment. The aim of the present study was to investigate the underlying relevant motion characteristics of goalkeepers' dive in relation to their preferred and non- preferred side.

Methods: Nineteen young competitive goalkeepers (16.5 ± 3.0 years, Tegner Level 9) performed a series of high and low dives on their preferred and non-preferred side. The dives were performed in a regular football goal on a natural grass football pitch. Full-body kinematics was collected through a set of 17 wearable inertial sensors (Awinda, Xsens). Data were normalized from the initial contact of the contralateral foot to the end of the dive [1]. Diving time was compared among the dive height and side (two-way ANOVA). Two separate principal component analyses (PCA) on high and low dives were conducted to reduce kinematic data dimensionality (input matrix 19 participants × 101 data points × 6 trials × 8 angles × 3 axes).

The PCA scores were extracted for each kinematic variable and compared between PS and nPS side (Student's *t* test with Cohen's *d* effect size) if the relative explained variability was >5% [1].

Results: Dive timing differed between high and low dives ($p < 0.003$, $\eta^2 > 0.041$) but did not differ between PS and nPS ($p > 0.05$, $\eta^2 < 0.007$). In high dive, participants exhibited greater hip internal rotation ($p = 0.008$, $ES = 0.52$) and less trunk lateral tilt ($p = 0.047$, $ES = 0.39$) in PS compared to nPS. In low dives, participants exhibited less hip adduction and knee rotation, and greater pelvis and trunk rotation in the initial diving phase in PS ($p < 0.037$, $ES 0.40–0.57$) compared to nPS.

Conclusions: When diving on their nPS, goalkeepers adopted sub-optimal motion pattern with delayed pelvis and trunk rotation and limited explosiveness towards the diving direction (hip external rotation and adduction). This is in line with current literature highlighting the need to improve horizontal and lateral skills in diving [2–3]. The differences were more evident in the low dives. The present study was the first to investigate academies goalkeepers' biomechanics in a sport-specific environment adopting an innovative approach with wearable sensors plus PCA dimensionality reduction. Such an analysis might be useful to goalkeepers' coaches to define the dominant differences in diving motion between PS and nPS and improve training

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OP2—The learning of motor competencies through different teaching styles. analysis of the behavior of the physical education teacher in secondary school

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Purpose: The teaching of motor competence requires knowledge of *how* to propose motor tasks and organize the didactic setting, to promote different way of learning, adapted motor tasks, and to develop psychological factors related to physical activity. Three questions arise: *what* skills, knowledge, and attitudes to teach; *how* to teach and promote different way of learning; *what* skills have been taught and learned. The present study aims to: a) share a repertoire of teacher behaviors specific for each teaching style; b) identify the relationships between the descriptors of teacher behavior and motor learning; c) design different teaching-learning situations.

Methods: The study, based on action-research method, involved 47 physical education teachers ($M = 20$, age: 43.46 ± 6.45 ; $F = 27$, age: 45.47 ± 8.90), with 3–7 years of service. The Teachers shared a repertoire of behavioral descriptors for each teaching style, both reproduction and production ones. The assumption is that the learning of motor competencies depends on the motor task, the way with which teacher request and propose it, and the relationships between the students in the teaching setting.

Results: A repertoire of 48 descriptors of teacher behaviour, 25 for reproduction styles and 23 for production styles was structured. Each descriptor presents a didactic scenario to deduce the modalities of communication between the teacher and the students and the degree of decision-making in the proposal of motor tasks and motor responses, respectively. The questions of the training course were:

how to propose a motor task to promote different ways of learning? *How* to request differentiated motor tasks and promote the variability of the practice? *Which* questions are related to the teaching styles of production and generate divergent and transferable motor answers? The definition of a repertoire of behaviors could orient the teacher's reflection on the didactic choices made.

Conclusions: The choice of teaching styles is fundamental to promote different ways of learning and personalized teaching interventions. The use of different teaching styles can enhance and facilitate the connection of the contents with the student's learning methods. Several factors influence the motor learning and a repertoire of descriptors is necessary to share the *how* to propose a motor task and the teacher student-students interaction. Furthermore, it is important to increase teachers' perception of the teaching styles used and to reflect on teaching choices.

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OP2—Scoring-first effect influences international elite rugby match outcome within the first 3 events of the match

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Purpose: The scoring-first effect was widely investigated in team sports, although its

presence is controversial. It was mainly supported by the “psychological momentum” theory (i.e., the added advantage obtained when initial success in an athletic contest produces momentum which leads to future success). In particular, this effect was reported to increase the likelihood of winning, especially in low scoring sports such as soccer. Nevertheless, it could be crucial in influencing the match outcome even in a high scoring rate sports such as rugby. However, because of its complexity, the combination of the first events in a match should be investigated in relation to the match outcome.

Methods: A set of 9858 performances of the northern and southern hemisphere club competitions (e.g., Top14, Pro14, Premiership, Currie Cup, Mitre Cup, and Super Rugby) from 2013 to 2020 were analyzed. Data were obtained from the Ultimate Rugby web domain (<https://www.ultimaterugby.com/#>). Principal actions [i.e., Score–S (try, conversion, kick at goal, drop goal, penalty try), Missed score–MS (missed penalty or conversion), Penalty Card—PC (red or yellow), Substitution –SUB] were coded in the 1st, 2nd, 3rd event of the match. A series of logistic regression models were implemented to investigate the timing of scoring and non-scoring events in relation to the match outcome.

Results: Score actions accounted for 75%, 69%, and 63% of the match's 1st, 2nd, and 3rd event. Scoring first increased the chances of winning 1.2, 1.4, and 2.4 times more than MS, SUB, and PC, respectively. On the 2nd and 3rd event only PC and SUB were detrimental for winning the match (i.e., odds ratio of 2.1 and 1.4 on both the 2nd and 3rd event). When considering the combination of the 1st and 2nd event, the worst scenario was represented by taking one or more PCs (odds ratio = 1.9 to 10.6).

Conclusions: In this study, the combination of the first two events of the match was considered within the bandwidth of the best (Score–

Score) and the worst scenario (Penalty Card-Penalty Card), in order to investigate the complexity of the scoring- first phenomenon. Like in other sports, the scoring-first effect occurs in high-scoring sports such as rugby union. Finally, excluding the absolute worst scenario (two penalty cards in a row), losing momentum (Missed score) combined with tacking a PC represent the worst scenario for winning an international rugby union match.

Acknowledgments: (non obbligatorio).

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OP2—Mechanism of hypoxemia during breath-hold diving

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Purpose: Pulmonary gas exchange in breath-hold diving (BDH) consists of a progressive increase in PaO₂ and PaCO₂ during descent. However, recent findings have demonstrated that PaO₂ does not consistently rise in all subjects. This study aimed to verify PaO₂ derangements at – 15 and – 42 m and to search for signs of atelectasis or other pulmonary changes explaining such discrepancies. **Methods:** After local IRB approval, 14 well-fit breath-hold divers were included (water temperature: 31 °C). Arterial blood was sampled immediately before, at depth, and immediately after a breath-hold dive—to – 15 and – 42 m. Signs of lung interstitial edema and atelectasis were searched at the same steps with a marinized lung ultrasound. We also assessed changes in inflammatory patterns and microbubbles formation after dives at different depths, and cerebral perfusion/oxygenation through marinized NIRS.

Results: In 5 subjects (– 15 msw) and 4 subjects (– 42 msw) the PaO₂ at depth decreased instead of increasing. PaCO₂ or lactate showed slight variations. At depth, only one subject showed focal B-lines. After the – 42 dive, most of the subjects developed signs of basal interstitial edema; two subjects demonstrated signs of focal lung atelectasis. No statistically significant differences were found in inflammatory biomarkers. SpO₂ and cerebral blood oxygen saturation remained high during descent and at the bottom, but declined during ascent, similarly between 15 and 42 msw, with greater changes in deeper dives.

Conclusions: Current experiments confirmed that some BH divers can experience hypoxemia at depth. The hypothesized explanation for such a discrepancy could be lung atelectasis. No signs of DCS have been reported after the dives.

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OP2—The trunk displacement index (TDI) for assessment of gait dynamic stability: application to Parkinson's disease

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Purpose: Humans' bipedal locomotion is characterised by the changes of trunk position and, consecutively, of the centre of mass (COM). Here, we set out a new synthetic kinematic index, that we named Trunk Displacement Index (TDI), able to quantify the displacement of the trunk with respect to the COM for the assessment of the dynamic stability during gait. We applied the TDI in Parkinson's disease (PD) to evaluate its motor impairment. Specifically, we compared the TDI in healthy controls (HC) and PD patients before (off condition—PDoff) and after (on condition—PDon) the levodopa treatment, in order to test the sensitivity of this new, replicable, biomechanical index.

Methods: Through a stereophotogrammetric system, we acquired 3D gait analysis data of 23 PD patients and 23 HC. Then, the TDI was calculated as the ratio between the mean position of both trunk and COM. The statistical analysis was carried out in MATLAB. We performed a permutation test (PERMANOVA) to compare the TDI of the three groups (HC, PD-off, PD-on). Moreover, we performed a Pearson's correlation analysis to verify a possible relationship between the TDI and the clinical motor evaluation (before and after the levodopa intake) assessed by the Unified Parkinson's Disease Rating Scale-III (UPDRS-III).

Results: Our results reveal that the TDI is able to distinguish the PD patients before and after the levodopa intake. Specifically, the PD-off group displayed higher TDI values of both PD-on group ($p = 0.005$) and HC ($p = 0.004$). Moreover, Pearson's correlation showed that the TDI positively correlated with the UPDRS-III.

Conclusions: The TDI is a synthetic biomechanical index able to differentiate the on/off condition of PD patients and it also displays a clinical relevance highlighted by the positive correlation with the UPDRS-III. Hence, the TDI can be considered a new, replicable tool able to analyse gait in both health and disease and, in addition, it represents a valid marker to track gait changes following pharmacological or rehabilitation protocols.

OP2—Rate of perceived exertion for prescribing exercise intensity in small-sided games

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Purpose: Rate of Perceived Exertion (RPE) is currently used to prescribe intensity (“production”) in closed skill activities¹, but, to our knowledge, no study assessed its validity in open skill activities such as SSGs. We aimed to demonstrate if RPE production can be used to modulate TL in SSGs.

Methods: Eight out-field competitive football players (17.9 ± 0.4 years) performed five 4-a-side matches that lasted four minutes with two minutes of recovery on a 30 × 20 m pitch size twice a week for a period of six weeks. The coach prescribed the intensity of each bout using three different anchors of the CR100 Borg’s scale (L, M and H were respectively 25, 45 and 75) in random order. Internal TL was monitored by a heart rate monitor and external TL by a GPS-accelerometer device. Players were familiarized with the scale and had used it regularly for the previous season. Results are presented as mean differences between conditions, 95% confidence intervals and p level.

Results: External TL analysis showed higher values in H and M compared to L bouts for total distance (H vs L 57.91 m [35.68–80.15] and M vs L 40.59 m [20.27 – 60.91, p < 0.001]), average speed (H vs L 0.86 km h⁻¹ [0.53–1.19] and M vs L 0.58 km h⁻¹ [0.28–0.89], p < 0.001) and distance covered at low speed (H vs M 20.45 m [8.45–32.46], p < 0.001 and M vs L 14.24 m [3.27–25.22], p = 0.006) and moderate speed (H vs M 36.02 m [18.83–53.23] and M vs L 25.13 m [9.41–40.85], p < 0.001). No differences were found between H and M intensities. Internal TL showed Edward’s TL and time spent above 90% of heart rate max were higher in H vs M (0.65 [0.01–1.32], p = 0.044 and 0.031 [0.00–0.06], p = 0.021), H vs L (2.56 [1.76–3.23], p < 0.001 and 0.12 [0.05–0.19], p < 0.001) and M vs L (1.78 [0.94–2.45], p < 0.001 and 0.09 [0.03 – 0.16], p = 0.002).

Conclusions: Our results showed the efficacy of RPE production in SSGs in a sample of youth football players. Monitoring athletes’ TL is a key point to optimize performance, but often, it is difficult for coaches to provide the right load using technical and tactical exercises such as SSGs. Nowadays, heart rate monitors and GPS devices allow real-time athletes’ monitoring, but they are expensive and require staff members dedicated to them. For these reasons, many teams cannot provide efficacy the optimal TL. Our interesting findings give a powerful tool to coaches of every level’s teams.

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OP2—The effects of a 4-week aerobic exercise training program on cardiopulmonary exercise testing and heart failure biomarkers in patients with univentricular heart

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Purpose: Several studies have shown that adult patients with Hypoplastic Left Heart Syndrome (HLHS) and Fontan circulation

have a reduced exercise tolerance that affects daily life. Recent studies have investigated the effects of aerobic exercise training in these patients with univentricular heart; however, this research topic is still poorly studied. The aim of this study was to evaluate the effects of an aerobic exercise training program on cardiopulmonary exercise testing parameters and cardiac biomarkers in patients with HLHS.

Methods: We enrolled 12 patients with a mean age of 24 ± 2.5 years (range 22–27 years), 50% male, with HLHS at Bambino Gesù Children’s Hospital IRCCS and University of Rome Tor Vergata. All patients underwent a cardiopulmonary test and blood sampling before (T0) and after (T1) a 4-week aerobic exercise program. Cardiac biomarkers hs-cTnT, NT-proBNP, ST2, GDF-15 were studied.

Results: Data analysis demonstrated an increase in cardiorespiratory performance after 4 weeks of aerobic exercise training activity. In particular, the data showed a significant improvement in test duration (p < 0.05), heart rate at rest (p < 0.05), heart rate recovery 1 min (p < 0.05), VO2 max (p < 0.01) and oxygen uptake efficiency slope (p < 0.05). At the same time, the data showed a significant reduction in NT-proBNP and ST2 values (p < 0.01 and p < 0.05, respectively) and a significant increase in GDF-15 (p < 0.01). No significant changes were found between the hs-cTnT values.

Conclusions: Our study demonstrated the 4-week efficacy of an aerobic training program in improving cardiorespiratory performance and cardiac biomarker values in adult patients with HLHS and Fontan circulation. To the best of our knowledge this is the first study that evaluated the effects of an exercise training program in these patients with univentricular heart.

OP3—The impact of physical activity on redox-status biomarkers and stress proteins during treatments of breast cancer patients

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Purpose: Breast cancer (BC) is one of the most commonly diagnosed cancer in women. Oxidative stress may contribute to cancer etiology through several mechanisms involving damage to DNA, proteins and lipids leading to genetic mutations and genomic instability. The literature indicates that physical activity (PA) has positive effects on every aspect of breast cancer evolution, including negative effects from medical treatments. Specifically, it is known that the beneficial association between PA and BC survival are partially related to its influence on antioxidant status and stress proteins response of the body¹.

Methods: Fifteen newly diagnosed BC patients (40–60 years), who underwent the same surgery and before beginning cancer-related treatments, were recruited and divided randomly into a control group (CG, n = 5) undergoing usual care, and an exercise group (EG, n = 10), which additionally participated in a PA program. With the aim to verify the ability of PA to counteract the negative effects on systemic redox-homeostasis induced by the BC treatment, we examined the impact of a 4-month exercise program on the modulation of plasma markers of oxidative stress, inflammation and the stress response, such as superoxide dismutase (SOD) and catalase (CAT) activity, total-glutathione (tGSH), lipid-oxidation (TBARs), total-antioxidant-capacity (TAC) and total-free-thiols (tFTH), as well as interleukin-6 (IL6), interleukin-8 (IL8), interleukin-10 (IL10), and

tumor-necrosis-factor-alpha (TNF α). Moreover, the expression of GPx1, HSP27, HSP70, SOD1 and SOD2 was evaluated at mRNA level in peripheral blood mononuclear cells (PBMCs).

Results: Even in the absence of significant changes in CAT activity, TAC, tFTH and TBARs levels ($p > 0.05$), exercise maintained SOD activity and tGSH levels in EG whereas in CG they were significantly decreased ($p < 0.05$). Moreover, we found a significant decrease of IL8 in both groups, whereas only in EG we observed a significant reduction in the pro-inflammatory IL6 and an increase of anti-inflammatory IL10 ($p < 0.05$). At cellular level, PA counteracts the reduction of HSP27 mRNA level ($p < 0.05$), and significant increases of the expression of SOD1 and SOD2 ($p < 0.05$).

Conclusions: These results highlighted the importance of PA as a potential adjuvant therapy, alongside usual care of BC, able to counteract the chemotherapy-induced negative effects on both stress proteins response and an already compromised redox homeostasis.

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OP3—The benefits of walking and health coaching in supporting therapeutic treatment of anxiety disorders

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Purpose: Anxiety disorders are common nowadays and they have been spreading among people regardless of age and gender throughout the pandemic lockdown. Although first-line therapy includes psychotherapy and medications, Physical Activity also proves to be an effective treatment to achieve mind-body wellbeing and to reduce anxiety and depression symptoms. The aim of this pilot study is to verify the effectiveness of Walking and Health Coaching in supporting first-line therapy in anxiety disorders.

Methods: Eight subjects (aged 18-74 and suffering from generalized anxiety disorder) were selected to participate in a “100-day, 10,000-step Challenge” last year. They had to track their daily steps and try to take at least 10,000. They had to read and reply to a weekly Health Coaching Newsletter, too. They could also have a monthly Health Coaching call, together with their first-line treatment. Outcomes were obtained thanks to the results of DASS-21 and WEMWBS Questionnaires.

Results: At the end of the study anxiety, depression and stress symptoms decreased while overall wellness increased.

Conclusions: Despite the small sample and its statistical significance, it's possible to reaffirm that Physical Activity helps first-line therapy, but people need to be guided through all the process. Having a Health Coaching guidance allows patients to keep up their motivation.

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OP3—Influence of thermal SPA therapies on physical activity and sleep

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Purpose: The thermal spa's relaxing atmosphere and treatments could favour physical activity (PA) practice and sleep improvements. To date, no studies in Italy have investigated these aspects; thus, the current study aims to shed light on PA and sleep behaviour during a week of thermal spa treatments.

Methods: Sixty-five participants ($M = 18$, 27.7%; 64.1 ± 10.9 yrs) staying at GB- Hotels (Abano Terme, Italy) 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 a week of thermal spa stay. A higher GSL-TPAQ score indicates a greater PA practice, with the cut-off point of 24 LSI distinguishing between *active* and *inactive* subjects. Concerning the MSQ, the lower the score, the lower the sleep problems and the better the sleep quality; a final score < 24 a.u. indicates good sleep quality. The questionnaires evaluate PA and sleep during the week before the compilation; thus the questionnaires assessed PA and sleep changes during the spa stay. Furthermore, participants recorded daily the PA practice and the use of thermal pools in a diary.

Results: Before the thermal spa stay, 50% of the sample had been classified as *active*, whereas the percentage of *active* subjects raised to 70% at the end of the thermal stay with a significant increase in the GSL-TPAQ score (before: 25.8 ± 18.4 LSI; during: 41.6 ± 32.7 LSI; $p < 0.001$), indicating an increase of PA during the thermal stay. Before the spa stay, participants with *no sleep problems* were 33%, while they were 42% at the end of the stay. The mean MSQ score significantly decreased during the spa stay (before: 30 ± 11.2 a.u.; during: 26 ± 10 a.u.; $p = 0.001$), indicating better sleep quality. One-way ANOVA showed that *active* and *sufficiently active* participants slept longer and better than *inactive* subjects and that those with *no* or *occasional sleep problems* practised more PA than participants with *moderate* and *severe sleep problems* (even though without significance). Correlations analysis showed a significant inverse relationship between the use of thermal pools and sleep quality ($r = -0.24$, $p = 0.05$), meaning that the greater the thermal pool use, the better the sleep quality during the spa stay.

Conclusions: A week of thermal spa treatments and stay seemed effective in incrementing the PA practice and sleep quality. PA practice could be favoured by the facilities (e.g., swimming pools and gyms) and better predisposition of the participants to being active during the stay (e.g. walking and biking). 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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OP3—The use of a wearable haptic metronome during running

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Purpose During running, increasing stride rate and reducing stride length allow decreasing lower extremity loading and injuries risk (1). Moreover, stride variability is linked to the risk of injuries and to the running performance (2). Metronome could represent a useful tool to manipulate running stride frequency. Lisini et al. proposed a haptic metronome to maintain a pre-determined walking stride frequency in physical activity programs (3). The purpose of this study was to verify the feasibility and the efficacy of a haptic metronome during running and to compare its effects with those of an acoustic metronome.

Methods Seven active volunteers (age: 27 ± 3 years, 5 M/2 F) participated in this study. The experiment included two sessions: Haptic Metronome (HM) and Acoustic Metronome (AM) session. The HM was a prototype, composed of four vibrating motors attached to an elastic band, placed on participants' right ankle. The AM was a mobile app, the participants heard the sound from in-ear headphones. During each session, they performed 400 m for 3 times at 4 different imposed frequencies (100, 86, 75, 67 strides/min). To evaluate the ability to synchronize with the metronome the "alignment percentage", namely the percentage of the time in which the imposed frequency was reached on total time, was computed. A Friedmann test was conducted to assess differences between sessions and frequencies.

Results The alignment percentage at 67 strides/min was higher in HM than in AM but it did not reach the significance. Comparable results were found between HM and AM at 75 and 86 stride/min. The alignment percentage was significantly higher in AM ($p = 0.016$) than in HM at 100 strides/min. No differences in speed were revealed between the two conditions.

Conclusions Results of this exploratory study indicate that HM is useful to set a running stride frequency similarly to AM, except at the highest frequency when the tactile stimulation could be more difficult to be perceived. Improvements in HM wearability and usability could increase its efficacy also at high frequency and speed. In future work, we plan to increase the number of participants to obtain more robust and reliable results.

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OP3—The role of objective measurement and subjective perception on players' discrimination in a professional soccer school

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Purpose: Soccer is a complex game that demands energy and information- processing-based motor abilities (Jukic et al., 2019). Therefore, professional clubs usually split their young players into different groups according to their ability levels. However, the most talented players are typically identified by traditional methods based on scout or coach experience (Unnithan et al., 2012). Thus, this study aimed to investigate the role of objective measurement and subjective perception on players' discrimination in a professional soccer school.

Methods: Forty-seven (47) young Italian soccer players (age: 11.1 ± 0.22 years; weight: 39.64 ± 5.24 kg; height: 144.74 ± 5.76 cm; BMI: $18, 91 \pm 2.08$ kg/m²) from a professional soccer school in Turin were recruited for this research. Players belonged to three groups according to an established level of abilities. Each player was evaluated on the sit and reach test, standing long jump test, shuttle dribble test, 10×5 shuttle run test and Mini-Cooper test. Coaches' subjective perception was assessed using The Questionnaire for the Assessment of Soccer Player Quality by the Coach (QASPQC) (Jukic et al. 2019). Data analysis was run using a one-way Analysis of Variance (one-way ANOVA). Furthermore, Tuckey's post hoc was used to determine differences among age classes.

Results: Results showed no significant differences between the first and the second group in all assessments. On the opposite, the first and the second group were significantly better in 20 mt sprints ($p < 0.05$), 10×5 shuttle-run ($p < 0.05$), and QASPQC outcomes ($p < 0.05$).

Conclusion: This study underlines the efficacy of subjective perception when motor abilities level is also significantly different. However, when physical performance does not differ, subjective perception cannot distinguish the players' value.

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OP3—Digital health technology in low back pain management: the dress-Kinesis's paradigm

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Purpose: Low back pain (LBP) carries a high risk of chronicization, greatly impacting the demand for care. We present a new mHealth tool, the Dress-KINESIS (D-K), designed within the participatory health framework by a group of researchers from the National Research Council with different skills and areas of expertise (epidemiologists, kinesiologists, physical therapists and IT developers) to (a) collect data about LBP risk factors, treatments and costs, (b) propose self-manageable plans of activity on a scientific basis and (c) share evidence-based prevention recommendations.

Methods: Population-based information collected through the D-K allows us to characterize user's severity level at the baseline and along the proposed cycles of activity. Subjects are grouped into levels of limitation identified according to the abilities in coping with daily living activities (Oswestry score, OS) and some others, identified through the Low Back and Lower Extremities scale. Subjects with severe disability status (OS > 40%) are excluded from D-K use, as well as subjects presenting co-morbidities. Referring to the Treatment-Based Classification system, the D-K proposes tailored programs including two sections of activity, to be performed for 3 days a week, during 3 cycles of activity (3 weeks for each cycle). One section comprises exercises aimed at strengthening the core muscles and the deep abdominal muscles, promoting respiratory control and increasing the range of motion of the spine and joints as well as overall body flexibility. The other includes aerobic activities and stretching movements, to limit bone loss and metabolic syndrome. Exercises are classified based on aim, starting position, type of movement, target muscles and effort intensity, in order to personalize the individual workouts by level of limitation and between different cycles of exercise. Before starting with exercise protocol, users perform 1 week of exercise feasibility testing to tailor their workout sessions. In each cycle transition, users are guided based on a set of standardized progression criteria.

Results: Comparison between a traditional rehabilitation approach for non-specific LBP patients with one involving the D-K support, shows that the system's efficiency could be increased.

Conclusions: This agrees with the European agenda for research and innovation which promotes scientific solutions developed by engaging citizens in the research cycle to improve communities' resilience.

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OP3—The use of metronome to learn the aerobic training pace in swimming

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Purpose: Metronome (MET) is a tool increasingly used in sports field. Swimmers use it during training but there is no evidence that MET can be used in a sensorimotor learning protocol to allow them to faithfully reproduce, without MET, the training pace previously learned. Sensorimotor learning is a complex process consisting of different stages: fast and slow learning, consolidation, and retention. The aim of this study was to investigate the stages of sensorimotor learning during swimming training sessions using a MET and to assess if athletes were able to reproduce the race pace previously learned.

Methods: The experimental design included four training days (D1, D2, D4, D5) and one-day rest (D3) during a week, followed by three control days in the following weeks (D8, D12, D15). During each training day, twelve athletes swam 1 × 100 m front crawl trial without MET (T0). After T0, they were asked to swim three times during the day: 2 × 100 m front crawl trials with MET (TR1, TR2,

TR3) followed by 1 × 100 m front crawl trial without MET (T1, T2, T3). During D8, D12 and D15 the athletes swam only at T0. MET was set in order to swim 100 m at the individual intensity corresponding to aerobic training zone (A2). During TR1-2-3 the participants were asked to swim the 2 × 100 m front crawl trials in synchronous with the MET. The time interval among MET audio feedbacks was adjusted to match with the time required to swim from side to side of the pool length (25 m) at the A2 intensity. Main outcomes were: 25 m-time interval (T25) and 100 m-total time (T100); time difference between real and set time to reach 25 m (TD25) and to reach 100 m (TD100), respectively; TD25 averaged on the 4 laps (A25); coefficient of variation (CV) of A25.

Results: Fast learning: a significant reduction in TD100 ($p < 0.01$), A25 ($p < 0.001$) and CV ($p < 0.001$) was observed after D1. Slow learning: TD100, A25 and CV at D1-T0 were significantly higher than at the other testing times during the training week. Consolidation: no significant changes were observed in TD100, A25 and CV between D1-T3 and D2-T0. Retention: a significant worsening in D8, D12 and D15 was found in TD100, A25 (always $p < 0.05$), but no significant changes in CV.

Conclusions: Fast learning and consolidation were observed during the training week. Retention was found only in CV. Therefore, athletes were able to swim following the A2 pace after the first training day. In the following weeks, only variability was maintained lower than before training.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP3—Structural and functional impairments of the skeletal muscle in patients with post-acute sequelae of SARS-COV2 infection

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Purpose: Previous studies showed persisting exercise intolerance and muscle weakness several months after SARS-COV2 infections; highlighting a new emerging syndrome called post-acute sequelae of COVID19 (PASC) (1). Impairments in muscle oxygen extraction and signs of degenerating muscle fibers were observed in patients hospitalized in the intensive care unit or with severe symptoms of infection (2, 3). However, many patients report PASC symptoms even after mild acute SARS-COV2 infection and the mechanistic bases of these alterations need to be investigated. This study aimed to quantify structural and functional impairments of the skeletal muscle in non-hospitalized PASC patients.

Methods: At least 3 months after infection, PASC patients ($n = 10$; yrs: 52 ± 9) and post-COVID19 patients without PASC symptoms ($n = 11$; yrs: 47 ± 9 ; CTRL) visited the laboratory on three non-consecutive days. Quality of life was evaluated by a questionnaire (4). Knee extensors maximal voluntary isometric contraction (MVIC) was assessed before (PRE), after (POST), and 10 min (POST10) following 80 maximal velocity isotonic contractions (every 3 s) at a fixed load. Peak O₂ consumption (O₂peak) was recorded during an incremental exercise test. Mitochondrial respiration was evaluated by high-resolution respirometry in permeabilized muscle fibers from the vastus lateralis. Single fibers cross-sectional area (CSA) and specific isometric force (P0/CSA) with the slack test technique (5) were also determined.

Results: Quality of life was significantly lower in PASC (66 ± 15) vs CTRL (91 ± 2 , $P < .05$). At PRE, MVIC torque was lower in PASC than CTRL (123 ± 36 vs 196 ± 60 Nm, $P < .05$). At POST, MVIC torque decreased similarly from PRE in both PASC and CTRL (-28 ± 13 vs $-26 \pm 13\%$, $P < .05$). At POST10, MVIC torque remained lower than PRE only in PASC ($-18 \pm 6\%$ from PRE, $P < .05$). O_2 peak was lower in PASC than CTRL (24.9 ± 0.3 vs 33.7 ± 0.5 ml/min/kg, $P < .05$). O_2 flux for CII in maximal uncoupled state conditions was lower in PASC than CTRL (257 ± 59 vs 113 ± 22 pmol/s/mg/CSact; $P < .05$). Muscle fiber CSAs were lower in PASC than CTRL (3970 ± 734 vs 5410 ± 1448 μm^2 ; $P < .05$). PO/CSA from type I and II muscle fibers was not different between groups ($P > .05$).

Conclusions:

Compared to CTRL, PASC patients showed reduced knee extensors maximal force-generating capacity, a slower recovery after dynamic fatiguing task, and lower exercise tolerance. Although a mild muscle atrophy was present, PASC symptoms seem related to impairments in the skeletal muscle oxidative function.

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OP3—Effects of a 7-day low- vs high-carbohydrate diet on continuous glucose monitoring metrics in competitive cyclists: preliminary results of a randomized cross-over trial

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Purpose: Continuous glucose monitor (CGM), a sensor that gathers minute-by-minute data on a rider's level of interstitial glucose, is one of the most recent technologies that appeared in professional cycling; it might help riders understand how their body reacts to and how this is altered by different types of fuel. On a scientific level, a few papers have been published on non-athletic subjects or athletes with diabetes, but data on healthy athletes is still scarce. This study aimed to investigate the glycemic responses to a low- or high-carbohydrate diet in healthy competitive cyclists while wearing a CGM.

Methods: A randomized cross-over design was used. Competitive cyclists (> 8 h training/week) were recruited. Participants (sample size calculation = 16 participants needed) were asked to follow, after a 3-day standard run-in diet, 7 days of either a low- or a high-carbohydrate diet, while a CGM (Abbott Libre Sense) measured their interstitial glucose, for 14 consecutive days. On the last day of each diet period, participants performed a 3-h training, with two 3-min all-out intervals at the start and at the end of the session, while power data were recorded. Glucose data were divided into sleep and wake phases and analyzed using the *iglu* Shiny app: mean glucose level, coefficient of variation (CV) and mean amplitude of glycemic excursion (MAGE) metrics were considered. Time in range (< 70, 70–140, > 140 mg/dL) was also calculated. Given the current low sample size, no statistical tests were conducted; results are reported as percentage variations.

Results: Data collection is currently ongoing. Preliminary data from three participants revealed slightly lower mean glucose levels during

sleep (− 6.9%) and wake time (− 4.4%) during the low-carb compared to the high-carb week. Nocturnal hypoglycemic episodes were detected only during low-carb. CV and MAGE seemed to not be affected by the dietary protocol. During the high-carb week, average power was higher in both 3-min intervals (+ 7.4%), and there was a lower decrease in power between the initial and final burst (− 4.1%) compared to the low-carb week (− 10.6%).

Conclusions: CGMs might offer a fast and easy snapshot of blood glucose levels. However, the usefulness of this technology to optimize off- and on-the-bike fueling strategies is questionable and needs further investigation.

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OP3—Circadian cardiovascular responses to exercise in the elderly with and without type 2 diabetes: is exercising in the morning more dangerous than in the evening?

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Purpose: Cardiovascular (CV) events strike more frequently in the early morning compared to the evening and normally increase with aging. The presence of type 2 diabetes (T2DM) further increases such an incidence. A 40% higher risk of heart attack, 29% increased risk of cardiac death, and 49% higher risk of stroke is reported in the morning. Endothelial function is blunted in the morning compared to the evening, while peripheral vascular resistance and arterial pressure are increased. We assessed whether CV response to exercise is potentially more dangerous for health in the morning vs evening in the elderly without and with T2DM.

Methods: Measures were performed on 30 old healthy individuals (H50-80; 50–80 years) and 30 old individuals with T2DM (T2DM18-30; 50–80 years), in the early morning (6am) vs evening (9 pm), at rest and during a 5-min isometric handgrip exercise at 30% of maximum voluntary contraction. A wide range of strong CV risk-related factors, including aortic stiffness assessed via carotid-femoral pulse wave velocity (cf-PWV), sympathetic vasoconstrictor responsiveness (SVR), forearm vascular conductance and blood flow, and arterial pressure, were measured via Doppler Ultrasound and haemodynamics monitors. Data were compared via 2-way RM ANOVA (effects of daytime and T2DM).

Results: Cf-PWVs were similar in the morning vs evening in both groups at rest ($p > 0.10$; H50-80: 7.9 ± 1.6 vs 8.5 ± 1.3 m/s; T2DM50-80: 8.0 ± 1.4 vs 8.6 ± 1.2 m/s) and during exercise ($p > 0.52$; H50-80: 8.2 ± 1.4 vs 8.7 ± 1.4 m/s; T2DM50-80: 8.4 ± 1.5 vs 8.7 ± 1.1 m/s), and also ($p > 0.81$) between H50-80 and T2DM50-80. SVR was similar in the morning vs evening in both groups ($p > 0.90$; H50-80: 0.4 ± 16.9 vs $0.1 \pm 16.6\%$; T2DM50-80: 11.3 ± 14.1 vs $10.4 \pm 11.5\%$), but higher ($p < 0.01$) in T2DM50-80 compared to H50-80 at both day times. The changes in vascular conductance ($p > 0.83$) and blood flow ($p > 0.16$) from rest to exercise were similar in the morning vs evening in both groups, although these differed between the two groups in the morning ($p < 0.01$) but not in the evening ($p > 0.20$).

Conclusions: At specific hours when CV risk is significantly different, there are small, non-statistically significant changes in variables related to CV risk at rest and during exercise, in both groups. However, our data reveal a neurovascular response to exercise altered by T2DM, as well as a different CV response to exercise in healthy vs diabetic individuals which is evident in the morning only.

OP3—Effects of 24-week polarized training vs. threshold training on body composition and cardiorespiratory fitness in obese male adults

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Purpose: Polarized Training (POL), induces greater Polarized Training (POL), induces greater improvements in body composition, maximal oxygen uptake ($\dot{V}O_2\text{max}$) and ventilatory thresholds in well-trained athletes, compared to threshold training (THR), even if POL has never been applied in adult males with obesity. In addition, adipose tissue produces adipokines that can be harmful or beneficial. Thus, the purposes of this study were to investigate changes in body composition, $\dot{V}O_2\text{max}$, ventilatory thresholds, and adiponectin expression induced by a 24-week either POL or THR program in obese male adults under their normal living conditions with a running competition at the end of the 24 weeks of training, for increasing adherence of participants to training.

Methods: Twenty male patients (mean age 39 y; mean body mass index [BMI] $33 \text{ kg}\cdot\text{m}^{-2}$) participated in this study (n: 10 POL, n: 10 THR), performed 3 sessions a week, for 24 weeks, supervised online by researchers. At baseline (PRE) and at the end of the training period (POST) body composition, physical capacities and expression levels of adiponectin were measured. POL group performed ~ 85–90% of total training below the first ventilatory threshold, and the remaining 10–15% above the second ventilatory threshold. The THR group performed ~ 65–70% of total training below the first ventilator thresholds, and the remaining 20–30% between the two ventilatory thresholds.

Results:

At POST, body mass (BM) and fat mass (FM) decreased by $-3.20 \pm 3.10 \text{ kg}$ ($P < 0.05$) and by $-3.80 \pm 2.80 \text{ kg}$ ($P < 0.05$) in a similar way for POL and THR groups. $\dot{V}O_2\text{max}$ and $\dot{V}O_2$ at RCP increased more in the POL group ($+8.5 \pm 12.2$ and $+9.0 \pm 17.0\%$, $P < 0.05$) than THR group ($+4.24 \pm 8.64$ and $+4.0 \pm 6.70\%$, $P < 0.05$), while $\dot{V}O_2$ at GET increased similarly in both groups ($+12.8 \pm 12.0\%$, $P < 0.05$). Also, seventeen of the twenty participants performed a challenge that is run a half marathon, a 30 km, or a marathon, depending on the level reached at the end of the study. Serum adiponectin levels increased in both groups (27.0 ± 2.6 vs. $22.3 \pm 4.5 \mu\text{g/mL}$; $p < 0.05$). Salivary adiponectin levels increased in both groups (22.8 ± 10.0 vs. $17.6 \pm 7.5 \text{ ng/mL}$; $p < 0.05$).

Conclusions: POL and THR were equally effective in improving body composition in obese subjects. On the contrary, POL training improved $\dot{V}O_2\text{max}$ and $\dot{V}O_2$ at RCP more than THR, without difference in $\dot{V}O_2$ at GET. Also, decreased adiposity is associated with a modified adiponectin profile. Thus, the results of this study could provide the foundation that over a long period of time (i.e. ≥ 24 weeks) POL training, represent a good alternative from the classical training applied in obese subject like (HIIT), or THR. Finally, the addition of a competition at the end of the study, has kept high the

adherence to training that, generally, tends to decrease after the first 2–3 months from the beginning of a training program.

OP3—Chronotype affects the physical performance of American football players

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Purpose: People typically display preferences for activity at certain time of day. These differences allow to distinguish three chronotypes: Morning-, Neither- and Evening-types (M-, N- and E-types) [1]. Several studies documented the influences of chronotype on sports performance [2], however, no one investigated them in the American football game. The present study aimed to verify whether physical performance differs related to chronotype in American football players.

Methods: Participants filled out the Morningness-Eveningness Questionnaire to evaluate their chronotype. After, they performed 4 physical tests: 40 yards (40y), L test (Lt), two-arms standings shot put (2-ASSP), and long jump (LJ), in order to evaluate different physical abilities: strength, agility, arms and legs power respectively. The physical tests were carried out on two different days, in the morning (8:30–10:00 am) and in the evening (8:30–10:00 pm), with a 3–4 day break.

Results: 43 male athletes were recruited (21.8 ± 4.6 years). The sample consisted of 12% (n = 5) M-types, 60.5% (n = 26) N-types, and 27.9% (n = 12) E-types. The three chronotypes showed similar results in physical tests conducted in the morning or in the evening session. The time of day in which the tests were carried out influenced the sports performance in E- and N-types. M-types showed no difference in test results between the morning and evening sessions, possibly due to the small number of participants. E-types performed better in the evening session than in the morning for all tests (40y: 5.4 ± 0.3 vs 5.3 ± 0.2 s., $p = 0.001$; Lt: 5.4 ± 0.3 vs 5.2 ± 0.2 sec., $p = 0.005$; 2-ASSP: 5.1 ± 0.5 vs 5.2 ± 0.5 m., $p = 0.001$; LJ: 2.1 ± 0.2 vs 2.2 ± 0.2 m., $p = 0.016$; morning vs evening sessions respectively). N-types performed better in the evening only in Lt (5.2 ± 0.2 vs 5.1 ± 0.2 s., $p = 0.013$), 2-ASSP (5.2 ± 0.4 vs 5.3 ± 0.5 m., $p = 0.042$), and LJ (2.2 ± 0.2 vs 2.3 ± 0.2 m., $p = 0.004$). A trend of improvement in performance during the evening session was found for 40y in N- types (5.40 ± 0.2 vs 5.36 ± 0.21 s., $p = 0.06$).

Conclusions: we can affirm that chronotype is able to influence the performance of American football athletes, in relation to the times of the day in which the tests take place. This provides useful information to trainers and coaches for the evaluation of the athlete's performance and for a correct work planning, in order to obtain the maximum benefits from training.

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OP3—Safety and tolerability of a supervised exercise program in patients with advanced/metastatic lung and pancreatic cancer

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Purpose: exercise (EX) is considered an adjunctive treatment for patients with cancer, given its benefits and potential impact on prognosis. Most evidence derives from studies conducted on patients with early-stage disease. This study aims to test the safety and feasibility of a 12-week EX program in patients with advanced lung or pancreatic cancer.

Methods: at the Oncology Unit in the Verona Hospital, patients with lung or pancreatic cancer were recruited to participate in a supervised EX program. The EX- program consisted of combined training, performed twice a week, including aerobic and strength exercises. The aerobic component progressively increased over weeks from 10 to 30 min at moderate intensity, whereas strength training, consisting of body weight or elastic-bands exercises, was performed in 2–3 sets of 8–12 repetitions at moderate intensity. EX intensity was checked using the 10-point Borg Rating of the Perceived Exertion Scale. Safety was monitored through the Common terminology Criteria for Adverse Event (AEs) v.5.0. Tolerability was evaluated by adherence to baseline and post-intervention assessments, adherence to the program, and the withdrawals rate. Secondary outcomes included cardiorespiratory fitness with the “Six minutes walking test” (6MWT), strength using the handgrip strength test and leg press test, and quality of life with the European Organization for Research and Treatment of Cancer Quality of Life and Core Questionnaire (EORTC-QLQ-C30). Exploratory outcomes were changes in neutrophils and platelet levels.

Results: Ten patients (four with lung and six with pancreatic cancer) were included in this analysis. Compliance was 100%, adherence to the exercise sessions was 83.6%, and no dropouts were registered. Regarding safety, seven Grade 1 AEs were recorded: delayed onset muscle soreness (n = 3), headache (n = 3), and dizziness (n = 1). 6MWT significantly increased (540.7 m vs. 576.3 m, p = 0.047), while positive tendencies were observed for handgrip strength (+ 3.2 kg), and leg press test (+ 19.5 kg). Neutrophils and platelet levels increased, even if statistical significance was not reached. No significant changes were detected in the EORTC-QLQ-C30.

Conclusions: The EX-program was shown to be safe and tolerable in patients with advanced/metastatic lung or pancreatic cancer. A randomized controlled trial will be set to verify the efficacy of this program in this population.

OP3—Neuromodulatory effects of theta burst on performance and fatigue: from the cortex to the muscle

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Purpose: Given the increased potential of repetitive transcranial magnetic stimulation to improve chronic fatigue, this study investigated the acute effects on neuromuscular fatigue and performance of different protocols of theta burst stimulation (TBS) during elbow flexion task in a young population.

Methods: In three distinct experimental sessions 10 young healthy subjects were subjected to three TBS protocols (intermittent TBS, continuous TBS, and sham TBS) and performed a fatiguing isometric sustained task to failure (35% MVC) of the elbow flexor to induce fatigue. Before and after the TBS and the task, maximal and sub-maximal isometric contractions were executed to measure: performance by maximal force (MVC) and time to task failure (TTF), changes in voluntary activation (VA, central fatigue) and potentiated twitch force (Q_{tw,pot}, peripheral fatigue) via the interpolated twitch technique, corticospinal excitability through the area and the cortical silent period (CSP) of each motor evoked potential (MEP).

Results: Compared with the sham condition (175 ± 70 s), TTF differs significantly in cTBS (126 ± 12 s) and not in iTBS (213 ± 73 s). MVC, VA, and Q_{tw,pot} decreased for effect of time during each TBS protocol, but only VA changed after cTBS (pre: 91 ± 4; post: 41 ± 40Nm) and iTBS (pre: 95 ± 5; post: 86 ± 6 Nm), compared to sham (pre: 93 ± 6; post: 69 ± 14 Nm). Also, the same trend of VA was reflected by the area and the CSP of the MEP after cTBS (area pre: 0.17 ± 0.12; post: 0.93 ± 0.55 mV s; CSP pre: 23 ± 12; post: 63 ± 22 ms) and iTBS (area pre: 0.15 ± 0.14; post: 0.14 ± 0.14 mV s; CSP pre: 18 ± 7; post: 20 ± 11 ms), compared to the sham (area pre: 0.14 ± 0.12; post: 0.32 ± 0.21 mV s; CSP pre: 20 ± 9; post: 37 ± 18 ms).

Conclusions: Both iTBS and cTBS seem to influence central fatigue and corticospinal excitability. Interestingly, such protocols partially alter the exercise performance without effects on peripheral fatigue. These preliminary data suggest that short non-invasive brain stimulation tools could have a relevancy in the modulation of central fatigue and exercise performance.

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OP3—Test of gross motor development (TGMD-3): evidence of motor competence and associations with sex in kindergarten children

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Purpose: Fundamental Motor Skills (FMS) play a crucial role within the general development of children and are important for further learning processes about special motor skills. The level of FMS is affected by gender and age. The aim of this study was to evaluate the locomotor and ball skills in male and female of 3, 4 and 5 years old.

Methods: A sample of 236 children (M = 119, F = 117) were tested using the Test Gross Motor Development 3rd Edition (TGMD-3) administrated by an expert. All data were stratified for gender and age. Descriptive statistics (mean ± DS) and the ANOVA (2-way)

were carried out, in order to highlight the significant differences ($p < 0.05$) among group. The measurement obtained from the TGMD 3 is the sum of raw results of the locomotor and ball skills subtests that make up the TGMD 3. The gross motor index (GMI) was obtained from the normalization tables in males and females of the two subtests. The standard Score Average is within a range of 90–109, according to Ulrich (2020).

Results: Take into consideration overall age, females showed higher GMI scores in all motor tests ($F = 108.62 \pm 10.98$; $M = 102.87 \pm 11.98$; $p = 0,000$) while ages compare shows alternating significant differences at 3y.o. ($F = 104.54 \pm 10.62$; $M = 98.09 \pm 11.29$, $p = 0,000$) at 4 y.o ($F = 111.37 \pm 12.34$; $M = 106.90 \pm 11.04$, $p = 0.113$) and 5 y.o. ($F = 109.61 \pm 9.90$; $M = 101.54 \pm 12.16$, $p = 0,000$). According to age the 3 y.o. group revealed minor GMI results than 4 y.o. (3y. 102.03 ± 11.24 ; 4y. 108.70 ± 11.71 ; $p = 0.003$). Further relation between 3 and 5 y.o. as 4 and 5 y.o. (5 y. 105.58 ± 11.76) not shows significant differences. Interaction between age per sex is not significant ($p = 0.577$).

Conclusions: In this kind of performance the female group is better than the male: a positive and unexpected result because of FMS in girls declines later (Coppens et al., 2021). These data show that FMS changing along 3–5 y.o does not follow a constant increase. The unstable FMS value is not an expected result, as an increase seems more likely in this age group. The decrease that is recorded between 4–5 years in the TGMD-3 represents a situation to consider because they are years of great neural plasticity and learning capacity.

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OP3—Stakeholder perceptions on the new professional figure of the sports Kinesiologist: an exploratory study

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Purpose: This study aims to understand stakeholders' perceptions in the world of amateur football concerning the recent provisions for master's degree graduates in Sport Sciences and Techniques (LM68), introduced by Legislative Decree No. 36 of Feb. 28, 2021. The problem is the existence of an overlap between the private legislation of the Italian Football Federation (FIGC) and the State legislation regarding the new professional profile in charge of planning, coordinating and conducting the training activities of football players in both professional and amateur fields. This overlap violates the principles of the institute of the European Qualification Framework (EQF), in the European Union and enlarged states, which declines the different educational levels in the common space of continental Europe

Methods: The work is based on a survey conducted through a questionnaire submitted to a sample characterized by presidents and instructors of 8 ASDs in the province of Salerno. The questionnaire consists of two thematic sections. The first section presents 5 items, common for both presidents and instructors, regarding the legislative innovation of the decree, seeking to detect perceptions of kinesiologists' enjoyment, appropriateness, usefulness, and scientificity for stakeholders. The second section presented 5 differentiated items. Presidents were asked to assess the work and knowledge of the instructors registered with their ASD. On the other hand, instructors were asked to self-assess themselves, judging their technical, methodological, and scientific skills. The collected data were analyzed using Fisher's exact test to check the correlation between the answers given by the interviewees.

Results: From the results, it was possible to appreciate a discordance of opinion from stakeholders regarding the new professional figure of the kinesiologist. Although most presidents and instructors favor introducing such a figure, contradictions emerge concerning the contribution the new professional profile can make in practice ($p = 0.03$; $p = 0.05$).

Conclusions: The perceptual contradictions that have emerged among stakeholders fuel the regulatory confusion described in the inherent problematic nature of overlapping the same professional functions accessed by different levels of education. Noting the sample limitations of the study and the primitive formulation of the questionnaire, it is necessary to replicate it to provide useful evidence to the legislature.

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OP3—Improved ankle dynamic balance and mobility in patients with ankle osteoarthritis after total ankle replacement

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Purpose: Total ankle replacement (TAR) is a treatment for end-stage ankle osteoarthritis which aims to reduce pain and restore ankle functions, such as mobility and range of motion. The Star Execution Balance Test (SEBT) allows to assess strength, flexibility, neuromuscular control, core stability, range of motion, balance, the interaction between proprioception, and joint stability. Furthermore, SEBT is proven to be useful for screening deficits in dynamic postural control among groups with lower extremity conditions. The aim of this study is to evaluate dynamic balance and ankle mobility differences between side-to-side pre-and post-TAR.

Methods: Eighteen patients (mean age = 60.3 ± 10.1) on the waiting list for TAR were enrolled in this study. All patients were evaluated before and after (> 9 months) the surgery. Each patient performed the short version of SEBT, which consist of 3 directions to reach with one foot: anterior (A), postero-medial (PM), and postero-lateral (PL). The means of tree trials for each direction were reported. All directions

were reached first with the non-operated leg (NoOp) and then with the operated leg (Op). The outcome was normalized upon leg length ((distance cm/leg length cm) \times 100). The pre-post surgery and the side-to-side difference in SEBT scores in A, PM, and PL directions were calculated pre- and post-TAR and compared through a paired sample *t* test ($p < 0.05$).

Results: Considering the pre- and post- surgery evaluation of the replacement ankle, all SEBT have improved (A pre = 57.3, post = 58.1, $p > 0.05$; PM pre = 71.9, post = 75.3, $p > 0.05$; PL pre = 53.1, post = 60.6, $p < 0.05$). Moreover, the outcomes of the healthy leg improved, even though the results were not statistically significant ($p > 0.05$). Concerning the side-to-side differences, a significant reduction was found for PL direction ($p = 0.004$, Cohen's $d = 0.79$) but not for the A and PM directions ($p > 0.05$).

Conclusions: The results of the study showed that the SEBT outcomes in patients with TAR improved after the implantation of the prosthesis. Indeed, the side-to-side difference between the Op and NoOp leg decreased, showing an improvement in dynamic balance and mobility. On the whole, the ankle prosthesis allows to partially restore symmetrical levels of dynamic balance between Op and NoOp legs measured through the SEBT.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP3—Validity of the Italian version of the talk test

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Purpose: Talk Test (TT) is commonly used as surrogate of maximal testing exercises due to its simplicity, validity and easily expose to determine exercise intensity in several populations. Since only few study validated its use in different languages, this study aimed to determine the validity of the Italian version of TT in healthy young adults.

Methods: Thirteen (female = 5; male = 8) young adults (age: 24.7 ± 3.0 years, body mass: 67.6 ± 14.9 kg, body height: 1.7 ± 0.7 m, BMI: 22.0 ± 4.3 kg/m²) participated in this study. Subjects performed one TT and one submaximal exercise test (SET) with respiratory gas analysis on a treadmill. The testing sessions consisted of a 3-min warm-up with a slope of 1% (fixed for the tests' execution time) at a comfortable subjectively speed of 60-65% of maximal heart rate (HRmax). The speed was increased by 1 km/h every 2 min (each stage) and subjects were required to rate their perceived exertion (RPE) on a 0 (rest)—10 (maximal effort) scale. At 1.5 min into each stage of the TT protocol, subjects were required to recite the Italian version of the Olympic Oath "I promise that we shall take part in these Olympic Games, respecting and abiding by the rules which govern them, committing ourselves to a sport without doping and without drugs, in the true spirit of sportsmanship, for the glory of sport and the honor of our teams". Immediately after reciting the speech, subjects were asked "Can you speak comfortably?" with three possible answers: "Yes", "Not sure" or "No". Tests were stopped if subjects: reached the 90% of HRmax; "No" as answer and subjects' fatigue. RPE and running speed values were averaged for the tests. Independent *t*-test was used to compare RPE and speed within TT and SET. Linear regression analysis (R2) to assess the relationship between TT and SET was used. Root mean square error (RMSE) was also calculated and statistical significance was set at $p < 0.05$.

Results: No differences ($p < 0.05$) were found between tests within RPE (TT: 3.4 ± 1.2 ; SET: 3.1 ± 1.3 AU) and speed (TT: 8.2 ± 1.5 ; SET: 8.9 ± 1.8 km/h). Strong and very strong linear relationship were found for RPE ($R^2 = 0.79$; RMSE = 0.58, $p \leq 0.0001$) and speed ($R^2 = 0.95$; RMSE = 0.40, $p \leq 0.001$) between TT and SET.

Conclusions: The strong relationship between the TT and SET indicated that TT might be a valid tool to assess exercise intensity when maximal tests with respiratory gas analysis are impractical due their sophisticated technologies and cost.

OP3—B-thalassemia patients show decreased efficiency of the neuromuscular function associated with chronic tissue hypoxia

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Purpose: Increased muscular fatigue in β -Thalassemia patients has been related to a combination of lower hemoglobin levels, lower cardiac efficiency, or increased deconditioning. Challenging this hypothesis, we studied the neuromuscular function in these patients, evaluating its possible association with chronic tissue hypoxia.

Methods: In a cross-sectional study, neuromuscular, hematological, biochemical and clinical features of patients affected by Transfusion-Dependent β -Thalassemia (TDT) or Non Transfusion-dependent β -Thalassemia (NTDT) were analyzed and compared to healthy subjects. Estimates of neural drive were obtained during submaximal isometric contractions by decomposing high-density electromyographic signals into the activity of individual motor units from the *vastus medialis* and *vastus lateralis* muscles. Muscle fiber conduction velocity (MFCV) was measured as an indirect estimate of average muscle fiber size. Serum HIF1 α and HIF2 α were measured by ELISA.

Results: A total of 36 subjects (15 healthy, 10 NTDT, 11 TDT) were enrolled in the study. Median age was 29 (range 20–43), 50% were female. Knee extension mean torque was lower in TDT group ($P = 0.038$), controlled for all relevant covariates, including GPAQ. When controlling for recruitment threshold and discharge rate at recruitment, the motor unit discharge rates were higher ($P = 0.014$) in TDT (12.0 ± 0.3 Hz) than in healthy controls (10.9 ± 0.2 Hz), while MFCV was lower ($P = 0.027$) in TDT (4.8 ± 0.5 m/s) than in healthy controls (5.3 ± 0.5 m/s). NTDT showed intermediate values for all parameters considered above. Serum HIF1 α levels were 4.3 ± 4.3 , 2.9 ± 1.9 , and 24.9 ± 42.2 ng/mL in healthy, NTDT and TDT, respectively ($P = 0.056$). HIF2 α levels did not differ significantly among groups. Both HIF1 α and HIF2 α correlated negatively with max torque exercised (Spearman's $\rho = -0.355$, $P = 0.036$ and $\rho = -0.416$, $P = 0.013$, respectively) and with MFCV ($\rho = -0.43$, $P = 0.02$ and $\rho = -0.60$, $P < 0.001$, respectively).

Conclusions: The increase in neural drive required to produce knee extension torques suggests lower efficiency of muscle tissue in β -Thalassemia patients. Chronic tissue hypoxia is associated with these features and could contribute to explain such modifications.

OP3—Barriers to physical activity practice in people with multiple sclerosis: a multicenter cross-sectional study

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Purpose: People with multiple sclerosis (pwMS) are more likely to be sedentary than the general population. It is known that this behavior can lead to disability and the development of comorbidities. The aim of this study was to define the main barriers that prevent physical exercise and to emphasize the importance of the general practitioner (GP) in promoting an active lifestyle.

Methods: The study was voluntarily attended by pwMS (≥ 18 years old) from the Multiple Sclerosis Center of IRCCS Mondino Foundation in Pavia and at the Italian MS Society (AISM) Rehabilitation Centre Liguria, in Genoa, Italy. A cross-sectional study design was performed using a self-administered survey that included information about demographic and disease characteristics, current physical activity, barriers, and motivation to exercise. A logistic regression model was used to estimate the odds ratio and the corresponding 95% Confidence Intervals for practicing exercise considering as covariates age, gender, disease duration, GP's advice, level of disability, and disease course. The analysis was performed using JASP software (2019, Version 0.11.1), and $p < 0.05$ was considered as statistically significant.

Results: The survey was completed by 741 pwMS (age 55.6 ± 12.5 , 66% females). Most respondents (75.3%) did not practice any exercise. The most common barrier to attending and/or starting an exercise program was fatigue, followed by travel and/or moving issues and a lack of time. Only 25.5% of participants were advised by their GP to exercise, but 48.6% of them attended an exercise program. People who received the GP's advice had a higher likelihood of practising than those who did not receive it (OR 2.96; $p = 0.001$). Finally, 69 out of 99 (69.7%) of pwMS who did not practice but received advice from GPs were more motivated to begin an exercise program.

Conclusions: Fatigue and physical issues are the main barriers to exercise for pwMS, but also other factors not related to the disease seem to be relevant, like travel issues and lack of time. We observed that the role of GP is crucial to persuade pwMS to practice exercise and sports. Therefore, the general Practitioners are encouraged to suggest starting an exercise program to pwMS who are not currently exercising.

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OP3—Development and validation of a questionnaire to assess benefits and risks of competition in primary physical education (BRC-PE)

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Purpose: International guidelines suggest competitive activities to be part of physical education (PE) programmes, as they can promote fair play, courage, commitment, teamwork, respect, and enjoyment among pupils (UNESCO, 2015; WHO, 2010). Despite these recommendations, primary school teachers are often reluctant to propose competitive activities in PE, and this is often due to their beliefs (Bernstein et al., 2021). The paper presents the development and validation of an instrument to assess primary teachers' beliefs about competition in PE.

Methods: A systematic literature review allowed identifying 13 papers exploring competition in PE settings. An initial pool of 37 items was extracted and organised in two emerging themes: *benefits* and *risks* of competition in PE. A sample of 433 participants (9.9% men) completed the questionnaire. The sample consisted of in-service primary school teachers (76.0%; M age = 45.6; $SD = 10.9$) and Education Science students (24.0%; M age = 23.5; $SD = 3.52$). Two hundred seventy-one participants (62.6%) reported to have experience in competitive sports, 258 (59.6%) reported experience in teaching PE.

Results: A Confirmatory Factor Analysis (CFA) was run to test a bidimensional model. Items were reduced in two steps: first, non-normally distributed items were removed; second, items were removed one at a time based on the lowest factor loading. The final model demonstrated excellent fit [$\chi^2(df) = 276.04(126)$, $\chi^2/df = 2.191$, $p < .001$; CFI = .96; TLI = .95; IFI = .96; RMSEA = .053 (CI: .044–.061)] with eight items accounting for each dimension. The two dimensions also demonstrated good reliability (*benefits*, $\alpha = .86$; *risks*, $\alpha = .88$). Differences between groups on the final items emerged: (1) in-service teachers perceived less risks than university students; (2) men perceived more benefits than women; (3) participants with experience in competitive sports perceived more benefits and less risks than participants with no-experience; and (4) participants with experience in teaching PE perceived less risks than participants with no-experience.

Conclusions: The Benefits and Risks of Competition in Physical Education (BRC- PE) 16-item questionnaire demonstrated validity and reliability for use within an Italian speaking population. Findings suggest participants' gender and experiences to influence beliefs about competition in PE. Further studies should extend the validity of the BRC-PE to other languages and cultures.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP4—Functional tests for ACL injury risk assessment: sex differences in landing kinematics

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Purpose: Non-contact Anterior Cruciate Ligament (ACL) injuries often occur during single-leg landings. Injury mechanisms involve adducted hip, extended knee, valgus stress, anterior tibial shear force, increasing knee load. Women present higher ACL injury rate than men, suggesting investigations in sex biomechanical differences through landing functional tests (LFTs). The use of fixed box height and jump length for males and females may affect the perceived difficulty and the results consequently. Therefore, this study investigated sex kinematic differences through LFTs, adjusted on physical and performance characteristics, analysing how FTs affect sex comparison.

Methods: 27 females and 29 males (18–30 years, 2+ weekly trainings, no lower limbs' injuries in the last 6 months, no knee injury history) performed hop, drop jump, drop jump + vertical or forward jump, with the dominant leg. The hop length was 90% of maximal forward jump (MJF), while 60% MJF in drop tasks with box height set at 20% of subjects' height. A 9-camera optoelectronic system detected the movements 38 skin-mounted markers and provided lower limb joints peak angles. Two-Way MANOVA (sex and FT, $\alpha = 0.05$) was used to analyse kinematics during landing (from initial contact to max knee flexion).

Results: Data from one male and three females were discarded from analyses, due to technical problems. MANOVA revealed significant effects of sex ($p < 0.001$) and LFT ($p < 0.001$), but not their interaction. Women landed with higher hip adduction ($p = 0.001$), knee abduction ($p < 0.001$) and knee internal rotation ($p = 0.050$) than men, with less flexed hip ($p = 0.002$) and knee ($p = 0.001$). The LFT affected hip and knee flexion and ankle dorsiflexion and eversion (all $p < 0.001$).

Conclusions: The LFTs were customized to perform unbiased sex comparison. Women showed riskier ACL injury-related patterns. High hip adduction and knee abduction imply lower joint control, as well as higher knee internal rotation. Their combination increases the ACL strain more than any other rotation, so they are main ACL injury risk factors. The extended leg is attributable to worse H:Q ratio that also affects the tibial anterior shift, increasing the risk. Although LFT affected lower limb kinematics, the interaction term had no effects, meaning that sex differences were independent on LFT. The customized LFTs may highlight athletes' harmful biomechanics to plan subject-specific ACL injuries prevention program.

OP4—Efficacy of a respiratory gymnastprotocol for healthcare professionals with post-COVID-19 conditions: the pilot study “breath again”

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Purpose: The “Breath Again” project was born thanks to the Health Promotion Program of the Department of Public Health of AUSL Bologna (Italy). The aim is to provide long-term support to health workers affected by SARS-CoV-2, contributing to their psychophysical recovery and enhancing the awareness and improvement of respiratory dynamic.

Methods: Six meetings, lasting two hours each, were held in Bologna province with 14 healthcare professionals (12 females and 2 males; age 44.49 ± 10.67) from October to December 2021. During the first and the last session all participants completed two questionnaires (EuroQol-5D-5L and “ad hoc questionnaire”) to assess respectively the health-related quality of life, self-perception and efficacy related to the intervention. They also performed the 1-Minute Sit-to-Stand

Test (1 m-STs). In the remaining four meetings, the subjects carried out a protocol of exercises focused on respiratory dynamics structured by the AUSL Bologna's kinesiologists in collaboration with Yoga and Feldenkrais instructors. After each lesson, the participants were asked to repeat at home, independently, one exercise from those performed and report in a diary the perception experienced. Paired sample T-test were used to assess baseline (T0) and follow-up (T1) differences.

Results: The 1 m-STs test showed a mean increase (T0 = 32.29 ± 10.29 VS T1 = 35.14 ± 12.62). The average EuroQol-5D-5L improved showing an average decrease (T0 = 0.91 ± 0.09 VS T1 = 0.90 ± 0.13 with a change of 0.14 ± 0.09 points (ns). Regarding the section “how is your health today” from the EuroQol-5D-5L, the average score increased from 73.77 ± 18.86 (T0) to 77.92 ± 14.83 (T1) with an average increase of 4.15 ± 10.29 (ns). Finally, the “ad hoc questionnaire” scored 15.25 ± 2.05 (T0) and 16.83 ± 2.21 (T1), with a mean increase of 1.58 ± 2.35 ($p < 0.04$).

Conclusions: The improving trend of the 1m-STs and the EuroQol-5D-5L results suggest an improvement in the physical status and in the health related quality of life after the intervention. Nevertheless, the most significant data are driven from the “ad hoc questionnaire”, which shows important perceived benefits in terms of self-perception and self-efficacy following the intervention. These results suggest that a path dedicated to building a self-awareness of the body using respiratory gymnastics can positively affect the quality of life of people experiencing post-Covid respiratory problems. The usefulness of expanding this intervention to a wider audience as possible emerges.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP4—Resistance training periodization in the COVID-19 ERA: mixed session versus block periodized programs in trained men

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Purpose: The purpose of the present investigation was to compare the effects of a mixed session resistance training program to a block periodized program on maximal strength, power, muscle morphology and perceived training load, in resistance trained individuals.

Methods: Twenty-two resistance trained men were randomly assigned to either a mixed session training (MSP; $n = 11$; age = 23.7 ± 2.6 y; body mass = 80.5 ± 9.8 kg; height = 175.5 ± 6.1 cm) or a block periodization (BP; $n = 11$; age = 25.7 ± 4.6 y; body mass = 81.1 ± 10.7 kg; height = 176.8 ± 8.4 cm) group. MSP and BP programs were equated in volume and included 10 weeks of training. The MSP program focused on power, maximal strength and hypertrophy in each training session while each mesocycle of BP was unidirectionally focused on one of these components. Participants were assessed for body composition, muscle morphology, maximal strength, upper and lower body power prior to and following the training period. In addition, training load (TL) was monitored using a session RPE approach.

Results: MSP led to significantly larger improvements than BP in fat free mass ($p = 0.018$; + 2.8% and 0.4% in MSP and BP, respectively), muscle thickness of the pectoralis ($p = 0.008$) and vastus lateralis ($p = 0.038$). MSP also showed a significantly greater improvement in IRM bench press ($p = 0.001$; + 8.6% in MSP and + 2% in BP). In contrast, BP program resulted in significantly greater improvements in vertical jump ($p = 0.017$; + 7.2%)

compared to MSP (+ 1.2%). No significant differences were noted between the groups for TL ($p = 0.362$).

Conclusions: Results of this study indicate that MSP may enhance hypertrophy and maximal strength to a greater extent than BP with the same training volume and perceived TL. However, BP may be more effective for lower body power improvement. The absence of specific phases in MSP makes this model more appropriate in time of pandemic when the date of the competitions may be subjected to sudden changes. BP programs indeed, require appropriate mesocycle lengths and a clear competition calendar, to align cumulative and delayed effects of the different unidirectional training phases with the main competitions.

OP4—Acute aerobic exercise and Irisin serum levels in young and middle-aged adults

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Purpose: Irisin is a hormone-like myokine involved in several and relevant physiological processes. Recently, there is an increasing interest in studying irisin, and its response to acute aerobic exercise (1). Indeed, aerobic physical activity can increase the circulating level of this myokine, promoting pleiotropic beneficial effects on human health. However, the exact outcome of acute aerobic exercise on the amount and time release of irisin is unknown (1, 2). The aims of this study were to explore the impact of an incremental exercise on serum irisin level in healthy male adults and to compare the acute exercise-induced irisin changes in young and middle-aged individuals.

Methods: Sixteen participants, young adults (YA: $n = 8$; age: 24.5 ± 2 y; BMI: 22.8 ± 2 kg/m²; peak oxygen uptake (VO₂peak): 47.5 ± 6 ml/kg/min) and middle-aged adults (MA: $n = 8$; age: 43.0 ± 9 y; BMI: 23.5 ± 2 kg/m²; VO₂peak 47.0 ± 8 ml/kg/min) performed an incremental exercise until exhaustion on a cycle ergometer. Their VO₂peak was determined via direct gas analysis and their blood samples were collected before the test, 15 min and 24 h post-exhaustion. The serum levels of irisin were determined using ELISA Assay (#EK-067–29).

Results: There were no differences between groups in BMI and VO₂peak ($p > 0.05$). Baseline irisin levels were significantly higher in YA with respect to MA (9.4 ± 1.1 vs 7.5 ± 1.8 ng/ml; $p < 0.05$). A significant increase of irisin level was detected 24 h after acute aerobic exercise both in young and middle-aged adults (4.2 ± 2.1 and 5.8 ± 2.5 ng/ml, respectively; $p < 0.001$). Noteworthy, after acute aerobic exercise, the change in serum irisin concentrations from 15 min to 24 h was significantly greater in MA than YA (4.4 ± 1.7 vs 2.8 ± 1 ng/ml; $p < 0.05$), resulting in a comparable irisin level 24 h post-exercise (13.3 ± 1.9 vs 13.6 ± 1.5 ng/ml; $p = ns$).

Conclusions: This study has shown that an acute aerobic exercise determined an increase in serum irisin concentration (both in MA and YA) and the highest values of irisin concentration were obtained 24 h post-exhaustion. Surprisingly, 24 h after exercise MA have achieved

the equivalent irisin level of YA, despite having lower basal irisin values.

Acknowledgments: We thank the young (students of Exercise and Sport Science degree course) and the middle-aged adults for the voluntary participation to the study.

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OP4—Translational research in the exercise oncology: effects of a home-based lifestyle intervention program and supervised exercise on the tumorigenic potential of triple-negative breast cancer cells

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Purpose: The use of cell culture models in exercise oncology has recently received growing interest [1], offering the opportunity to evaluate the effects of different exercise types and intensities and to identify physiological predictors of those effects. We have previously shown that conditioned serum, obtained after high-intensity endurance cycling sessions performed by healthy young women, markedly impacted the microtumor-forming capacity (3D growth) of cancer cells [2]. Here, the effects of a home-based lifestyle intervention program and supervised exercise in breast cancer survivors (BCS) are presented.

Methods: Conditioned sera were obtained from sedentary BCS enrolled in two ongoing clinical trials. The first trial (MoviS, NCT04818359) aimed to evaluate the effects of lifestyle interventions on the quality of life of BCS who, in the first recruitment round (30 subjects), followed a 12-week home-based, remotely supervised, moderate intensity aerobic exercise training program. The second trial (20 subjects) aimed to evaluate the effects of two on-site supervised aerobic exercise sessions performed at moderate and vigorous intensity. Serum samples were used to induce 3D microtumor growth in semi-solid medium.

Results: Results from the first trial revealed that 16 out of 30 serum samples obtained after the intervention training showed a $> 5\%$ of reduction in microtumor formation capacity with respect to serum collected before (21.2% on average). Considering samples from all 30 BCS, the average reduction was 10.2% ($p > 0.01$). Interestingly, statistical analyses revealed that IGF-1 was the only predictor of microtumor formation. Preliminary results from the second trial revealed that the microtumor formation induced by serum collected after the exercise sessions is 10–15% less than that induced by serum taken at rest, without any significant differences between exercise intensity.

Conclusions: These results demonstrate the potential of a lifestyle intervention program in tumor progression control. The precise evaluation of the effects induced by exercise and lifestyle changes in relation to physio/metabolic parameters could allow us to identify predictors useful for cancer prevention. Improving our understanding of the relationship between physical exercise and cancer progression will be useful in optimizing recommendations and exercise protocols for cancer recurrence prevention.

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OP4—Impact of active lifestyle on the primary school children oral microbiota composition

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Purpose: The composition of human oral and gut microbiota is influenced by diseases, including cardiovascular and Non Communicable Diseases (NCDs)¹ and by regular training according to the intensity and volume of training^{2,3}. The aim of this study was to compare the oral microbiota composition in active (A) and non-active (NA) primary school children living in Piedmont Region.

Methods: 126 primary school children (5 Piedmont schools; 47.3% female; mean age = 10 ± 1 y) were classified according to the questionnaire (PAQ-C-It) and accelerometry (Actigraph wGT3X-BT) in A and NA⁴. The composition of oral microbiome was investigated in all children using 16S rRNA sequencing. Amplicon sequence variants (ASVs) were filtered, decontaminated and phylogenetically assigned using DADA2 software⁵. Differential abundance analysis for microbiome taxa and pathway data were obtained using LEfSe algorithm⁶.

Results: *Prevotella pallens* and *aurantiaca*, *Gemella para-haemolysans* and *Neisseria mucosa* were most abundant species (Linear Discriminant Analysis (LDA) score: 4.0, 3.5, 3.0, 4.0; False Discovery Rate (FDR) 0.015, 0.005, 0.010, 0.005, respectively) in NA compared to A oral microbiota. Conversely, *Parabacteroides merdae*, *Simonsiella muelleri*, *Collinsella aerofaciens*, and *Prevotella nigrescens* were most abundant species (LDA score: 2.5, 3.0, 3.5, 4.0; FDR 0.015, 0.005, 0.010, 0.005, respectively) in A compared to NA oral microbiota.

Conclusions: We evidenced differences in abundance and diversity of microbiota species in A compared to NA children; in particular the abundance of species like *Parabacteroides merdae* associated to healthier profile⁷ in A and species like *Neisseria mucosa* associated to unhealthy phenotype⁸ in NA children. Our results highlight the influence of active lifestyle on the healthier oral microbiota composition.

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OP4—lifelong football training affects circulating MIR-1303 expression and mcf-7 human breast cancer cell line proliferation and migration

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Purpose: The aims of the present study were to analyse the effects of lifelong football training on the expression of circulating miR-1303 in veterans football players (VPG) and on the proliferation, and migration of human breast cancer cells (MCF-7) in in-vitro system.

Methods: 15 VPG and 15 active untrained (CG) males matched for age (66–72 y) were recruited by the Copenhagen University. Blood samples at rest (VPG and CG) and immediately after a football match (VPG) were collected. MCF-7 cells were cultured to confluence in DMEM with 10% FBS¹ than starved in 0.5% FBS for 18 h and scratched to perform a wound healing assay 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 (miR-1303-I; mir-Vana® miRNA mimic, Thermo Fisher, Italy) for 24 h and 48 h; the wound closure percentage was calculated in each group and among the groups. The expression of mir-1303 in sera from VPG and CG pools and in transfected MCF-7 cells was determined by RTqPCR. Phospho-AKT (Ser473) and mTOR protein expression levels were determined by western blot analysis in MCF-7 cells after 48 of treatment.

Results: We found that the expression of miR 1303 was downregulated in the serum pool from VPG compared to CG (p < 0.05), as we previously demonstrated in the vastus lateralis muscle from VPG compared to CG². We demonstrated an increase of 18% in wound closure in miR-1303 compared to FBS or miR-1303-I treated MCF-7 cells (p < 0.05), respectively at 24 h. Moreover, MCF-7 cells treated with VPG pool sera shows a 15% compared to CG (p < 0.05) and 21% reduced wound closure compared to miR-1303 transfected cells (p < 0.01), respectively at 24 h. Significant increase of Phospho-AKT (Ser473) and mTOR proteins expression were found in miR-1303 compared to FBS or miR-1303-I treated MCF-7 cells (p < 0.05) after 48 h.

Conclusions: Our preliminary results indicate that the expression of circulating miR- 1303 was lower in VPG compared to CG; we also evidenced that miR-1303 expression affect proliferation and migration of MCF-7 cells by targeting PI3K-AKTmTOR pathways. Ongoing experiments are in progress in order to evaluate the effects of lifelong football training on MCF-7 cell invasion.

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OP4—Relationship between perceived mental health and physical activity levels: observational study in 63 subjects with intellectual disability

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Purpose: People with intellectual disabilities have a greater risk of developing anxious-depressive syndromes than the regular practice of physical activity results, in the general population, in a behavior able to prevent and control the symptoms of these pathologies. This study aims to investigate the relationship between the amount of physical exercise performed and the level of mental health perceived in people with intellectual disabilities.

Methods: This observational study was carried out through the administration of questionnaires in paper or electronic form at national sports federations, cooperatives, and associations in charge of subjects with intellectual disabilities. The study subjects were evaluated through medical history questionnaire, Self-assessment scale of anxiety and depression according to Zung (SAS/ SDS)² and IPAQ-SF questionnaire for the detection of physical activity levels.

Results: Of the 63 participants in the study (Aged 36 ± 13), 36% had mild intellectual disability, 56% moderate and 6% severe. Weak and not statistically significant correlation between amount of physical activity and perceived anxiety level was observed ($r = 0.23$; $p > 0.05$). Weak but statistically significant correlation was observed between the amount of physical activity performed and the level of perceived depression ($r = 0.30$; $p = 0.01$). For further analysis the subjects were then divided into tertiles based on the amount of physical activity carried out expressed as MET/week (First tertile 0-999 MET, second tertile 1000-2999 MET, third tertile 3000 + MET). A statistically significant difference in perceived anxiety levels was observed between first and third tertile ($p = 0.03$), and in perceived depression levels between first and third tertile ($p = 0.03$).

Conclusions: The relationship between the amount of physical activity performed and the level of perceived mental health remains unclear, probably due to the sample being too small and heterogeneous. However, it was possible to observe how the tertile composed by the most active subjects (> 3000 MET) reported levels of anxiety and depression which were significantly lower than the tertile composed by the least active (0–999 MET). It is therefore likely to believe that people with intellectual disabilities can benefit from participation in sport and physical activity reducing depressive and anxiety symptoms.

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OP4—Evaluation of back muscles asymmetries in adolescent idiopathic scoliosis through infrared thermography

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Purpose: Adolescent idiopathic scoliosis (AIS) is a three-dimensional spine deformity characterized by a structural alteration with the vertebrae rotated and displaced from the normal body axes. The method for diagnosing scoliosis is x-rays; however, they may have adverse health effects and are often prescribed before the actual presence of scoliosis is even hypothesized. Currently, the clinical assessment of AIS is achieved with the forward bending test and measuring the hump with the scoliometer. Infrared thermography (IRT) is an alternative noninvasive method that can individuate any thermal asymmetry of the body, pointing out an altered muscle activity in that area. Scoliosis individuals commonly present lower sEMG activity of the concave side muscles compared with the convex side muscles; IRT can measure that difference. This study aimed to analyze the back surface temperature of adolescents with and without scoliosis to detect differences between concave and convex sides.

Methods: Forty-eight adolescents were recruited, 24 of whom had AIS diagnosed by x-rays. The back surface temperature was assessed with the FLIR E54 thermal imaging camera. The muscles trapezius (TM), latissimus dorsi (LDM), and quadratus lumborum (QLM) were considered. Moreover, they were classified according to the scoliosis situs into thoracic scoliosis, thoracolumbar scoliosis, and individuals without scoliosis. For statistical analysis, the mean temperature differential (Δ mt) between the left and right sides was analyzed by ANOVA and post-hoc Tukey test.

Results: The mean age of the sample is 13.4 ± 2.32 years, weight 50.0 ± 10.4 kg, height 152 ± 11.4 cm. The thoracic scoliosis group presents a Δ mt of the TM of $0.47^\circ\text{C} \pm 0.16^\circ\text{C}$, the Δ mt of the LDM is $0.37^\circ\text{C} \pm 0.30^\circ\text{C}$, the Δ mt of the QLM is $0.63^\circ\text{C} \pm 0.35^\circ\text{C}$. The thoracolumbar scoliosis group presents a Δ mt of the trapezius muscle of $0.19^\circ\text{C} \pm 0.22^\circ\text{C}$, the Δ mt of the LDM is $0.42^\circ\text{C} \pm 0.21^\circ\text{C}$, the Δ mt of the QLM is $0.49^\circ\text{C} \pm 0.26^\circ\text{C}$. The non-scoliotic group presents a Δ mt of the trapezius muscle of $0.09^\circ\text{C} \pm 0.09^\circ\text{C}$, the Δ mt of the LDM is $0.12^\circ\text{C} \pm 0.09^\circ\text{C}$, the Δ mt of the QLM is $0.21^\circ\text{C} \pm 0.27^\circ\text{C}$.

Conclusions: The findings confirm the thermal differences between the right and left side muscles of the back in those individuals with thoracic and thoracolumbar scoliosis; meanwhile, non-scoliotic individuals did not present a statistically relevant temperature differential.

OP4—Effect of a 12-week training program with unstable devices on strength and dynamic balance in older adults

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Purpose: Ageing involves several physiological changes such as loss of muscle mass, muscle strength, and alteration of balance control mechanisms. Consequently, there is an increased fall risk that can lead the older adult to a reduced self-sufficiency in daily living activities. Investigating the role of different physical activities to

counteract the age-related declines deserves attention. The present study aimed to evaluate the effects of two trainings performed with and without unstable devices, on dynamic balance control and lower limb strength.

Methods: 37 healthy older adults (M = 16; F = 21; mean \pm SD: 72.9 \pm 5.3 yrs; 1.62 \pm 0.17 m; 69.6 \pm 12.5 kg) volunteered to participate to the study. They were randomly assigned to a control (CTRL, no training), stable (ST, training on firm surfaces) or unstable (UNST, training with unstable devices) group. The two training protocols lasted 12 weeks and included two sessions per week. Subjects were assessed three times: before starting the training protocol, after 6 weeks of training, and at the end of the training. Balance tests were performed over a dynamometric platform (AMTI BP6040—AMTI force and motion) placed on a servo-controlled electrically driven movable platform (Shaker 100, EnginLAB srl, Padova, Italy). Subjects underwent 3 trials where a sudden perturbation occurred (direction: posterior-anterior; displacement: 50 mm; ramp rate: 100 mm/s). Each trial lasted 60 s and the perturbation was randomly produced between seconds 20 and 40. Two trials without perturbations were randomly administered to avoid an expected perturbation every trial. Considering the first 2.5 s after the perturbation, we calculated the displacement between the maximum and minimum peak of the anterior-posterior CoP trajectory (Max-oscillation) and the standard deviation of that trajectory within the time window (post-perturbation variability—PPV). The maximal strength of the dominant leg was assessed isometrically with a custom-built chair and a load cell.

Results: An overall training effect was detected for the isometric strength ($p < 0.001$). Max-oscillation and PPV decreased in both ST and UNST after training ($p < 0.001$).

Conclusions: Our findings demonstrated that both stable and unstable trainings are useful to improve dynamic balance and strength performance in healthy older adults. Further investigations are needed to better determine the exercise progressions since the greatest improvements occurred after 6 weeks of training.

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OP4—Impact of different movement education methodologies on the development of motor skills and executive functions in preschoolers

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Purpose: Generalist teachers in kindergarten often struggle to practice movement education with preschool children. Some difficulties may arise from lack of knowledge of appropriate methods and techniques. The purpose of the research is to investigate the impact of teaching methods on the development of motor skills and executive functions in preschoolers.

Methods: A quasi-experimental study was carried out. Three intact kindergarten classes with the same economic background ($n = 87$; mean age = 5.36 yrs) were recruited. Each class underwent 10 lessons, 1-h each, once a week. 35 children followed the "Storytelling in Motion" method, 22 "free play" and 29 "traditional" movement education. Standardized tests were administered before and after the study: TMC, M-ABC-2, test of physical fitness, day/night test. A mixed between-within subjects' analysis of variance was conducted to

assess the impact of the three different interventions (Storytelling, free play, traditional PA), across two time periods.

Results: There was significant interaction between program type and time, and for time (Wilks' Lambda) in some tasks of all the three groups, and the main effect comparing the three types of interventions was significant for the tasks: throwing bean bag; long jump; jumping on mats; walking, running in slope; platform bricks; bicycle trail, day/night, suggesting a difference in the effectiveness of the three teaching approaches. In the two executive function tasks (bicycle trail and day/night) only the moving storytelling method produced a significant increase over program type and time ($= .001$) and among groups ($= .043$).

Conclusions: All three methods showed significant results in some motor tasks and significant results comparing the three approaches. Executive function tasks seem to benefit from the in-motion storytelling method, in line with the literature. This study would need to be replicated on a larger number of children and also investigating different socioeconomic levels. However, these results are encouraging for supporting the mission of preschool teachers.

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OP4—A causal analysis of factors affecting ball velocity in the sitting volleyball serve

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Purpose: In current practice the technical instructions of the Sitting Volleyball (SV) serve is largely based on intuition, being to some extent guided by the biomechanical information describing the Standing Volleyball serve. This is the first study exploring the performance of the SV serve by investigating the causal factors associated with the post-impact ball velocity (VBALL).

Methods: Thirty-seven SV male athletes aged 37.8 \pm 12.7 years underwent linear anthropometry and upper body strength assessment and performed ten successful maximal effort serves. For each serve, VBALL was measured using a sports radar gun. At the instant of ball impact, the hip, shoulder, elbow and wrist angles (HipANGLE, ShoulderANGLE, ElbowANGLE and WristANGLE respectively) as well as the height of the ball (HeightIMPACT) were estimated through 2D motion analysis. The causal relationships between variables were described using a Directed Acyclic Graph (DAG), identified by the application of the Peter-Clark causal discovery algorithm, and modelled by a linear Structural Equation Model (SEM).

Results: The DAG and the related estimated SEM showed that a smaller HipANGLE determines a greater ShoulderANGLE which, in turn, causes a greater ElbowANGLE. A more open ElbowANGLE together with a greater vertical reach allowed for a greater HeightIMPACT. Finally, increased HeightIMPACT along with greater abdominal strength are beneficial for higher VBALL. The evaluation of the goodness of fit model evidenced an overall R^2 of 0.85 and a root mean squared error of approximation of 0.16, indicating an acceptable goodness of fit of the model to the data. The R^2 of the equations explaining VBALL, HeightIMPACT, ElbowANGLE and

ShoulderANGLE were 0.56, 0.74, 0.24 and 0.29, respectively. The P values of the likelihood ratio test of the estimated SEM vs the saturated model and of the estimated SEM vs the baseline model were $P = 0.027$ and $P < 0.001$, respectively.

Conclusions: These results underlined that the SV serve is a multifactorial stroke involving anthropometric, technical and strength factors and suggest that athletes should improve their abdominal strength and master the technique necessary to perform the serve with the shoulder and the elbow joints fully extended in order to produce the greatest possible impact on the ball. Understanding the causal factors related to the SV serve performance is of scientific and practical interest for coaches and physical conditioners to improve their training programs.

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OP4—Cardiovascular effects of whole-body cryotherapy in non-professional athletes

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Purpose: Whole-body cryotherapy (WBC) is a recent strategy widely used for muscle recovery after injury that can activate inflammatory response and counteract the inflammatory response due to specific diseases, characterized by high levels of inflammation. WBC consists of 2–3 min exposure to dry air at cryogenic temperatures up to -190°C . The study aimed to investigate changes in blood pressure, heart rate, oxygen saturation, respiratory rate, and body temperature in non-professional trained runners during WBC.

Methods: Ten middle-distance runners received 3 once-a-day sessions of WBC. Subjects underwent blood pressure measurements and ECG recorded before and immediately after the daily WBC session. During WBC we recorded a single lead trace (D1) for heart rhythm control. In addition, the 5 vital signs blood pressure, heart rate, oxygen saturation, respiratory rate, and body temperature were monitored before, during, and after all WBC session.

Results: We did not report significant changes in ECG main intervals (PR, QT, and QTc). Mean heart rate changed from 50.98 ± 4.43 bpm (before) to 56.83 ± 4.26 bpm after WBC session ($p < 0.05$). The mean systolic blood pressure did not change significantly during and after WBC [baseline: 118 ± 5 mmHg, changed to 120 ± 3 mmHg during WBC, and to 121 ± 2 mmHg after session ($p < 0.05$ vs. baseline)]. Mean respiratory rate did not change during WBC as well as oxygen saturation (98 vs. 99%). Body temperature was slightly increased after WBC, however it remains within physiological values.

Conclusions: In non-professional athletes WBC did not affect cardiovascular response and can be safely used. However, further studies are required to confirm these promising results of safety in elderly non-athlete subjects.

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OP4—Effect of an active breaks intervention in terms of classroom behaviour: results from an ad hoc questionnaire for Italian’s teachers enrolled in 2021 vs 2022

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Purpose: The most frequented environment for children is the school where they spend most of their daily time. For this reason promoting physical activity (PA) during school provides additional opportunities for children to be physically active. Active breaks (ABs) are short bouts of PA led by teachers inside the classroom. ABs interventions have shown an effect on different health outcomes including cognitive health and classroom behaviour. The aim of our study was to evaluate the teachers’ perception toward children classroom behaviour after performing ABs comparing 2021 with 2022.

Methods: We conducted a pre-post multicentre study, from January 2021 to July 2022. Each school performed ABs for ten weeks. An ad hoc questionnaire (five- points Likert scale) was administered to a female sample of teachers from different cities (centre-northern Italy), to assess possible differences in perceptions about students’ behaviours classroom before and after the ABs intervention. Specifically, the 15 items proposed were divided in to the following domains: student’s classroom wellbeing, student time on task and teaching’s benefits. SPSS.22 was used to conduct statistical analysis.

Results: A total of 88 teachers answered to the questionnaire (mean age 49.96 ± 8.41). The pre-post differences were calculated using paired T-test and ANOVA was performed to analyse group differences. Results show a general significant improvement in students’ classroom well-being ($+ 0.95 \pm 3.70$; $p = 0.018$) and children’s time on task ($+ 1.72 \pm 3.73$; $p = 0.000$). We obtained no differences in consideration of teaching benefit. We reported a trend of improvement in the total score even if not- statistically significant ($+ 1.57 \pm 10.22$). No differences were found for children’ or teachers’ age and social context (city and suburban). Observing the year of recruitment of the schools there was a difference in the general score of the questionnaire before the ABs (2021 = 48.98 ± 7.16 VS

2022 = 51.89 ± 7.15) and after the ABS (2021 = 49.16 ± 11.07 VS 2022 = 53.73 ± 10.25 p = 0.05)

Conclusions: Our results underlined that ABs produce positive effects on student well-being and time on task behaviour based on teachers' perception. In addition, there was an improvement in general well-being both before and after ABs in 2022 compared to 2021, reflecting the negative impact of COVID-19 on school well-being. This intervention appears to be feasible and manageable for all age groups and settings supporting the idea that all teachers can use ABs in different settings.

OP4—Functional assessment of a transfemoral amputee subject treated with osseointegration surgery

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Purpose: The purpose of the present study was to provide the functional assessment of a transfemoral amputee patient before osseointegration surgery and after rehabilitation by means of wearable sensors

Methods: A transfemoral amputee patient (male, 47 years, time from amputation 18 years) scheduled for osseointegration surgery was enrolled. The patient was able to walk without aids and performed a gait test the day before surgery with his standard socket-type prosthesis, consisting in 10-m walking in a hospital indoor hall, two at self-selected speed and two at the fastest speed possible. The test was repeated 3 months after surgery (after the clearance from the rehabilitation, 3 M FU), and 6 months after surgery (6 M FU). A set of 17 wearable inertial sensors (Awinda, Xsens Technologies) was used to collect full body kinematics. Complete gait cycles were isolated and spatiotemporal and kinematical parameters were extracted. The differences between the amputee (AL) and the sound (SL) limb among the follow-ups were reported. One-way ANOVA with post-hoc comparisons was conducted in Spm1D (p < 0.05).

Results: Shorter step length and longer swing phase were found for the AL at pre-op, with greatest differences in the midstance. Also, hip abduction and rotation, pelvis forward tilt and obliquity, trunk forward tilt, and lateral bending on the AL were also noticed. At follow-ups, symmetry index progressively improved (1.14, 1.09, 1.06 at pre-op, 3 M FU, and 6 M FU, respectively). Asymmetries in hip abduction, hip rotation, and pelvis rotation decreased at follow-ups and no more trunk forward and lateral tilt were found.

Conclusions: The altered spatiotemporal and kinematical parameters found preoperatively were in line with the current literature [1]. After rehabilitation, the patient showed higher time spend on the AL and lesser kinematical asymmetries. The osseointegration surgery showed to progressively restore a physiological kinematics in the transfemoral amputee patient.

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OP4—Could a massed fit-light training program improve executive functions in basketball players?

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Purpose: Basketball requires a strong cognitive involvement of Executive Functions (EFs). However, the demands for sport seasons do not permit planning a distributed schedule of practice to improve EFs. Therefore, we implemented a massed training program by means of Fit-light to enhance EFs in young basketball players during pre-season period.

Methods: A total of forty-nine players (age = 15.0 ± 1.5 yrs, BMI = 21.0 ± 2.8 kg/m²) were divided into FIT-L and CTRL groups. Both performed the same basketball training program, daily enriched with Fit-light training or shooting session in FIT-L and CTRL group, respectively. The subjects were assessed before and after a massed schedule of practice over a period of 3 weeks (5 training sessions per week) in both cognitive (Eriksen Flanker and Digit Span tasks) and fitness tests (T-test, Yo-Yo IR2 and 10 m sprint test). Moreover, perceptual and emotional (eRPE; sRPE; PACES; PBS-S) measures have been collected during the training period to understand the temporal dynamics of the training effect, comparing FIT-L and CTRL groups.

Results: RM-ANOVA (2 groups × 8 times) did not show any differences on Digit Span and Flanker task between groups and group × times interaction. Similar results were found also for fitness and emotional tests. However, RM-ANOVA (2 groups × 6 times) on session and exercise perceived effort (RPE) showed significant interaction effect groups × times (sRPE: p value = 0.0001; eRPE: p value = 0.01) with higher values in FIT-L vs CTRL group after training.

Conclusions: A three weeks of massed practice enriched with Fit-light training increased the perceived training effort, most likely due to higher cognitive demands maintaining the same level of enjoyment in both groups. However, this kind of training seems not to generate additional improvements in the FIT-L group compared to CTRL in EFs, fitness level and emotional responses. Future studies should analyse the effect of a Fit-light distributed practice rather than a massed one on EFs.

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OP4—Comparison between conventional and neuronavigated strategies to assess corticospinal responsiveness in unfatigued and fatigued knee-extensor muscles

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Purpose: In the study of neuromuscular fatigue, researchers commonly use functional criteria to position and hold the transcranial magnetic stimulation (TMS) coil. This could influence the magnitude of corticospinal excitability and inhibition responses due to imprecise and unsteady positions of the coil during testing sessions. To reduce coil position and orientation variability, neuronavigated TMS (nTMS) could be used. We evaluated the accuracy of nTMS and a standardized function-guided procedure for maintaining TMS coil position both in unfatigued and fatigued knee extensors.

Methods: Eighteen participants (10F/8 M) volunteered in two identical and randomized sessions. Maximal and submaximal neuromuscular evaluations were performed with TMS three times before (PRE_1) and three times after (PRE_2) a 2 min resting session and one time immediately after (POST) a 2-min sustained maximal voluntary isometric contraction (MVIC). The located “hotspot” was maintained either with or without nTMS. MEP, silent period (SP) and the distance between the “hotspot” and the actual coil position were recorded.

Results: A time \times contraction intensity \times testing session \times muscle interaction was not observed for MEP, SP, and distance. Bland-Altman plots presented adequate agreements for MEP and SP.

Conclusions: Spatial accuracy of TMS coil position over the motor cortex did not influence corticospinal excitability and inhibition in unfatigued and fatigued knee extensors. The variability in MEP and SP responses may be due to spontaneous fluctuations in corticospinal excitability and inhibition, and it is not altered by the spatial stability of the stimulation point.

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OP4—On the acceleration, velocity and mechanical power of the maximal sprinting

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Purpose: The aim of this study was to develop an equation to compute the mechanical external power (P_{ext}, i.e. the power needed to accelerate and rise the body centre of mass (BCoM)), as a function of velocity. The so obtained P_{ext}, added to mechanical internal power (P_{int}, i.e. the power needed to accelerate limbs with respect to the BCoM), yields the total mechanical power, the power that the muscle-tendon units exert to move the body. Mechanical power, acceleration and velocity were computed on the fastest sprint performed up to now, the Usain Bolt world record (WR) on the 100 m.

Methods: Based on Pavei et al. (2019) and Zamparo et al. (2019) data, we developed the equation for P_{ext} as a function of velocity (and acceleration) and it was applied to the velocity time-course of the WR. From Minetti (1998) and Pavei et al. (2019) we computed P_{int} based on the kinematic available data on the WR.

Results: WR peak acceleration occurred at the very beginning of the sprint, whereas top velocity, with its mono-exponential increase, was reached after about 7 s. P_{ext} peaked (35.6 W/kg) at 1.2 s and then decreased mainly due to the decline of the acceleration. P_{int} increased mono-exponentially with the velocity and reached a plateau (33.4 W/kg) after about 7 s. The sum of the two components yielded an increased total power up to 2.9 s (50.3 W/kg) and a consequent plateau.

Conclusions: This is the upper limit of the mechanical power that can be exerted during a sprint, but it is a paradigmatic example of the interplay between acceleration and velocity. During the initial steps of the sprint, acceleration reaches the maximum values when the velocity is very low; by increasing sprint time, as the velocity increases, the acceleration tends to vanish. This complementary behaviour of acceleration and velocity reveals that metrics which rely on only one aspect are not so effective. On the other hand, mechanical power accounts, by definition, for both acceleration and velocity and could be a more useful parameter to monitor when accelerative (and decelerative) events are considered.

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OP4—The career pathway of Italian soccer players selected for national teams: young or senior success?

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Purpose: We aimed to verify if senior international athletes had international experience during their time as youth athletes.

Methods: We recorded the list of convocations in youth and senior national teams of 1206 Italian male soccer players. We calculated how many senior national players were already selected in youth national teams (retrospective analysis) and how many junior national players have been subsequently selected in senior national teams (prospective analysis). We also analyzed the asymmetric birthdate distribution of national team players, representing the consequences of the relative age effect (RAE).

Results: We found that: (i) less than 40% of players selected in senior national teams have already been selected in U18 and U19 teams; (ii) less than 20% of players selected in U16, U17, U18, and U19 national athletes have been subsequently selected in the senior national team. The players born in the first quartile of the year were 8.0 and 2.5 more represented than those born in the last quartile of the year in U16 and U21, respectively. The RAE was smaller in players who successfully transitioned from junior to senior national teams compared to those who failed the transition.

Conclusions: Most players in the senior national team were not previously selected in youth national teams suggesting that junior international experience is not a prerequisite for an international career in adulthood. There was a large prevalence of RAE in junior

national teams and which decreased with age. Overall, the selection for junior national teams in the junior categories seems weakly related to senior careers.

Comparison of Core Stability versus McKenzie Exercises in people with low back pain: effects induced by 4 weeks of training on pain, flexibility and spine mobility

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Purpose: 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 in LBP management is well documented, even if the debate about the most effective type of training is still present. The aim of this study is to investigate the effects of a 4 weeks specific training on LBP symptoms, trunk mobility and muscle flexibility in adult people suffering from this pathology.

Methods: Thirty people (age: 30–50 years old) were recruited for the study. All participants were untrained and affected from chronic non-specific LBP. Participants were divided into 2 groups composed by 15 people each one: Training Group 1 (TG-1) and Training Group 2 (TG-2). Both groups trained twice a week for 4 weeks (8 sessions in total) with a duration of 30 minutes each session. TG-1 performed 7 Core Stability exercises with focus on core muscles activation while TG-2 executed 6 McKenzie method exercises (spine mobility and specific LBP antalgic positions). All participants were assessed pre and post training to evaluate pain intensity (Numerical Rating Scale—NRS), posterior chain muscles flexibility (Forward Bending Test—BEND) and trunk mobility (Schober Test—SCHOBER). In addition to group training, participants repeated Core Stability (TG-1) or McKenzie (TG-2) exercises individually at home.

Results:

NRS and SCHOBER significantly improved in both TG-1 and TG-2 ($p < 0.01$), while significance was observed in BEND for TG-2 only ($p < 0.05$). Group comparison evidenced significance for NRS, with better improvements observed TG-1 ($p < 0.01$). No differences were reported for SCHOBER and BEND during TG-1 and TG-2 comparison ($p > 0.05$).

Conclusions:

Previous results suggest that both type of training are effective for pain reduction and lumbar spine mobility improvements, while only McKenzie exercises increased posterior muscle chain flexibility during forward bending test. Since Core Stability exercises led to better results about LBP symptomatology after 4 weeks of specific training, the combination of both kind of exercises could be useful in people suffering from LBP.

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OP4—A systematic approach to assessing the gender dimension in sport science

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Purpose: Historically, the sport has been based on sex, and the determination of sex was based on biological criteria, which does not account for transgender and intersex persons who experience incongruence between their biological sex and gender identity. Bearing in mind that the principles of non-discrimination and gender equality are defined as fundamental in Chapter 1 of the Olympic chart, it is essential to include both the sex and gender dimension in every stage of development and implementation of sports research, policy, or health interventions. To date, scientific literature focuses more on physical and physiological differences in the sport between athletes and athletes, and only a few studies have been conducted addressing the role of gender. Moreover, gender-specific data are rarely collected from relevant indicators, and gender assessment tools have only infrequently been used. Therefore, this study aimed to emphasize the need for a systematic approach to assessing the gender perspective in sport medicine.

Methods: This was a perspective study that wanted to open a discussion on the introduction of the Gender Impact Assessment (GIA), an evidence-based methodology that carried out an ex-ante or ex-post evaluation to analyze the impact of gender, and plan interventions, programs, or policies to improve gender equality through gender-oriented strategies. Analyzing physiological (e.g. cardiorespiratory fitness, muscle strength, metabolic production and gait biomechanics), biochemical parameters and psychological factors, including social relations of power linked to gender and culture, emerges that there were gender inequalities in sports science.

Results: According to GIA, there is a need for ad hoc laboratory reference ranges that consider the combined impact of physical activity on the physiological sex-based differences. Moreover, there is a need to promote gender equality and prevent discrimination based on gender identity and/or sex/gender variations.

Conclusion: GIA is an evidence-based tool that can assess how policies, programs, and services meet all people's different needs and inspire positive transformational change, allowing researchers, policymakers, and stakeholders to leave the gender binary vision and to adopt a more inclusive gender continuum based on the real-world data.

OP5—Physical activity and sleep behaviour in women carriers of BRCA 1/2 mutations

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Purpose: The *BRCA 1/2* mutations are the most known typologies of hereditary breast cancer (BC). In women carry these mutations, studies have provided preliminary evidence of a protective role of physical activity (PA) against BC, particularly during adolescence or early adulthood. The German LIBRE study confirmed a significantly lower BC prevalence in *BRCA 1/2* women who reported higher PA during their adolescence. In addition, physical activity has also been shown to improve or have a protective effect on sleep in women with a diagnosis of BC. Aim of the present study is to explore the potential association between sleep quality and PA in women carriers of *BRCA1/2* mutations.

Methods: 63 women (47.6 ± 12.4 years) with *BRCA 1/2* mutations in care at Fondazione IRCCS Istituto Nazionale dei Tumori, Milan were recruited for the study. The participants filled out the *Godin Shephard Leisure-Time Physical Activity Questionnaire* (GSL-TPAQ) and the *Pittsburgh Sleep Quality Index* (PSQI) for the evaluation of the PA levels and sleep, respectively. Moreover, they underwent to anthropometric, metabolic, and blood sample evaluations. Data were analyzed with SPSS version 27.

Results: Through the questionnaires, the women were classified as inactive ($n = 41$) and active ($n = 22$), and as bad ($n = 37$) and good sleepers ($n = 26$). Good sleepers showed significantly higher PA levels compared to bad sleepers. Women in the higher tertile of GSL-TPAQ total score (≥ 27 METs/week) have a prevalence ratio (PR) of being good sleeper of 2.85 (1.25–6.52, 95% confidence intervals) compared to women in the lower tertile (≤ 11 METs/week). These results were consistent in *BRCA1* and *BRCA2* women. Considering each single question of PA intensity, the PR of being good sleeper by unit of increase of METs/week was higher and significant in women engaged in strenuous and moderate intensity PA.

Conclusions: These findings suggest a direct association between PA and sleep quality in women carriers of *BRCA* mutations.

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OP5—NIRS Assessment of skeletal muscle oxidative metabolism impairment in patients with Friedreich's ataxia

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Purpose: Friedreich's ataxia (FRDA) is an inherited autosomal recessive disorder affecting primarily central and peripheral nervous systems, skeletal muscle and myocardium. In FRDA patients, reduced levels of the mitochondrial protein called frataxin cause impairment of mitochondrial function, iron overload and increased oxidative stress [1]. Current clinical scales estimate disease severity based on symptoms as progressive gait disturbances, limb ataxia and muscle weakness [2]. These scales cannot quantify skeletal muscle mitochondrial dysfunction and they have moderate sensitivity to change, usually requiring an elevated number of subjects or long period of

treatment in interventional trials [3]. Thus, new quantitative approaches to monitoring disease progression are needed. Near infra-red spectroscopy (NIRS) is a non-invasive technique which has been demonstrated effective in assessing muscle impairments in patients with chronic obstructive pulmonary disease, chronic heart failure and metabolic myopathies [4]. The aim of the study was to assess whether NIRS can be a valid tool to evaluate skeletal muscle oxidative metabolism impairment in FRDA patients.

Methods: Nine FRDA patients (age: 28 ± 8 ys) and fourteen healthy subjects (CTRL, age: 25 ± 3 ys) were recruited. Fractional O_2 extraction ($\Delta HbMb$) of vastus lateralis, expressed as % of a reference value obtained during a transient ischaemia of lower limb, was evaluated by NIRS during an incremental exercise test up to exhaustion on a recumbent cycle-ergometer [4]. Muscle oxidative capacity ($m\dot{V}O_2$) of gastrocnemius medialis was estimated by NIRS from recovery rate constant (k) of tissue saturation index changes during intermittent arterial occlusions [5].

Results: In FRDA patients mean age at onset was 16 ± 6 ys, mean score on the Scale

for the Assessment and Rating of Ataxia (SARA) was 18 ± 7 (out of 40). $\Delta HbMb$ was lower in FRDA ($37.1 \pm 13.2\%$) compared to CTRL ($65.0 \pm 21.8\%$, $p = 0.003$). k was lower in FRDA ($1.20 \pm 0.52 \text{ min}^{-1}$) compared to CTRL ($2.75 \pm 0.76 \text{ min}^{-1}$, $p < 0.001$). A correlation was found between $\Delta HbMb$ and k ($r = 0.65$, $p = 0.004$).

Conclusions: FRDA patients, compared to healthy controls, showed impaired muscle oxidative metabolism of both vastus lateralis and gastrocnemius medialis. In addition, mitochondrial dysfunction estimated by NIRS was correlated between two muscle groups. Thus, NIRS represent an appealing non-invasive tool to characterize severity and progression of the disease in FRDA patients.

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OP5—Differences in maturity, body composition, and anthropometric characteristics among young volleyball players

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Purpose: Volleyball is a game characterized by intense efforts of short intensity. The main characteristics of volleyball athletes are jumping ability, power output, and force. Anthropometric characteristics play a determinant role and could vary according to the competitive level. In youth teams, it is important to consider maturity status because it could influence the performance of the athletes, but there is a lack of literature about this topic. For this reason, the present study aimed to verify differences in maturity status, body composition, and anthropometric characteristics of the athletes of eight under13 volleyball teams, and to value if maturity status influences the difference in the anthropometric/body composition characteristics. **Methods:** Ninety-four young volleyball players were recruited during a national tournament carried out in Treviso. Anthropometric characteristics (height, weight, lengths, widths, circumferences, and skinfold thicknesses (SK)) and bioelectrical impedance were carried out. Body mass index (BMI), body composition parameters (Fat mass (FM, kg), and Fat-free mass (FFM, kg)), and the areas of the upper

arm, calf, and thigh were calculated. In addition, the Bioelectric Impedance Vector Analysis (BIVA) procedures were applied. For each player maturity status was calculated. A two-way ANOVA was assessed to determine the differences between the teams

Results: Considering the maturity status, 62 boys (66.4%) were classified as “on time” (OT), 20 (21.3%) as “late” (L) and 12 (12.3%) as “early” (E). Three clubs presented boys with E as maturity status and two of them presented no boys with L maturity status. E boys presented significant higher values in several anthropometric characteristics (such as height, weight, and BMI) compared to OT and L players. However, E young volleyball players showed no significant differences in SK, and BIVA values compared to the other two groups. Regarding body composition, “E maturers” reported significant differences for FFM compared to OT and L, and for FM compared to L.

Conclusions: Young volleyball players classified as “E maturers” seemed to have higher values of the anthropometric characteristics linked to better performance. In fact, between the eight teams, two of them that presented “E maturers” were ranked in the top places of the tournament. The results of the present study could have practical implications for talent selection, but other studies are needed to better evaluate the relationship

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

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OP5—Ergometabolic and topographic evaluation of handbike tracks in urban area

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Purpose: Most people with walking impairments such as spinal cord injured people and lower limbs amputee do not reach the proper amount of weekly physical activity (PA) suggested by WHO and ACSM, due to their functional limitation. Low levels of PA and sedentary lifestyle are strictly related to higher incidence of non communicable disease. Local governments may contribute to PA practice with targeted policies and urban interventions to give these populations the infrastructures and the proper information related to the metabolic effort required to practice PA (Martin Ginis et al. 2021). In light of this, our work aimed to verify the possibility to classify different handbike urban tracks on their ergo metabolic cost. For users, informed choice is crucial for adherence to continuous PA

Methods: 10 healthy young adults cycled with a HB at self selected speed across four tracks suitable for HB in Brescia municipality. The subjects cycled 4 selected tracks (T1, T2, T3 and T4) on 4 different days. The evaluation was performed using a heart rate strap, a metabolimeter to calculate MET, an hub powermeter and Garmin Edge 510 to collect metabolic end topographical data.

Results: The track length was 2.57, 1.79, 0.96 and 2.66 km and the elevation gain was 8.4, 5.6, 3 and 23 m; then, the mean power used to perform the tracks were alike (69 ± 25 , 72 ± 28 , 71 ± 37 , and 76 ± 14 W) with similar peaks (193 ± 54 , 211 ± 63 , 252 ± 81 and 235 ± 24 W) for T1, T2, T3 and T4 respectively. In all the tracks the subjects performed at least a moderate PA (>3 MET). Moreover, MET and speed showed a statistically significant correlation on 3 of the 4 tracks tested (T1 $p < 0.001$ $R=0.9$, T2 $p < 0.001$ $R=0.89$, T3 $p=0.003$ $R=0.83$). On the other hand, T4 is the only track where all the

subjects performed no less than vigorous PA (>6 MET). In T1, T2, T3, moderate intensity PA was reached cycling at 8, 7.8, 7.5 km/h and vigorous intensity PA was reached at 14.9, 14 and 14.8 km/h respectively.

Conclusions: In summary, the topographical characteristics of all these tracks ensure the possibility to achieve moderate or vigorous PA, by modulating the cycling speed. The description of these tracks based on the ergometabolic cost could be a useful tool for people with walking impairments to plan and structure their exercise in order to raise the level of weekly PA. Last, the municipality may use this information to valorize these paths and to promote adapted PA in urban areas.

OP5—Changes in localized electrical impedance myography induced by fatiguing contractions and time-course of recovery

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Purpose: Local electrical impedance myography (EIM) has been demonstrated to change in response to different level of muscle contractions and fatiguing tasks. However, there is still little evidence about the potential use of EIM to assess muscle fatigue and monitor fatigue recovery. The aim of this study was to measure changes in EIM components induced by fatiguing contractions and the time-course of recovery.

Methods: Ten healthy men (mean \pm SD; age = 22 ± 1 yrs; body mass = 75.6 ± 9.2 kg; height = 175.5 ± 8.0 cm) underwent cycles of 5-s knee extensors maximum voluntary isometric contractions (MVIC)/5-s rest, until MVIC dropped to 50% initial MVIC. MVIC, EIM components (i.e., resistance, reactance, and phase angle) were measured locally (over the anterior thigh) via bioelectrical impedance analysis PRE, POST, POST 5 min (POST5), POST 10 min (POST10), and every 10 min (POSTX) until the 90th min of recovery after the fatiguing exercise. On a separate day, participants performed the same time-course of MVIC and EIM evaluations than the intervention session without the fatiguing task (CTRL).

Results: After fatiguing contractions, MVIC recovered within POST40 compared to PRE ($P > 0.05$). Resistance decreased peaking at POST20 (-6.5% , $P < 0.01$) and recovered within POST50 compared to PRE ($P > 0.05$). Reactance decreased peaking at POST20 (-21.6% , $P < 0.01$) and recovered within POST50 compared to PRE ($P > 0.05$). Phase angle decreased peaking at POST20 (-15.5% , $P < 0.01$) and recovered within POST50 compared to PRE ($P > 0.05$). Some inter-individual differences in recovery time were present, particularly for MVIC. No significant changes occurred during CTRL at any time points in any variable ($P > 0.05$).

Conclusions: These preliminary results show that fatiguing contractions induced alterations in the local EIM components. MVIC and local EIM alterations returned to PRE-values within 60 min from the cessation of the fatiguing task. These results indicate that local EIM may have the potential to monitor recovery after a fatiguing exercise. However, further experiments are needed to confirm these preliminary results and investigate inter-individual variability.

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OP5—Activity pacing in people living with HIV: technical issues in training prescription and monitoring through the combined use of an actigraph and smartphone app

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Purpose: Activity pacing (AP) is a strategy to manage fatigue during physical exercise programs to not exacerbate fatigue symptoms and improve adherence. We carried out a pilot study to investigate if a combined use of an actigraph (Philips Health Band) and smartphone app was useful to improve fitness in people living with HIV (PLWH). We here focus on technical issues related to use of such digital devices.

Methods: This was a randomized-controlled study divided in two phases: 2-weeks Observational Phase (OP) in which subjects performed their daily routine and were monitored in a subject-blind configuration of devices; 16-weeks Training Phase (TP), with subjects either randomized into an Experimental Group (EG: no-blind configuration) or Control Group (CG: blind configuration). The actigraph provided tracking of HR, daily steps, minutes per day at steps > 100/min (moderate physical activity) or > 130/min (vigorous physical activity), via Bluetooth to a mobile app installed on subjects' smartphone which transmitted the data to Philips Actigraphy Server System (PASS) website. All data were accessible to trainers for AP exercise prescription.

Results: Twenty-four PLWH were enrolled: 12 in EG and 12 in CG. Two EG and one CG subjects did not start the study due to health band/app pairing problems. Therefore, 21 subjects, 10 in EG and 11 in CG, were considered for the analysis. We encountered issues related to band/app pairing (n = 5) and/or data transmission (n = 18), depending on different models, operating systems and configurations of mobile phones. Considering a total of 2337 days of monitoring (18 subjects fully monitored, 3 subjects ongoing), we collected complete data of 937 days (40%), with complete monitoring of > 80% of days in two subjects (9.5%), and of > 50% in 6 (28%). The proportion of days with complete data monitoring was higher in OP than TP [245/294 (83%) vs. 693/2044 (33%), $p < 0.0001$, Chi-square test], and in EG than CG [576/1223 (47%) vs. 361/1114 (32%) $p < 0.0001$]. However, limited data availability did not enable to assess differences between EG and CG as for HR, number of steps and minutes per day at steps > 100/min or > 130/min.

Conclusions: The technical problems encountered with the digital devices affected training prescription and monitoring, therefore preventing to assess their efficacy to improve fitness.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

OP5—Kinectome: a new mathematical approach based on network theory to characterize human movement

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Purpose: Movement patterns stem from synergical interactions of several body elements, which are finely tuned by the nervous system, in order to accomplish a motor task. Hence, to carry out a comprehensive analysis of movement we need to represent multiple relationship occurring at the same time. To this aim, we described these interactions within the network science framework, where body elements and their interactions represented the nodes and the edges of a network, that we named kinectome, and that we analyzed through well-grounded mathematical tools.

Methods: Using a stereophotogrammetric system, we recorded the position of 21 reflective markers applied on bone landmarks of sixty healthy individuals during gait. Time series of acceleration changes were cross-correlated obtaining a kinectome for each subject, where entries of the matrices represent the synchronization among body elements. The kinectomes were analyzed as follows: intra-group variability was assessed using standard deviation; kinematic communities were obtained with community detection method; movement pattern individuality was assessed using fingerprint approach.

Results: Kinectomes showed higher variability at head and arms level, while legs displayed similar patterns across individuals. Community detection highlighted three communities in healthy gait: upper body, right leg, and left leg. Finally, a recognition rate higher than 95% showed that each subject can be distinguished based on its movement pattern through the kinectome.

Conclusions: Network approach to movement analysis allows to study movement within solid theoretical approaches, which highlight informative characteristics of movement. This approach has proved itself useful in defining motor patterns including the whole body and individuating motor features at subject-specific level. Kinectomes may be exploited in several fields such as clinical assessment of motor disease, sport performance evaluation, and robotics.

OP5—Perceptions of generalist teachers in primary school on their competences to teach physical education on applied of the reform on compulsory teaching for 2 hours per week entrusted to the graduate of exercise and sport science IN classes IV and V

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Purpose: For a recent reform of the law classes IV and V of primary school, the teaching of physical/movement education (PME) is entrusted by specialist teacher, with a master's degree in Exercise and sport science, while for classes I, II and III is entrusted by general teacher master's degree in Primary education sciences, thus determining 2 teaching models of the PME. Therefore, it is useful to know the opinion of generalist teachers on the importance of the subject and its training and competencies to understand the school context to prepare any guidelines for application of the reform. Aim is to measure the levels of self-assessment of the adequacy of general teacher professionalism for teaching EFS and the importance of the PME.

Methods: A questionnaire, for a territorial sample of 153 generalist teachers (53 ± 7.4 years), consisting of 3 general questions and 6 specifications, with a 5-point Likert response, has been made to have

perceptions of its own training and competencies as well as the importance of the teaching of the (PME). The descriptive statistics were used to synthesize the data in M SD and %. Since the data were treated in an interval, Pearson's correlation analysis was performed to detect the extent and statistical significance of the relationships between the variables. The magnitude of the correlation was classified as strong ($1.0 < r < 0.5$), moderate ($0.5 < r < 0.3$) and weak (from $0.3 < r < 0.1$) and $P < 0.05$ was considered statistically significant.

Results: 38% expressed neutral opinion on adequacy of teaching (2.67 1.08) while 31% considered it inadequate for the number of teaching hours (2.82 1.11). 85.6% is very much agree on the usefulness (4.83 0.42). 84.3% do not perceive own training adequate while 15.7% feel enough/very trained and is physically active (95.8%) and has already taught (87.5%). 52.3% consider the sports tutor in primary school very positive (4.41 0.81). Adequacy of teaching was positively correlated to the perception el ($r = 0.5$; $p = 0.000$). Adequacy of own training was positively correlated both to adequacy of teaching at a qualitative level ($r = 0.4$, $p = 0.000$) and quantitative ($r = 0.2$, $p = 0.010$). The usefulness of the subject for a correct psycho-physical growth was positively correlated to positive experience by teacher with sports tutor ($r = 0.3$; $p = 0.001$)

Conclusions: The training of generalists is inadequate. However, being physically active and previous experiences may be able to influence the perceived level of competence of teachers. Collaboration with the sports tutor positively influences

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OP5—Eager to set a record in a vertical race? test your VO2MAX first!

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Purpose: To explore the relationship between maximal aerobic power (VO2max) and performance in vertical races (VRs).

Methods: In total, 261 performances, from 26 VRs, and CPET data of 57 well-trained mountain runners (49 M: age 25 ± 6 years, BMI 21.3 ± 1.6 kg/m², VO2max 75.3 ± 5.8 mL/min/kg; 8 F: age 25 ± 6 years, BMI 19.1 ± 1.7 kg/m², VO2max 65.1 ± 3.1 mL/min/kg), collected over a 10-year period, were analysed. Performance times were normalized for the fastest known time for the selected VR (performance coefficient = performance time/current record), then the relationship with VO2max was modelled separately for national (NVRs) and international (IVRs) VRs. A separate analysis was also performed in the IVRs of current vertical kilometre (VK) records.

Results: Three different ($p < 0.001$) exponential models described the relationship between performance and VO2max in IVRs ($R^2 = 0.96$, $p < 0.001$), NRs ($R^2 = 0.91$, $p < 0.001$) and VRs of current VK records ($R^2 = 0.97$, $p < 0.001$). Estimated mean VO2max requirements (mean with 95% CI) to win/set a record time in IVRs were 86.2(85.3–87.1)/89.4(88.3–90.6) and 73.9(73.4–74.3)/76.7(76.2–77.2) mL/min/kg, for males and females, respectively, 86.1(85.0–87.1)/90.4(89.0–91.8) and 74.8(74.2–75.3)/77.1(77.6–77.7) mL/min/kg in the VRs of current VK records, decreasing to 83.5(82.4–84.7)/87.4(85.9–89.0) and 66.6(65.7–67.4)/70.5(69.9–71.1) mL/min/kg in NVRs. Besides, our study suggested a tendency towards a non-uniform variation in the energy cost of off-road running, likely attributable to the different features of the VRs (e.g., terrain, technical level, use of poles).

Conclusions: These data provide standard VO2max requirements for mountain runners to win and establish new records in VRs and stimulates new research on the energy cost of off-road running.

Acknowledgments: (non obbligatorio).

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OP6—The grow your muscle study (GYM): a home based, app- monitored physical exercise intervention for older people with sarcopenia. Preliminary results at screening and baseline

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Purpose: Sarcopenia is a pathophysiological process of aging, caused by reduction of muscle strength, mass and function and it is associated with an increased risk of falls, fractures, physical disability, and death. We hypothesized that a home-based, app- monitored body-weight resistance training program will be effective in improving muscle health in elderly and people living with HIV (PLWH) with sarcopenia. We here compare measures of muscle mass, strength, and function in candidate participants at screening and in the first enrolled patients at baseline.

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 a condition of 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 baseline (BL), week 12 (W12) and end of study (W48) participants are tested for muscle strength (handgrip, leg extension), balance and gait (Mini-BESTest), leg function (chair standing, 6MWT); body composition by dual energy X-ray absorptiometry (DEXA, W48 only) and leg muscle volume by magnetic resonance imaging (MRI, W48 only); quality of life, profile of mood and cognitive states, blood lipids and soluble and cell biomarkers of inflammation and muscular function.

Results: Fifty-four participants [age: 62 (57–69); BMI: 23.8 (57–68), median (IQR)] have been screened so far and 11 (20%) have been enrolled in the study, 6 in EG and 5 in CG. Among the 54 screened participants, there was a positive significant relationship between BMI and ASMMI ($p < 0.0001$; $R = 0.7$, Spearman's correlation). This correlation was maintained in the 11 enrolled participants at baseline ($p = 0.0001$; $R = 0.9$), in addition to a significant correlation between BMI and handgrip ($p = 0.005$; $R = 0.8$), ASMMI vs handgrip ($p = 0.001$; $R = 0.9$) and chair-stand vs Mini-BESTest ($p = 0.005$; $R = 0.8$).

Conclusions: Preliminary data show that BMI can be used as a potential tool for screening of sarcopenic participants. Moreover, in the small group of participants who were enrolled so far, we also observed that sarcopenia not only reduced muscle strength, but also balance.

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References: (non obbligatorio).

OP6—Effect of music and time of day on cardiorespiratory responses during aerobic exercise

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Purpose: For a proper exercise (EX) prescription, it is necessary to consider the individual needs, such as the effect of regular training at a specific time of day¹ or of listening to music while exercising². The evidence regarding the combined effect of music at different times of the day do not seem to be sufficiently investigated. The aim of the present study is to examine the effects induced by music listened during the aerobic exercise on oxygen consumption ($m\dot{V}O_2$), in males and females, in two different intensity domains (moderate and vigorous), at two different times of day (morning and evening).

Methods: Forty university students were recruited: 20 males and 20 females (age 22.7 ± 2.6 yrs; BMI 21.8 ± 2.5 kg·m⁻²; $m\dot{V}O_{2max}$ 39.7 ± 7.9 mL·kg⁻¹·min⁻¹). All subjects performed 4 training sessions at two different times of day, with and without self-selected motivational music³: 2 in the morning from 8:30 to 9:30 am (MO + M, MO-M) and 2 in the evening from 17:30 to 18:30 pm (EV + M, EV-M). Each training session included 6 min of cycling at constant load corresponding to 60% (MOD) and 90% (VIG) of $m\dot{V}O_{2max}$, interspersed with 10 min of recovery. The $m\dot{V}O_2$ was continuously monitored, obtaining data averaged every 30 s (Fitmate, Cosmed, Italy).

Results: At the end of MOD EX, females, regardless of listening to music, obtained lower $m\dot{V}O_2$ in the evening ($p = 0.03$) (EV + M 1192.0 ± 236.6 and EV-M 1203.4 ± 252.5 vs MO + M 1232.1 ± 284.3 and MO-M 1216.5 ± 249.5 mL·min⁻¹, respectively); males attained lower VO_2 while listening to music only in the evening ($p = 0.04$) (EV + M 1876.7 ± 283.5 and EV-M 1915.7 ± 313.4 vs MO + M 1896.8 ± 302.7 and MO-M 1867.7 ± 316.7 mL·min⁻¹, respectively). At the end of VIG EX, regardless of listening to music, only females showed lower $m\dot{V}O_2$ in the evening ($p = 0.02$) (EV + M 1946.2 ± 390.6 and EV-M 1980.7 ± 464.4 vs MO + M 1985.9 ± 453.3 and MO-M 1985.7 ± 422.8 mL·min⁻¹, respectively).

Conclusions: Regardless of listening to music, during both MOD and VIG intensity aerobic activities, females seem to achieve better aerobic performance in the evening, while males seem to benefit from listening to music only in the evening. For a proper EX prescription, the evening seems to be the most favourable training time of day. However, music remains an excellent tool for increasing enjoyment during EX and improving adherence².

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OP6—Physical education and movement in primary school: the perceptions of teachers in service in primary school in teaching method

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Purpose: The dual teaching of physical and/or movement education (EFe/oM) in primary school by teachers of different university training, generates the overlap of the 2 roles: general teacher of pedagogical sciences and the one specialized in exercise and sport science. There will be the problem of the coexistence of 2 different types of teachers who use different teaching methodologies for a different university education. Aim is to understand about the perceptions of current generalists to have a preview of the context situation in which specialist teachers will operate.

Methods: 5 questions were given to a convenience sample of 153 teachers in service Naples province. The questions were: (1) Do you think that a training course of 20–25 h may be enough to train a general teacher to the specific teaching of the efe/om? (2) Do you think that specific training is needed to teach EFe/oM? (3) Are you physically active? (4) Do you believe that your personal knowledge/experience of physical activity and sport can be used in teaching EFe/oM? (5) Age. The data has been processed with the Chi-quadro

Results: Two statistically significant relationships emerged ($p < 0.05$). The first is between question No. 1 and No. 2 ($p = 0.018$). Of 93.5%, who believe that specific training is needed to teach EFe/oM, the 30.7% believe that 20–25 h are enough to train a generalist teacher in this discipline, unlike the 62.7% believe that the hours would be insufficient. The second is between question No. 3 and question No. 4 ($p = 0.007$). Among the 48.8% of partially active teachers, 37.7% believe they can transfer their experience on physical and sport activity in the teaching of the EFe/oM only in the general aspects and not in the exercise aspects.

Conclusions: Many generalist teacher believe that 20-25 h of training is enough to teach EFe/oM, but they also said that specific training would be needed to teach EFe/oM. Moreover, it is perceived that being physically active is a source of experience for the teaching of the EFe/oM, but that such experience would be transferable only to theoretical aspects and not to exercise aspect. The results reveal a lack of awareness of the particular training required for the teaching of the EFe/oM which presents a theoretical corpus different from the other 10 subjects (Italian, mathematic, art, history, geography, sciences, technology, music, religion) because of theoretical contents of them, but, above all, it is centered on physical exercise content aimed at movement, physical, relational, cognitive and social development.

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OP6—Biomechanical analysis following a single session of individualised whole-body vibration in young adults with autism spectrum disorderS-ASD

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Purpose: In the present study were investigated the acute effects of individualised whole-body vibration (WBV) on locomotion and balance synchronised with surface electromyographic activity (sEMG) in young adults with ASD.

Methods: Six young adults with ASD (sex:males; age:22.7 ± 3.4 years; stature:175.7 ± 3.7 cm; body mass:78.0 ± 10.1 kg; body mass index:25.3 ± 4.1 kg/m²) and five healthy adults (sex:males; age:26.4 ± 1.1 years; stature:175.8 ± 8.2 cm; body mass:68.9±10.0 kg; body mass index:22.8±2.1 kg/m²) took part in the present investigation. Gait analysis was executed using a 3D motion capture system, when the participants walked on a motorised treadmill at 3-km/h. Angle-angle diagrams were determined by plotting the angles at adjacent joints against each other (hip-knee angle/knee-ankle angle). The body sway (medio-lateral/forward-backward) was measured on the force platform during different bipodalic standing positions (bipodalic static/bipodalic dynamic); open eyes/closed eyes. sEMG activity synchronised with gait and body sway was also recorded on the muscles (VL, BF, TA and LG) of the dominant leg.

Results: Baseline measurements showed that hip/knee and knee/ankle areas were wider in healthy than the ASD participants (P = 0.043; P = 0.021). No significant differences were found in the other variables (balance and sEMG activity) between the two groups (P > 0.05). Individualised WBV tended to increase the knee-angle perimeter (P = 0.064) modifying the muscle activation of VL (P = 0.034), BF (P = 0.016), TA (P = 0.003) and LG (P = 0.077). WBV did not affect the body sway in the different conditions except for TA muscle activation (P = 0.031) synchronised with the body sway recorded during bipodalic-static position and closed eyes.

Conclusions: The results of this investigation show that the angle-angle diagram is a sensitive parameter to underline gait alteration in young adults with ASD. Also, the individualised whole-body vibration stimulus modifies acutely the leg muscles activation during walking gait.

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PP01A—Effects of lifelong football training on oxidative stress levels in MCF-7 human breast cancer cells

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Purpose: Breast cancer (BC) is the most common cancer in women worldwide (1). Recently, the benefits of a regular training program, including the adapted football training, in BC prevention and in survivors have been provided (2). In particular, aerobic training

positively affects different cellular pathways such as cell migration, apoptosis and oxidative stress in normal and in tumor cells (3). The aim of this study was to investigate whether lifelong football training could reduce/counteract the oxidative stress in MCF-7 human breast cancer cells.

Methods: MCF-7 cells were cultured according to (4). Cells were seeded at a density of 2×10^5 cells in 6-well plate, starved in 0.5% FBS for 12 h and treated with H₂O₂ at different concentrations (50, 100, 200, 250 and 300 mM) for 4 h in order to set-up the experimental conditions. Subsequently, 4 sera pool each containing serum from 5 older men (> 65 years) lifelong football players (at least 15 years, VPG) and 4 sera pool each containing serum from 4 active untrained men (CG) matched for age, both recruited from P. Krstrup's group, were used for this study. MCF-7 cells were seeded to confluence, then starved, treated or not with 300 mM H₂O₂, 4 h, then cultured in 5% sera from VPG or CG pool for 72 h, respectively. Cells were collected and processed for the measurement of reactive oxygen species (ROS) by using the DCFDA/H2DCFDA—Cellular ROS Assay Kit (Abcam). Data comparison between groups was performed using ANOVA test. Differences were considered statistically significant with a p < 0.05.

Results: We observed a significant reduction of ROS in MCF-7 cells treated with 300 μM H₂O₂ for 4 h and subsequently cultured with VPG pool sera, compared to CG (O.D., Fluorescence 485/535 nm, VPG vs CG, p < 0.05).

Conclusions: Our preliminary results suggest that lifelong football training counteracts the oxidative stress in BC cells, thus reducing the risk of BC occurrence and progression. Ongoing experiments will evaluate the effect of lifelong football training and oxidative stress on MCF-7 cell invasion and apoptosis.

Acknowledgments:

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PP01B—Calcium and melatonin supplementation improves muscle function and Irisin in mice

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Purpose: Physical training and natural diet can change the expression of myokines and improve muscle function. Irisin is known to be produced during training and has anti-inflammatory and pro-metabolic effects on muscle and adipose tissue. Melatonin is a neurohormone that has been associated to irisin release, but its effect has not been evaluated during physical exercise. Another important feature related to muscle function, and in turn, to metabolic activation is the presence of Calcium that can modulate energy expenditure. As a matter of fact, the effect of melatonin and calcium upon irisin release following physical activity and the related effects on the adipose tissue are still not clear.

Methods: In this study mice subjected to 14 days of training sessions and receiving a calcium rich diet with or without melatonin were tested. At the end of the experimental procedure, circulating levels of irisin were assessed and fat samples were collected to evaluate mRNA

expression of irisin precursor and its transcriptional activator (FNDC5, PGC1 α), targets of adipose tissue metabolic pathways (FASN, FABP4, SIRT1 and PPAR γ) and inflammatory profile (Adiponectin, Visfatin, IL-6 and TNF- α)

Results: At the end of the study force was improved and fatigue reduced in mice taking calcium compared to controls. Additionally an enlargement in muscle fibers was observed together with increased circulating levels of irisin. Irisin concentration was increased at the end of the experimental procedure by either melatonin administration and calcium supplementation. Also physical performances in terms of strength were improved after the two weeks of training. Moreover, the adipose tissue metabolic profile was influenced by both types of treatments, suggesting that in physically active subjects irisin might promote adipose tissue remodeling.

Conclusions: The overall findings suggest that both melatonin and calcium supplementation are able to influence irisin activity, and differentially modulate the adipose metabolic profile, thus confirming a significant role of the myokine over this tissue.

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References: (non obbligatorio).

PP01C—The effect of an adapted physical activity intervention for pregnant women during childbirth preparation classes: preliminary results from the well-done! study

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Purpose: Regular physical activity (PA) during pregnancy is beneficial for the health of mothers and babies. The World Health Organization recommends that all pregnant and post-partum women without contraindications should perform at least 150 min of moderate-intensity aerobic PA throughout the week. Unfortunately, less than 15% of pregnant women reach these recommendations. The aim of the WELL- DONE! Study is to co-design an adapted physical activity intervention (APAI) for pregnant women to include in childbirth preparation classes (CPCs) and evaluate its feasibility and efficacy in terms of PA levels and other outcomes.

Methods: The present study was a quasi-experimental study designed in collaboration with pregnant women and midwives using focus groups. The APAI intervention was conducted by kinesiologists and midwives at the Bologna University Hospital Authority St. Orsola-Malpighi Polyclinic (Italy). During CPCs the experimental group (EG) performed 1 h of PA administered by midwives and co-supervised by kinesiologists for 6 weeks, while in control group (CG) 1 h was spent to explain the importance of PA during pregnancy at the beginning of CPCs. PA levels were assessed using the Pregnancy Physical Activity Questionnaire (PPAQ) at the baseline and at the end of the intervention. Statistical analysis was performed using SPSS.18.

Results: We enrolled 77 pregnant women from the 24th to the 32nd weeks (mean age 34.8 \pm 4.3) from November 2021 to May 2022. Preliminary results from 60 participants showed that the PPAQ for total activity significantly improved in the EG after 6 weeks (Δ 13.74 \pm 29.65, p value 0.04) while slightly raised in the CG but not significantly (Δ 3.47 \pm 40.76, p value 0.59). In particular, the moderate activity significantly improved in EG (Δ 7.96 \pm 16.97 p value

0.04) while worsened in CG (Δ - 4.13 \pm 24.53, p value 0.29). However, there was no statistically significant difference between groups.

Conclusions: Preliminary findings suggest that the introduction of an adapted physical activity intervention in childbirth preparation classes administered by midwives and co-supervised by kinesiologists improves physical activity levels of pregnant women. The cooperation between these two professional figures is crucial to promote the physical activity for health in this population.

Acknowledgments: (non obbligatorio).

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PP02A—Combining vitamin e-functionalized chocolate with physical exercise to reduce the risk of protein-energy malnutrition in pre-dementia aged people—the Choko-age study

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Purpose: The cytoprotective effects of vitamin-E and the effects on the regulation of cortisol secretion of polyphenols contained in chocolate and exercise are known. However, the hypothesis that the combined application of these strategies can prevent the decline of musculoskeletal metabolism and mitochondrial function, has never been verified in frail elderly. The aim of this study is to verify the combined effect of supplementation with chocolate with a high content of polyphenols added to vitamin- E and the regular practice of physical activity on muscle mass in elderly subjects with cognitive decline, a population with high risk of malnutrition and frailty.

Methods: The subjects included in the study will first be placed in a “run-in” phase (2–3 weeks) in which they will have a diet that guarantees a daily protein intake of 0.9–1.0 g/kg and included in a program of physical exercise. After that, subjects will be randomly assigned to one of the three groups for a duration of 3 months: (A) control group that will maintain the diet with correct protein intake and will follow the 3 days/week high intensity exercise program; (B) experimental group that will combine diet and exercise and will take 30 g/day of chocolate containing polyphenols and vitamin-E; (C) experimental group that will combine diet and exercise and will take chocolate without vitamin-E. The primary outcome will be the quadriceps muscle volume (QMV). Health-related biomarkers, mitochondrial respiration, evaluations of maximal force, vascular function, energy cost of walking and VO₂max, functional performance will be tested.

Results: Literature shows that in 3 months the QMV in elderly people at risk of frailty who do not take part in any specific intervention can decrease from 1.0 to 1.5%. Therefore, we expect that group A will increase QMV of 2%. On the other hand, we expect a 4% increase in

group B and a 2.5% increase in group C. The best adaptations are expected in group B thanks to synergistic effect of vitamin E, polyphenols and exercise.

Conclusions: The results will be interpreted to understand the molecular mechanism underlying the adaptations induced by nutritional intervention, supplementation and regular physical activity so as to be able to develop effective interventions to counteract the loss of muscle mass typical of this population.

PP02B—Pre-task motivational music enhances response time in elite TAE kwon do athletes

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Purpose: Music is a powerful tool to boost athletic performance. Recent evidence shows that listening to music before an exercise may lead to an increase of physical performance. However, intrinsic and extrinsic music factors may influence physical performance differently. Findings showed that both motivational (MM) (tempo > 120 bpm) and preferred (PM) music might improve physical performances. Martial arts, especially combat competitions, require fast response times (RT) to achieve high performance levels. Therefore, investigations on the effect of MM and PM on RT in these athletes might be helpful to increase their performance. In the present study, we investigated the effect of MM and PM on RT in elite Taekwondo athletes.

Methods. In a cross-over randomized design, RT of fifteen elite Tae Kwon do athletes (Age = 19.1 ± 2.8 years; Height: 1.68 ± 0.10 m; Mass: 58.9 ± 10.6) were recorded while performing a choice response task (CRT) after being exposed to 10 min of PM, motivational music (MM) and control condition (CC—no music) using wireless earphones during a self-administered warm-up. For the CRT, athletes had to kick as fast as possible against a punching bag when colored light switched on. Depending on the color of the light, participants had to perform a roundhouse kick aiming at head (green light), at waist level (blue light), or do no action (red light). Before (T0) and after (T1) the self-administered warm-up participants filled in the Feeling Scale (FS) and the Felt Arousal Scale (FAS). After the CRT participants' Rate of Perceived Exertion (CR10 scale) was recorded.

Results. RT was significantly shorter ($p = 0.045$) in MM than CC conditions (806 ms vs 847 ms, in MM and CC respectively). No significant difference in RT was observed between all the other conditions. RPE was significantly lower ($p = 0.015$) in MM than CC condition (1.68 vs 2.07, in MM and CC respectively). Moreover, a trend ($p = 0.077$) was observed toward lower RPE in the MM condition compared to PM. A main effects of time for ($p < 0.01$) FS and FAS was observed.

Conclusions. The exposure to MM during warm-up improves RT and reduces the subjective perception of effort (RPE) in elite Taekwondo athletes. These results suggest that pre-task music is an effective strategy to improve RT in well-trained athletes. Future studies should investigate whether the effects of MM on RT are due to improvements in peripheral or central nervous system.

PP02C—The effects of a 6-week physical activity intervention on the perceived quality of life of older adults living in two residential care facilities of Marche region

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Purpose: The perceived quality of life (pQoL) is a complex concept that can be affected by several factors, including social relationships, psychological state, and physical health. Several studies demonstrated how physical activity (PA) in older adults could be an effective approach to improve different aspects of pQoL. Particular attention must be paid to older people who live in residential care facilities (RCFs), in which their psychological sphere and physical aspects can be strongly affected [1]. This study aimed to investigate the effects of PA intervention programs in RCFs context, assessing the modulation of health-related factors and pQoL.

Methods: Two different RCFs (RCF-A and RCF-B) were included in the project, in only one of which a PA expert was already present at the beginning of the study (RCF-A). 29 subjects (age: 86.55 ± 6.46 yrs) were recruited for a 6-week PA intervention, structured and followed by the PA expert. The PA frequency and type (individual or in groups) were assessed at the beginning and at the end of the intervention; moreover, the short-form 12 questionnaire (SF-12) was proposed at the two timepoints to calculate mental and physical component scores (MCS and PCS) of the pQoL.

Results: At the beginning, MCS and PCS were higher in the RCF-A (MCS = 52.0 ± 8.7; PCS = 46.6 ± 9.7) than in the RCF-B (MCS = 43.4 ± 10.2; PCS = 43.9 ± 10.2). After the introduction of a PA expert, in the RCF-B a significant improvement in the attendance to the individual PA was registered ($p < 0.001$), and the MCS of the participants significantly increased ($p = 0.023$). Particularly, 11 out of 21 RCF-B residents showed an increase of at least 6 points in their MCS. Moreover, at the end of the study, the mean MCS and PCS resulted higher in RCF-B, in which the PA expert was introduced (RCF-A: MCS = 46.8 ± 7.7; PCS = 43.1 ± 8.5—RCF-B: MCS = 49.5 ± 6.7; PCS = 46.1 ± 10.6). On the other hand, the attendance to group PA resulted to be high in both timepoints, without any change. Lastly, data obtained from the RCF-A remained constant overtime.

Conclusions: Pursuing active aging is essential, particularly in older people living in RCFs. Even if group PA could be useful to improve socialization and psychological aspects, we found a strong impact of the individual PA in the mental sphere of pQoL, suggesting that improving the attendance to this type of PA can be effective in RCFs older adults. To confirm these data and to assess the effectiveness of group PA, other RCFs will be included in the project.

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PP03A—Upper limb strength, trunk range of motion and body balance in para and able-bodied rafting athletes

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Purpose: Para-rafting is one of the newest sports practiced by athletes with disabilities and requires appropriate balance control by an athlete with physical impairments. The upper limbs play a predominant role during paddling; however, the trunk and lower limbs assist in providing stabilization, generating muscle strength and power to be transferred to the upper limbs. This study aimed to explore the differences in upper limb strength, trunk range of motion, and body balance between para-rafting and rafting athletes.

Methods: We recruited eight parathletes with a lower limb amputation, spina bifida, vertebrae fracture and eleven athletes without physical impairments during an event of the World Rafting Championships. We assessed upper limb strength with shoulder muscles isometric strength and handgrip strength tests. Trunk flexion, extension, lateral bending, and rotation left/right were used to assess trunk range of motion in a seated position. Body balance was evaluated during a specific sport movement during a seated position on the raft. Independent t-test was used to identify differences in upper limb strength, trunk range of motion, and body balance between the two groups. A one-way ANCOVA adjusted for participants' age was used to estimate the differences in body balance on the raft between parathletes and able-bodied athletes.

Results: A statistically significant age difference was found between the athletes ($p = 0.004$). No between-group differences were observed in upper limb strength and trunk range of motion. A statistically significant variation was observed in body balance on the raft ($F = 6.75$, $p = 0.02$, $\eta^2 = 0.30$).

Conclusions: The parathlete group had a higher age than the rafting athletes without impairments. This result was expected since the parathletes begin participation in the sport later, after the injury and the rehabilitation process. The parathletes presented a lower balance control on the raft, and there is no difference between para and able-bodied athletes in terms of upper limb muscle strength and trunk mobility. These results may contribute to understanding the adaptations from Rafting and guide training and prevention programs for para-rafting athletes.

PP03B—Percentiles for the chronotropic response to exercise in young athletes aged 10 – 18 years

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Purpose: The assessment of the chronotropic response during acute physical exertion can allow the discovery of many cardiovascular diseases even at a young age. However, the increase in heart rate (HR) depends on the age and sex of the subject and the modality of the graded exercise test. This study aims to provide sex- and age-related

normative values for heart rate performance in young athletes aged 10–18.

Methods: A retrospective study was carried out on 7896 young athletes (5356 males and 2540 females) aged between 10 and 18 who underwent pre-participation screening to obtain eligibility for competitive sport. First, anthropometric parameters, performance data, and HR are reported. Thus, each age calculated third, tenth, twenty-fifth, fiftieth, seventy-fifth, ninetieth, and ninety-seventh percentiles for the stage-by-stage HR response, according to sex and graded exercise test modality category.

Results: Young female athletes of all ages showed lower performance with fewer stages performed on the cycle ergometer and the treadmill. Young male athletes on treadmill and cycle ergometers show lower HR values at submaximal intensities. The treadmill allows a longer duration than the cycle ergometer for males and females.

Conclusions: Sex, age, and the specificity of the movement performed must be considered in assessing the chronotropic response in the young population, particularly for those who carry out a training program. In addition, providing reference values of HR response to acute physical exertion may allow for a better functional assessment of the young athletes.

PP03C—Effects of self-talk manipulation combined with resistance training in elderly females: a pilot study

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Purpose: In the elderly, muscle mass and function decrease, thus altering balance and gait and increasing the risk of falls. It has been demonstrated that in older people resistance training (RT) improves muscle strength¹. In young subject RT combined with cognitive interventions, such as motivational self-talk, increases its efficacy². Motivational self-talk refers to the use of self-verbalization to assist in psyching up, control of arousal levels, confidence, and mental preparation³. The aim of this pilot study was to compare the effects that RT combined with motivational self-talk and RT alone induce on lower limb muscle strength in elderly women.

Methods: Eight elderly women (mean \pm SD: 65.25 \pm 4.13 yrs) were randomly assigned to two groups: RT group and Resistance Training Self-talk (RTS group). In the RT group ($n = 4$) they performed a conventional RT for lower limbs, while in the RTS group ($n = 4$) they mentally repeated the motivational self-talk sentence while performing the RT. Each 60 min training session was divided into 10 min of warm-up, 40 min of resistance exercises and 10 min of cool down and it was repeated twice a week. The intervention period lasted 4 weeks. Sit to stand (STS), time up and go (TUG), one maximum repetition (1RM) (assessed by leg press, leg extension and leg calf machines) tests were performed at baseline (T0), at the end of the training period (T4) and 2 weeks later (T6).

Results: In both groups the number of repetitions in STS significantly increased from T0 to T6 ($p < 0.05$), whilst TUG duration showed a decreasing trend (T0 vs T4 $p = 0.08$, T0 vs T6 $p = 0.06$). 1RM leg press significantly increased in both groups from T0 to T4 and T6 ($p < 0.01$). Only in RTS group significant increases from T0 to T4 and T6 ($p < 0.01$) were observed in the muscle strength expressed in 1RM leg calf and 1RM leg extension.

Conclusions: Our preliminary results show that, in elderly women, the motivational self-talk combined with resistance training induced significantly higher increase in lower limbs' muscle strength compared with that observed in the RT group. This demonstrates that, in

elderly women, the combination of a cognitive intervention with a conventional resistance training may improve the efficacy of the training.

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PP04A—Relationship between age, BMI, intelligence quotient, and field tests performance in soccer players with intellectual disability

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Purpose: The importance of sport practice for people with Intellectual Disability (ID) has been well documented. Adapted soccer is a sport practiced by people with ID, but scientific knowledge is still scarce in this area. The present study aimed to evaluate the relationship between age, Body Mass Index (BMI), Intelligence Quotient (IQ) and performance (lower limb strength and sprint abilities) in soccer players with ID.

Methods: Thirty-eight male athletes (age = 21.1 ± 4.9 ; BMI = 23.3 ± 3.8) with ID (10 autism spectrum disorders, 12 cognitive deficits, 7 psychic-mental behavioral disorders, 7 down syndrome, 2 other chromosomal syndrome) practicing adapted soccer in the “Insuperabili’s team” participated in this study. Sprint performance was assessed with the 20 m sprint test and the Standing long jump test was used to evaluate lower limb strength. The degree of association between two continuous variables was measured by the Pearson’s correlation coefficient (r) in the case of normally distributed variables and by the Spearman’s Rho (r_s) in the case of non-normally distributed variables. Statistical significance was set at $P < 0.05$.

Results: A negative and statistically significant association was found between the Standing long jump test and the 20 m sprint test ($r_s = -0.647$, $P < 0.001$). The correlation analysis conducted on a sub-group of athletes ($n = 18$) showed a negative and statistically significant association between the IQ and the time required to complete the 20 m sprint test ($r_s = -0.520$, $P = 0.027$) as well as a positive and statistically significant association between the IQ and the Standing long jump test ($r = 0.593$, $P = 0.010$). No statistically significant association was found between age and performance (Standing long jump test and 20 m sprint test).

Conclusions: The results showed that in athletes with ID a higher BMI as a negative impact on the performance on the Standing long jump test. Moreover, the IQ seems to have an impact on the performance in both the Standing long jump test as well as the 20 m sprint test. Findings therefore suggest the hypothesis that the higher the IQ, the better the performance. In order to better support such a hypothesis, the sample size needs to be increased and regression analysis performed. Further, future studies with a larger sample size are planned to investigate the association of IQ and performance in athletes according to the type of intellectual disability.

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References: (non obbligatorio).

PP04B—Air pollutants and physical performance: the impact of PM 2.5 and PM 10 on VO2max

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Purpose: Countries are adopting increasingly stringent anti-pollution rules to decrease pollution levels. Studies have shown a relationship between air pollution and impaired cardiovascular and respiratory function that exposes to an increased risk of acute and long-term health problems [1]. In addition, adverse changes in biomarkers of physiological and biochemical functions related to pollution were also identified. The smaller the particle, such as pm 10 and pm 2.5, the greater its potential to cause damage because it can penetrate deeper into the lungs. This would appear to be directly related to the athletes’ aerobic performance and therefore to their performance during sports competitions [2]. The present study aimed to investigate the effect of exposure to different air pollutants on aerobic performance in young adults.

Methods: Yo-Yo Intermittent Recovery Test level 1 was performed to estimate the subjects’ VO2max. In order to carry out the tests in situations of different levels of air pollutants (pm10 and pm 2.5), two Yo-Yo Intermittent Recovery Test sessions were performed. Furthermore, to evaluate the effect of exposure to different air pollutants on physical performance, an average of 7 days before the test sessions of each air pollutant was considered for the analysis. Participants filled out the mini sleep questionnaire and answered some questions in order to assess their sleep and physical condition before the test sessions.

Results: 13 young adults, 3 females, were recruited (22.8 ± 1.8 years). The two sessions (S1 and S2) showed statistically significant different mean values of pm10 (30.8 ± 9.6 vs 47.0 ± 6.8 , $p = 0.001$; S1 vs S2 respectively) and pm 2.5 (21.4 ± 5.3 vs 32.4 ± 6.3 , $p = 0.001$; S1 vs S2 respectively). No sleep differences were found comparing the two sessions (hours slept: $07:26:32 \pm 00:35:47$ vs $07:16:32 \pm 00:32:17$, $p = 0.376$, S1 vs S2 respectively). Moreover, participants stated to be in good physical condition. S1-S2 comparison showed a trend of higher athletes performance during the S1, test session with less pollution, compared to the S2, test session with more pollution (estimated VO2max: 43.5 ± 1.5 vs 43.1 ± 1.8 mL/min/kg, $p = 0.07$; S1 vs S2 respectively).

Conclusions: Although it has not reached statistical significance, probably due to the small sample, we can assume that the levels of pm 10 and pm 2.5 would seem to influence aerobic performance. Studies with a larger sample are needed to confirm this.

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PP04C—Endurance training or leisure physical activities: how is impacted the maximal oxygen uptake

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Purpose: The maximal oxygen uptake (VO₂MAX) is deeply influenced by aging and the modality of exercise training regularly practiced such as endurance exercise or leisure physical activity. However, it is not clear if the daily energy expenditure is playing a role in this scenario. Therefore, the aim of this study was to investigate if the daily energy expenditure, type of exercise training (endurance Vs leisure physical activity) or age are correlated to the VO₂MAX of healthy elderly. Our hypothesis was that the VO₂MAX is more correlated to the daily energy expenditure rather than age and exercise training practiced.

Methods: Ten older adults (≥65 yrs) without chronic diseases were recruited for this preliminary analysis. The testing procedure included a maximal incremental test for measuring VO₂MAX, weekly energy expenditure (Kcal/week) and walked distance in a week (km/week) that have been measured by means of a sport watch (Polar Vantage M). The potential correlation between the variables has been investigated with the Pearson correlation coefficient.

Results: Interestingly, the VO₂MAX was not correlated with the different ages of the recruited subjects ($r = -0.34$; $p \geq 0.05$). While on the contrary, a significant correlation was found between the VO₂MAX and the weekly energy expenditure of the subjects ($r = 0.69$; $p \leq 0.05$). Any association were retrieved between the modality of exercise training practiced by subjects (endurance Vs leisure physical activity) and the VO₂MAX.

Conclusions: These preliminary results suggest that, in an elderly, the VO₂MAX is correlated with weekly energy expenditure (Kcal/week) but it's not impacted by the intensity or volume of the exercise training practiced. New approaches including specific recommendation for the leisure physical activity should be implemented in the available guideline for health benefit in this population.

PP05A—A case report of prehabilitation in lung cancer: could exercise make the difference?

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Purpose: Surgery is the best chance of cure for patients with lung cancer. Nevertheless, some patients may be ineligible due to poor cardiopulmonary function. The present study aims to explore the impact of exercise prehabilitation in a 79 years- old female, affected by lung cancer and functionally borderline for surgery.

Methods: A four weeks exercise program to perform three times per week was proposed. Each session lasted approximately 1 h, preceded by a warm-up, and concluded by stretching activities for cool-down. A progressive exercise program composed of cyclo-ergometer high-intensity interval training, two strength exercises, and breathing activities was proposed to increase the cardiopulmonary reserve. The safety and feasibility of the program were continuously checked during the program. Baseline and post-intervention assessments included: (i) functional capacity, with the 6-min walking test

(6MWT), (ii) muscle strength, using the handgrip strength test, (iii) flexibility, with the back scratch and chair sit and reach tests, (iv) anthropometric measures, using the body mass index (BMI) and the waist-hip ratio, and (v) quality of life assessed with the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ C-30).

Results: Compliance to the intervention was optimal 100% (12/12 sessions), and no adverse events were registered. Compared to baseline, post-interventions assessments revealed a gain in the cardiorespiratory fitness of + 55.5% (200 m vs. 331 m), in the muscular strength, of the right arm, + 26.3% (19 kg vs. 24 kg) and left arm, + 3.3% (27 kg vs. 28 kg). BMI moved from 26.8 to 26.1. kg/m² and waist-hip ratio from 0.99 to 1.01. Quality of life improved, in particular in domains regarding physical functioning of (73.33 pts vs. 93.33 pts), emotional functioning of (25 pts vs. 50 pts), fatigue of (22.22 pts vs. 0 pts) and global health status of (66.66 pts vs. 75 pts). Given the improvements obtained in the prehabilitation program, the patient has undergone surgery.

Conclusions: Exercise prehabilitation was shown to be safe, feasible, and effective in increasing physical parameters and preparing the patient for surgery. This case study suggests the importance of pre-operative exercise to prepare physically and psychologically and increase eligibility for surgery in patients with cancer.

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PP05B—Perceptual and physiological responses underlying the greater exercise tolerance of arm + leg cycling vs. leg cycling

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Purpose: The comparison between arm+leg cycling (Arm+leg) and leg cycling (Leg) has long been used in exercise physiology to shed some light on the determinants of maximal oxygen uptake. However, this comparison is of interest for a series of other physiological and practical implications that have received limited attention so far. We aimed to investigate potential differences in exercise tolerance between these two exercise modalities and evaluate underlying perceptual and physiological responses.

Methods: Twelve trained individuals performed six performance tests (three for each of the two exercise modalities) in separate, randomised visits. The tests consisted of an incremental step test and two time-to-exhaustion (TTE) tests performed at 90% or 75% of the peak power output (PPO) reached in the Leg incremental test. Exercise tolerance, perceived exertion, and cardiorespiratory variables were recorded during all the tests.

Results: Higher ($P < 0.001$) PPO and VO_{2peak} values were observed in the Arm + leg incremental test (337 ± 32 W; 3913 ± 378 mL·min⁻¹) compared to the Leg incremental test (292 ± 28 W; 3610 ± 310 mL·min⁻¹). A longer TTE ($P < 0.001$) was found both in the 90% of PPO (638 ± 154 s) and 75% of PPO (1675 ± 525 s) Arm + leg TTE tests compared to that of the Leg TTE tests (307 ± 67 s; 880 ± 363 s). At isotime, VO₂ and heart rate values were similar or higher in the Arm + leg modality, while perceived

exertion, respiratory frequency and minute ventilation were generally lower ($P < 0.05$).

Conclusions: The greater exercise tolerance observed in the Arm + leg modality was generally accompanied by a lower physical effort at isotime compared to leg cycling, despite similar or higher values of VO_2 and heart rate found in the Arm + leg modality. These findings have implications for devising exercise strategies to reduce perceived exertion while maintaining a relatively high metabolic rate.

PP05C—The temporal association between body characteristics and speed performance over twenty-five years in Italian adolescents

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Purpose: Physical fitness (PF) is positively related to skeletal and metabolic health, and it had an inverse relation with obesity. Several studies demonstrated that adolescents with obesity have the worst performance in PF and in speed-agility (SA), defined as a combination of the ability to move quickly and to change direction, contributing to an augmented risk to develop pathologies. To the best of our knowledge, many studies analyzed the trends of obesity and SA separately, but there is a lack of data about SA ability trends in adolescents with obesity. We aimed to investigate SA trends in children with obesity in the last few decades to define the association between body weight and physical performance.

Methods: We recruited 3,923 Caucasian children from 1985 to 2010 in the same school in Northern Italy, near Milan. Once a year, at the ages of 11–12- and 13 years old, we collected anthropometric measures and SA performance. The tests conducted were the 30-m Sprint Test, the 60-m Sprint Test and the 4 × 5 m Run Test, which are valid and reliable methods to assess the SA in children and adolescents. We pooled the data into 5-year-period study waves and then stratified our analysis into test-sex-age BMI-z-score specific groups.

Results: We reported an undetermined trend across the years. A significant decline in the 4 × 5 m run test ($p < 0.001$) was noted through the years (in particular in the last wave) in both sexes; an increase in the BMI was also noted. While we did not report a decline in the 30 m and the 60 m run tests, we noted a decline in the 4 × 5 m run test also stratifying for BMI categories in both genders.

Conclusions: In conclusion, fitness tests highlighted differences in normal weight compared to adolescents with overweight/obesity that could be important for health monitoring, at least in brief sprint performance. Additionally, SA fitness decline is an alarming factor that should generate corrective actions.

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PP06A—Effects of a 12-weeks online exercise program on physical efficiency, perceived health and reduction of WRMSDs in a group of workers exposed for biomechanical overloads

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Purpose: Work-Related Musculoskeletal Disorders (WRMSDs) are a typology of disorders resulting from exposure to work; they include different inflammatory and degenerative conditions affecting muscles, ligaments, joints, tendons, peripheral nerves and blood vessels. They are currently at first positions of occupational diseases in many countries. The present study aimed to assess the effects of an exercise program in the reduction of pain and symptomatology of WRMSDs, in increasing physical efficiency in a population of workers.

Methods: The study involved a population of workers ($n = 136$) from 12 companies in the northern Italy, who participated in a physical exercise program performed online using Zoom® platform. Workers were divided into 14 groups and the program was structured in 24 sessions with a frequency of 2 times a week and a duration of 50' per session. A questionnaire was used for data collection, consisting of an adapted Italian version of the Nordic Musculoskeletal Questionnaire (NMQ), Visual Analogue Scale (VAS), questions inherent in the Physical Component Score (PCS) of Short Form 12 Health Survey (SF-12) and a part of Self-Reported Physical Fitness (SRFit) Survey for analyze some domains of The Six Senior Fitness Test. The questionnaire was administered at the beginning and at the end of the activity, to evaluate the effects of the exercise program on pain, symptomatology, physical efficiency and perceived physical health. Another questionnaire was administered at the end of the project. It is a 7-question survey with possible response using a 5-point Likert scale. This was used to objectify liking and satisfaction from the participants.

Results: The results show a trend toward maintenance of physical abilities and perceived physical health. A slight reduction in perceived pain can be observed. Regarding satisfaction, the average score given by completing the questionnaire is 4,30 out of 5 points on the Likert scale.

Conclusions: There may be some critical issues with regard to remote mode of delivery, but this analysis has shown how physical activity performed remotely can be well tolerated, successful and reasonably useful in reducing painful symptoms in major body regions affected by WRMSDs.

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PP06B—Assessment of the validity of a new incremental taekwondo-specific cardiopulmonary test to evaluate athlete's physiological and metabolic profile

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Purpose: It has been demonstrated that trained athletes generate higher maximal oxygen uptake (VO_2max) on tests that are similar

mechanically to movements performed in the specific sport when compared with generic tests¹. The aim of this study was to assess the validity of a new incremental Taekwondo-specific cardiopulmonary test.

Methods: Seventeen ($n = 10$ males; $n = 7$ females) competitive black belt athletes (age: 21.1 ± 4.3 ys, years of practice: 13.9 ± 2.5 ys, height: 1.70 ± 0.1 m, weight: 60.4 ± 8.5 kg) were evaluated in a crossover study design. They performed on separate days, once per week and in randomized order, cardiopulmonary exercise test (CPET) and an intermittent Taekwondo-specific test (ITKS). The CPET was performed on a treadmill with an initial speed of 8 km/h, increased by 1 km/h every minute until exhaustion. The ITKS test started with 10 s of alternating leg kicks, progressively increasing by 5s each stage until the 4th stage, interspersed with 5s of passive recovery. After the 4th stage the athletes performed 25 s of kicks on each stage until the last (10th stage) and the passive recovery phase after the 4th and the 7th stage lasted 30 s. VO_{2max} , volume of carbon dioxide (VCO_2), respiratory exchange ratio (RER), maximal heart rate (HRmax) and blood lactate concentration ($[La]^-$) were continuously monitored during each test. The rating of perceived exertion (RPE), by the Borg's scale 6–20, was used to assess the subjective level of fatigue experienced at the end of each testing session. The significance level was set at $p < 0.05$.

Results: Statistical analysis showed that VO_{2max} and HRmax were not significantly different between CPET and ITKS tests ($p = 0.85$ and 0.76 , respectively). RER and $[La]^-$ values were significantly higher in ITKS than those in CPET ($p = 0.002$ and 0.001 , respectively). Finally, no differences in VCO_2 and RPE between the two tests were found ($p = 0.53$ and 0.84 , respectively).

Conclusions: Our results demonstrate that ITKS is a valid tool to assess aerobic power and capacity in taekwondo athletes, based upon direct comparison with a CPET. The ITKS allows a more specific evaluation of the variables for the physiological and metabolic profile assessment of taekwondo athletes. This test can be also used to assess and control the effects of training and can help coaches and sport scientists in prescribing the more effective training program.

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PP06C—Evaluation of oxygen and energy consumption with a telemedicine protocol: responses in healthy vs obese older population. Preliminary results

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Purpose: To evaluate the physiological and exertional responses of normal weight vs obese older individuals of both sexes throughout two distinct aerobic sessions of exercise using telemedicine as a method.

Methods: Twenty older (> 60 years) men and women who were obese or not ($BMI \geq 30$ kg/m² or < 25 kg/m²), were instructed to exercise for two sessions using both Video 1 (containing exercises for beginners) or Video 2 (for advanced). Both videos were 35 min long and included: warm-up, aerobic workout of 12 exercises each to be repeated for 30 s for 3 sets with a rest of 60 s (Video 1) or 90 s (Video 2) between set and cool down. Before intervention, the participants performed a physical performance battery and waist circumferences were obtained. Additionally, RPE (0-10) was collected at the conclusion of the exercise session. At rest and before the

cool-down, ventilation (VE, L/min), oxygen consumption (VO_2 , ml/min and ml/kg/min), energy expenditure (EEtot, kcal), Metabolic Equivalent of Task (METs, ml/O₂), heart rate (HR, bmp), respiratory quotient (RQ) were collected using a portable metabolimeter (K5, Cosmed). A three-way ANOVA test was used to detect significant differences ($p < 0.05$) in all the variables considering the Video1/2, obese/non-obese and sex as two-level factors.

Results:

Significant differences were found between Videos 1 and 2 for the following parameters: HR ($p = 0.006$), VO_2 (ml/min) ($p = 0.002$), VO_2 (ml/kg/min) ($p = 0.002$), VE ($p < 0.000$), METs ($p = 0.002$) and EEtot ($p = 0.040$) before cool-down. Obese/non-obese factor significantly affected resting values of METs ($p = 0.002$), and values of VO_2 (ml/kg/min) ($p = 0.031$), METs ($p = 0.031$) before cooling down. Sex factor significantly affected resting values of VO_2 (ml/min) ($p = 0.000$), VE ($p = 0.001$), EEtot ($p = 0.000$) and values of: VO_2 (ml/min) ($p = 0.007$), VE ($p = 0.005$) and EEtot ($p = 0.022$) before cooling down. The RQ showed a significant ($p = 0.037$) video x sex interaction before cooling down.

Conclusions: Both Videos were effective in enhancing the physiological response above rest both in obese and non-obese participants. Therefore, it is suggested that prescribing aerobic exercise via video modality might constitute an effective strategy for promoting positive physiological adaptations in older adults.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP07A—Effect of 8-week tennis training on motor skill proficiency and cognitive functions in adolescents with down syndrome

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Purpose: Down Syndrome (DS) is the most frequent genetic mental disability. Individuals with DS experience a variety of physical, motor, and cognitive challenges throughout their lifespan. The importance of exercise for individuals with DS has been well documented. It has been assumed that the practice of tennis may be attractive and beneficial for people with DS. This preliminary study investigated the effects of an 8-week tennis training intervention on motor skill proficiency and cognitive functions of adolescents with DS.

Methods: 14 adolescents with DS were enrolled and were allocated to either the Experimental Group (EG; females, $n = 5$; males, $n = 2$) or to the Control Group (CG; females, $n = 2$; males, $n = 5$). EG trained regularly for 90 min twice a week for 8 consecutive weeks with an expert tennis coach. CG continued to perform their daily activities during the 8 weeks. At the beginning (T0) and at the end (T1) of the 8 weeks experimentation period, participants were assessed for: (1) motor skill proficiency: agility (Timed Up&Go Test, TUG), upper limb coordination (7 items by the Bruininks Oseretsky Test of Motor Proficiency, BOT-2), gross manual dexterity (Box and Block Test), fine manual dexterity (9-Holes Pegboard Test); (2) cognitive functions: working memory (Corsi Test) and executive functions (Tower of London Test, TOL). Mann-Whitney Test, Covariance Analysis (ANCOVA) (2 timed and 2 groups) and Wilkoxson Test for paired data were employed for statistical analysis. The level of significance was set at $P < 0.05$.

Results: The results showed that an 8-week period of tennis training improved both motor skills and cognitive functions in the EG. In particular, the results of the EG highlighted a statistically significant

improvement between T0 and T1 in the TOL (points, + 14.72 and level, + 5.14), Corsi Test (+ 33%), Box and Block Test (16%), TUG (23%) and 3 items of the BOT-2. The CG showed no statistically significant differences in the considered tests between T0 and T1.

Conclusions:

An 8-week period of tennis training in adolescents with DS seems to be sufficient to improve both motor skills and cognitive functions. The results obtained in this preliminary investigation are encouraging and suggest the potential benefits of tennis for adolescents with DS.

Acknowledgments: (non obbligatorio).

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PP07B—Mechanical efficiency and its determinants: insight from a single-leg amputee model

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Purpose: To investigate determinants of mechanical net efficiency (hnet) in single-legged amputee subjects (AMP) compared to a group of healthy controls (Ctrl). Our hypothesis was that AMP would have exhibited reduced hnet compared to Ctrl possibly due to negative adaptations and interactions between central and peripheral factors, as well as different recruitment of the two limbs (whole limb, WL vs. amputated limb, AL) during exercise with consequent different cycling pattern.

Methods: Eight males with single transtibial amputation (36.6 ± 10.5 years; 73.1 ± 14.7 kg) and 8 age-matched controls (37.1 ± 10.8 years; 82.6 ± 13.2 kg) performed exercise on a reclined cycle ergometer pedaling with both lower limbs, at absolute workloads (60 W and 100 W). AMP group exercised with prosthesis, so both limbs were involved. We examined pulmonary parameters, central and peripheral hemodynamics, and right/left limb recruitment during pedaling. Oxygen uptake, mean arterial pressure, femoral blood flow (FBF), and single leg power of both limbs were studied to assess central and peripheral determinants of hnet. Body composition was measured by means of DXA and FBF was normalized for the volume of the lower limb.

Results: During exercise executed at 60 W, hnet was $22.1 \pm 2.4\%$ and $20.3 \pm 2.6\%$ ($p = 0.298$) in AMP and Ctrl respectively, at 100 W hnet was $20.4 \pm 2.5\%$ and $18.2 \pm 2.5\%$ in AMP and Ctrl respectively ($p = 0.257$). Despite no difference in hnet AMP exhibited a significantly lower FBF for AL compared to WL ($p < 0.001$) as well as compared with the limbs of Ctrl group (both $p < 0.001$). No between group differences were found in any other variable. The balance of the two limbs resulted in favor of the WL in AMP group, especially at lower intensity, while in Ctrl group right and left limb were balanced ($\geq 50/50$) at both intensities.

Conclusions: Contrary to our initial hypothesis, single-legged amputee individuals did not show reduced mechanical efficiency compared to healthy controls during cycling at different intensities. Results of this study suggest positive adaptation of both central and peripheral factors in both limbs in order to maintain mechanical efficiency.

PP07C—Adapted physical activity project in Alzheimer's disease subjects and their carers: the collaboration between patients association and “palestra della salute”

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Purpose: Non-pharmacological therapy such as Adapted Physical Activity is still poorly applied in individuals with Alzheimer's disease. The following project aims to provide a structural and objectively feasible model of administering adapted physical activity to subjects with Alzheimer's and Caregiver, in order to evaluate the impact of physical exercise on the functional capabilities of the participants.

Methods: The sample was identified from members of the Alzheimer's Association of Ferrara (AMA) who joined the project. We had 13 participants that performed the functional assessments at the beginning of the project (T0) and 5 months later a physical activity program (T1). Evaluation consisted in: 6MWT, SPPB, TUG, 5-STs, BBS. The proposed activity was supervised by kinesiologists, for twice a week. Inclusion criteria included a Mini-Mental State Examination (MMSE) score > 18 (at screening less than six weeks prior to baseline visit), age between 50 and 90 years, and a caregiver with regular contact.

Results: 9 subjects (6M&3F) with mean age 72.3 ± 6.2 , completed the project, 6 subjects were retested at T1 (4 drop out). The six subjects tested followed a statistically significant improvement at 6MWT T0= $323(\text{mt}) \pm 80$; T1= $361.3(\text{mt}) \pm 86$ ($p = 0.03$); and interesting improvement at SPPB: T0= $10.5 \pm 1.6(\text{score})$; T1= $11 \pm 1.51(\text{score})$; TUG: T0= $9.4 \pm 2.2(\text{sec})$; T1= $8.4 \pm 1.9. \text{ sec}$; 5-STs: T0= $13.9 \pm 5.4(\text{sec})$; T1= $11 \pm 2.6(\text{sec})$; BBS: T0= $53.7 \pm 1.5(\text{score})$; T1= 53.7 ± 2.2 .

Conclusions: Such work affirms the importance of the interaction between certified structures as the “Palestra della Salute”, the different professional figures and local associations to ensure quality and innovative service on the territory. Recent studies (1) showed a slowdown in cognitive impairment associated with an improvement of daily activities (ADL) induced by the practice of physical exercise(2), placating aggressive attitudes at particular times of the day, giving benefits in managing the caregiver.

Acknowledgments: (non obbligatorio).

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PP08A—Effects on health-related quality of life, physical function, adherence and safety of an exercise program with two different types of coaching for postmenopausal women with osteoporosis: a randomized controlled trial

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Purpose: We evaluated the effectiveness of an exercise program designed to improve the quality of life in women with postmenopausal osteoporosis when administered as individual home training (IT) or group gym training (GT). We hypothesized that the effects on health-related quality of life (HRQoL), physical function, adherence, and safety of a specifically designed exercise program are the same when coaching and encouragement are provided by live supervision as for the GT or by telephone contacts at regular time intervals such as IT.

Methods: It was a single-blind, randomized study, which included postmenopausal women aged ≥ 40 years with primary osteoporosis. Each group performed the exercise program in two 1-h sessions per week for 18 months.

Results: No significant differences were observed between the IT and GT groups and between the baseline and the two follow-up assessments within each group for HRQoL (ECOS-16) which was the main outcome measure of the study; as well as for disability (WHODAS) and fear of falls (SHORT FES-I). On the other hand, weekly physical activity (PASE) was in the moderate activity range at baseline and increased significantly during the study reaching an intense activity level in both groups at the end of the study. Both groups showed similar significant improvements in knee and shoulder mobility and functional capacity (6-min walk test). However, no differences were observed in the comparison between the IT and GT groups.

Conclusions: These results indicate that coaching and encouragement, in both modes, can be valuable tools for performing exercise safely and effectively

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PP08B—Recovery from a cardiopulmonary exercise testing in physically active collegiate smokers: cardiorespiratory and metabolic kinetics analysis

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Purpose: Cigarette smoking is one of the leading risk factors for cardiovascular and pulmonary diseases. Its constituents impact negatively on cardiovascular and pulmonary function: i) nicotine increases the heart rate and the cardiac work, stimulating the sympathetic nervous system; ii) tar impairs O₂ diffusion across the alveolar-capillary barrier; and iii) carbon monoxide reduces O₂ transport and extraction. The impact of cigarette smoking on

cardiopulmonary functionality has been mainly investigated by exploring the response to exercise onset and during maximum efforts, with less attention to the recovery phase. Hence, this study aims to assess the time-course of the pulmonary O₂ uptake (VO₂) and related variables after a maximum exercise in smokers compared to healthy controls. We expected a blunted and delayed recovery of cardiopulmonary and metabolic variables in smokers.

Methods: Seven physically active young smokers [SMK; age: 21 ± 2 yr.; body mass: 77 ± 6 kg; stature: 1.79 ± 0.07 m; maximum VO₂ (VO₂max): 44.5 ± 4.5 ml·min⁻¹·kg⁻¹; 13 ± 5 cigarette/day for 6 ± 2 years; mean \pm SD] and 9 non-smokers [CTRL; age: 24 ± 2 yr., body mass: 77 ± 10 kg; stature: 1.78 ± 0.08 m; VO₂max: 46.5 ± 6.5 ml·min⁻¹·kg⁻¹] were enrolled. Individual pulmonary function was assessed by spirometry. Peak values of ventilation (VE), VO₂ and heart rate (*f*H), and the maximum aerobic power (Wmax) were determined during an incremental step test (25 W/2 min) on a cycle ergometer. A 5-min of active recovery at 30 W (30 rpm) followed the test. A mono-exponential function fitting was used to determine the amplitude (AMP), starting value (Y0) and time constant (τ) of the investigated variables responses. Vagal reactivation was assessed by a heart rate recovery (HRR) index (HRR30).

Results: Spirometric values did not differ between groups. SMK showed a higher *f*H (+ 13%; $P = 0.01$) at rest, a lower Wmax (- 11%; $P = 0.05$) and peak VE (- 11%; $P = 0.03$) during exercise, and a slower τ in VO₂ (- 18 s; $P = 0.01$), VE (- 23 s; $P = 0.04$) and VCO₂ (- 24 s; $P = 0.05$), but not in *f*H, during recovery. Lastly, SMK showed 5-beat lower HRR30 ($P < 0.05$).

Conclusions: Despite a similar pulmonary function, slower respiratory and metabolic variables kinetics were found during recovery in smokers. No smoking effect was found on *f*H time constant, even though the lower HRR30 indicated a blunted vagal reactivation. Other mechanisms, like the mechanical pulmonary afferent activation, may have counteracted the nicotine-induced sympathetic over-activation.

PP08C—Preventive and adapted motor activity in idiopathic scoliosis: from postural assessment to methods of intervention. The clinical cases

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Purpose: The Ministry of Health national guidelines (2017) on postural classification, analysis and measurement, underline the need to evaluate postural attitude through the alignment of cranium and parts of the body, as well as musculotendinous and nervous units observation

Methods: Purpose of the study is to present the observation outputs and the methods of intervention in two clinical cases of structural scoliosis (female 14 yrs.) respectively treated with IOP (S. Pivetta) without brace and SBPP (The Schroth Method) with brace. Both cases showed postural (and lifestyle) enhancement through preventive and adapted motor activity.

Results: Multiple treatment methods are available, as scientific evidence demonstrated (SOSORT 2016 Guidelines, Scoliosis Research Society SRS). In the third millennium it is necessary to move towards conservative treatments for scoliosis through both kinesiological and physiotherapeutic devices.

Conclusions: Kinesiology has always addressed motor activity for spine issues but combined with physiotherapy it allows the creation of protocols of postural training in the long period. The aim of

kinesiology is to enhance people's state of health through preventing disorders and pathologies.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP09A—Anthropometry, body composition and performance in sitting volleyball athletes

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Purpose: Sitting Volleyball (SV) is a fast and dynamic game in which athletes are required to move quickly on the playing court using the hands in order to get into position early enough to play effectively. The sport-specific sprint performance in SV requires athletes to be exceptional movers in forward, backward, lateral and multidirectional movements. The aim of this study was to investigate how the anthropometric and physical fitness characteristics of athletes relate to their sport-specific sprint performance from both a training and classification perspective.

Methods: Thirty-five SV male athletes practicing SV at a national/international level volunteered in this study. All athletes were actively training (estimated mean training time per week, 4.2 ± 1.5 h). The experimental protocol consisted in the assessment of anthropometry, body composition (by-means of Dual-Energy X-Ray Absorptiometry), upper-body strength (Sit-Ups Test, Seated chest pass test and Handgrip strength test) and sport-specific sprint performance (5 m backward Sprint Test, Modified Agility T-test and Speed and Endurance Test). The degree of association between two continuous variables, accounting for the effect of assigned functional class, was measured by partial correlation (rPC).

Results: The results showed that greater hand span and lower percentage of fat mass at both the sub-total and regional level were all associated with better sport-specific sprint performance (rPC ranging from 0.341 to 0.485; $P < 0.05$ for all). Moreover, negative and statistically significant associations were observed between the performance in the considered upper-body strength tests and the time to complete the Modified Agility T-test and the Speed Endurance Test (rPC ranging from -0.339 to -0.483 ; $P < 0.05$ for all).

Conclusions: The statistically significant negative association between the hand span and the sport-specific sprint performance suggests that impairments, like for example a total or partial hand amputation, could have a negative impact on the sprint abilities typical of SV. This result opens the way for future research with a larger sample size aimed at considering further criterion which could be used in SV to attribute the functional classes to athletes. The results of the present study should also encourage physical conditioners and coaches to include exercises to strengthen the upper body musculature in their training programs in order to improve sport-specific sprint performance.

PP09B—Myofibril linearity in muscle image analysis: an approach based on circular statistics

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Purpose: An interesting problem in analysing the image of muscle tissue is represented by the attempt to evaluate the linearity of myofibrillar structures and their possible deviation from a straight line. By indicating with α_i the angles between two successive sarcomeres along the same myofibril, Cisterna et al. (2021) proposed an index that can be thought as the mean of the angles (taken in absolute value). In this contribution, we propose an alternative approach to the same problem.

Methods: Our proposal, based on circular statistics, taking a cue from the same angular data α_i proposed by Cisterna et al.; circular statistics has been used earlier to study muscle cell alignment. Ideally, for each angle α_i , it is possible to construct a unit vector having the base at the centre of a goniometric circumference and the vertex on the circumference from which to calculate the resulting vector, which, divided by n (that is the number of angles or the number of sarcomeres minus 1), gives the resulting mean vector. From here, two parameters can be obtained:

the direction of the mean vector (if it is equal to 0, it means that the displacements to the right balance those to the left; or, as an extreme case, that the sarcomeres are perfectly aligned);

the length of the mean vector r , that can range between 0 (representing perfect isotropy – or a circular uniform distribution – i.e., the maximum possible misalignment) and 1 (representing perfect anisotropy, i.e., the maximum possible alignment).

It is also possible to perform a statistical test using the mean vector length r as test statistics: Rayleigh test is the best known in circular statistics; its null hypothesis is the uniform circular distribution of the angles, and the alternative hypothesis is a generic anisotropy.

Results:

The method we propose, unlike the one indicated by Cisterna et al., uses circular analysis techniques instead of linear analysis methods, which makes it more elegant and gives greater substance to statistical analysis (but in contrast, it also has greater computational complexity).

Conclusions:

In conclusion, our method has potential use in several sarcomere-related conditions by providing a quantitative definition of myofibril linearity in skeletal muscle.

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PP09C—Biomechanical monitoring when applying individualised whole-body vibration in a person with multiple sclerosis: a 3-years of follow-up

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Purpose: This study aimed to investigate the individualised whole-body vibration effects (WBV), by monitoring locomotion, balance, and strength with synchronised surface electromyographic activity (sEMG), during a follow-up of three years.

Methods: A PwMS (age:62 years; stature:180 cm; body mass:65 kg; body mass index:20.1 kg/m²), who showed a left weaker side than the contralateral, took part in the present study. The individual WBV magnitude was determined by recording sEMG in the upper (biceps brachii-BB, anterior deltoid-AD, and palmaris longus-PL) and lower limbs (vastus lateralis-VL, biceps femoris-BF, tibialis anterior-TA,

and lateral gastrocnemius-LG). The kinematic analysis, when the participant walked on a motorised treadmill, was executed using a 3D motion capture system. Angle-angle diagrams were determined by plotting the angles at adjacent joints against each other (hip-knee angle/knee-ankle angle). The balance was assessed by measuring the body sway (medio-lateral/forward-backward) on the force platform during different bipodalic standing positions (bipodalic static/bipodalic dynamic); open eyes/closed eyes. Hand-grip strength test with synchronised sEMG activity of upper limbs muscles was performed.

Results: The areas of the knee/ankle diagrams, increased in the strongest ($\Delta = 476.42\%$) and weakest lower limbs ($\Delta = 1150.99\%$). The rate of force development (RFD) increased in the weakest ($\Delta = 32.16\%$) and decreased in the strongest ($\Delta = -11.92\%$). The sEMG activity during RFD increased in all the muscles of the weakest upper limb (Δ ranged from 59.52 to 80.48%), whereas in the strongest limb increased only in PL muscle ($\Delta = 186.44\%$). Medio-lateral sway decreased during the several conditions (Δ ranged from -6.86 to -74.95%); similarly, forward-backward sway decreased (Δ ranged from -40.42 to -75.78%).

Conclusions: The results of this investigation show that individualized whole-body vibration improves the area of the knee-ankle diagram (conjoint range of motion during walking), balance, and strength variables.

Acknowledgments: (non obbligatorio).

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PP10A—Reduced on-set oxygen uptake kinetics in patients with heart failure: can exercise training mitigate this phenomenon?

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Purpose:

Heart failure (HF) is a syndrome characterized by functional and structural abnormalities of the heart, which in turn result in impairment of almost all oxygen transport pathways leading to impaired $\dot{V}O_2$ kinetics. These changes are manifested by typical signs such as dyspnea and exacerbated fatigue resulting in reduced exercise tolerance and severe limitations to activities of daily living. In addition, it has been demonstrated that patients with HF exhibit slower onset of $\dot{V}O_2$ kinetics. Exercise training seems to ameliorate some of these clinical manifestations, however it is not clear if these factors are associated with the ejection fraction (EF).

Therefore, the purpose of this study was to evaluate: a) the impact of endurance exercise training on the $\dot{V}O_2$ onset kinetics and b) the

impact of the EF on the change in $\dot{V}O_2$ onset kinetics in patients with HF.

Methods: All patients completed short-term cardiac rehabilitation (CR) of a duration 19 ± 4 days including a group-based 1-h session, 6 d/w exercise program of low- moderate intensity aerobic training on cycle ergometer. The endurance training sessions lasting 40 min/day started from a workload of 0 watts; a day-by-day progression was performed according to symptoms of dyspnoea and fatigue. Before and after the training period, patients performed a 6MWT instrumented with a metabolic system (K5, Cosmed, Rome, Italy). The raw metabolic $\dot{V}O_2$ breath-by-breath data were fit with a single exponential model. Mean response time (MRT) is represented by the time constant τ of the exponential function. Work mean response time, (wMRT) was calculated to quantify $\dot{V}O_2$ kinetics by correcting MRT for work rate during the first phase of the 6MWT using the following equation: $wMRT = MRT/Amp$

Results: The study involved 40 patients (72 ± 6 yrs), classified in NYHA class II or III, clinically stable with EF of $37 \pm 13\%$ (65% with reduced EF). After the training period, no significant differences were shown on the MRT (from 0.94 ± 0.30 min to 0.91 ± 0.28 min, $P = 0.4237$) however patients ev a significant reduction of wMRT, with a difference of $0.1 \times 10^{-3} \text{ min}^2/\text{ml}$ ($P < 0.04$). There was a significant negative correlation between the improvement in wMRT and EF ($R = -0.402$, $P = 0.010$).

Conclusions: In conclusion, in patients with HF a short period of exercise training had a significant impact on the onset $\dot{V}O_2$ kinetics by reducing the oxygen deficit, and the improvement seems inversely related to the EF.

PP10B—The effects of a soccer match on cardiac troponin i levels in male amateur soccer players

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Purpose: Cardiac troponins are the reference markers for the diagnosis of acute coronary syndromes. However, recent studies have shown that healthy professional athletes have a significant increase in cardiac troponins after intense physical activity. Conversely, there are few studies on the evaluation of cardiac troponins in amateur athletes. The aim of this study was to evaluate cardiac troponin I in amateur soccer players after a soccer game.

Methods: For the study, 22 amateur soccer players from the University Sports Centre of the University of Rome Tor Vergata were enrolled. The blood samples were collected before the start of the soccer game, immediately at the finish, 3 h and 24 h from the time the game ended.

Results: The data showed a significant increase of serum troponin concentrations immediately after the game ended and after 3 h ($p < 0.001$) and then a return to baseline levels after 24 h ($p < 0.001$).

Conclusions: Our study demonstrated a significant increase in cardiac troponin I in amateur soccer players, without any evidence of cardiac damage. Further studies will be needed to better study cardiac troponin I kinetics during exercise

PP10C—Effect on physical function of an exercise program in adults with total hip replacement: case study

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Purpose: Total hip replacement (THR) is among the most common elective surgical procedures worldwide. A large body of published evidence has consistently shown that this surgical procedure successfully decreases pain and improves joints mobility and quality of life. However, patients could present significant muscular atrophy and weakness in the limb affected by arthrosis that can persist for months after THR, with mobility deficits remaining for many years. Exercise programs beyond the initial post-operative rehabilitation period have been shown to reduce pain and joint stiffness, improve physical function and lessen the chance of accidental falls after surgery. Despite that, individuals who have completed THR treatment do not seem to increase physical activity from pre-to-post-surgery. The purpose of this case study is to investigate the effects of a 3-months exercise program after 6 months from total hip replacement.

Methods: Six people with THR were enrolled in the study. Participants were divided into a control group (CG) (mean age 67.7 ± 9.6 yrs) and an intervention group (IG) (mean age 62.3 ± 0.6 yrs). The intervention group performed a specific exercise program for 3 months in 1-h sessions of 2 days/week. All the sessions were supervised by a specialized trainer. Participants were evaluated 6 months after THR and after 3 months of training. The results evaluated were: maximal strength of the lower limbs measured with a hand-held dynamometer; lower limb function assessed with 30 s Chair-Stand Test (30sCST); and physical performance examined with Time Up and Go (TUG).

Results: Regarding the maximum extension force of the operated hip, we found a statistically significant improvement in the IG (+105.9%; $p < 0.05$), on the contrary in the CG the improvement was not statistically significant (17.9%; $p > 0.05$). Furthermore, flexion (+ 27.8%), abduction (+ 8.2%) and adduction of the hip (122.4%) and extension of the knee (+ 31%) in IG improved ($p > 0.05$). The 30sCST and TUG showed good lower limb function and good physical performance in both groups. However, the results of both tests did not show improvement after 3 months of training.

Conclusions: The subjects examined in both groups presented a good functional status 6 months after surgery. In addition, the IG increased maximal strength after the 3-month training.

PP11A—Judo for older adults: the coaches' needs of knowledge

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Purpose: Within the European EdJCO project on the development of an educational programme for coaches of older novice and expert judoka, the aim of this study was to explore the views of expert judo coaches on their knowledge and needs of information for training older practitioners.

Methods: In total, 470 international (Europe 48%, Americas 22%, Africa 23%, Asia 5% and Oceania 2%) judo coaches (IJF: level 1, 55.3%, level 2, 33%; judo black belt: 3.4 ± 1.7 dan; $F = 15\%$; university education: $68\% \geq BA$) responded an online survey on coaching judo for older adults encompassing demographic information and 35 items (Aging process; $n = 7$; Safety and First Aid: $n = 4$; Organisation & Environment: $n = 5$; Physiology and Fitness: $n = 3$; Psychology & Mental Health; $n = 8$; Teaching & Training; $n = 8$) to be rated on a 7-point Likert scale for their knowledge and needs of education. A bivariate go-zone plot was used to show the relationship between the mean ratings of the knowledge and needs.

Results: Findings highlighted the lowest knowledge and the highest need of education for Immune function, Medical certificate and drug use, Family and social support, Evaluation, Psychological disorders, Adapted judo techniques for older practitioners.

Conclusions: The judo coaches' point of view presents a coherent and useful starting point to develop an educational curriculum on teaching and specific methodology to train older judo practitioners.

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PP11B—Effects of a three years training program on adiponectin serum levels in young basketball athletes

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Purpose: The importance of training in regulating body mass and performance is well known. In addition, exercise can regulate energy and even inflammatory homeostasis by promoting the release of soluble molecules from adipose tissue. Among these, adiponectin has gained increased attention recently. This study aimed to examine adiponectin modifications in competitive basketball players during training, competition, and the recovery period of 3 seasonal championship.

Methods: 12 male elite basketball players (25 ± 6 years, weight of 92 ± 10 kg, and height of 195 ± 9 cm) were recruited and biochemical parameters measured. Adiponectin serum concentrations were measured by ELISA assay in sera from athletes at 0 months (T0) in the preseason phase, 3 months after (T1), and 6 months (T2) after the start of the championship; 3 championships were monitored (2018, 2019, 2020).

Results: we found that adiponectin serum levels decreased from T0 to T1 and T2 in all 3 analyzed championships (T0: 17.98 ± 2.10 , T1: 12.75 ± 2.14 , T2: 12.44 ± 1.03 ; T0: 15.08 ± 2.76 , T1: 12.75 ± 2.21 , T2: 12.53 ± 0.90 ; T0: 13.92 ± 1.6 , T1: 13.15 ± 0.5 , T2: 11.92 ± 0.9).

Conclusions: adiponectin serum levels correlates with the different championship phases, suggesting that different training levels affects the endocrine functions of the adipose tissue and adiponectin secretion. Correlations of adiponectin with biochemical and anthropometrical parameters as well as with physical abilities will clarify the molecular basis of adiponectin modulation in elite basketball athletes throughout the championship and the usefulness as a biomarker of performance.

PP11C—Training and detraining effect after home exercise program administered as monitored individual home training or supervised online group training

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Purpose:

Osteoporosis is accompanied by an increased risk of fracture resulting in pain, decreased physical and social functional capacity, and quality of life. Many studies have shown that resistance training can safely increase muscle strength and bone mass and improve functional performance. However, cessation of training has been found to be associated with a loss of muscle mass and muscle strength, the extent of which depends on the length of the detraining period. This study aims to understand training-induced adaptations and whether these can be maintained after 6 months of cessation of an exercise program when administered as monitored individual home training (MIHT) or supervised online group training (SOGT).

Methods: 20 women with postmenopausal osteoporosis (age: 66 ± 5.7 years) were randomly assigned to an MIHT group ($n = 10$) or an SOGT group ($n = 10$). Participants completed 18 months of training twice a week. The SOGT was performed in 2 training sessions of 1 h per week under the direct supervision of the trainer via a digital platform. For the MIHT group, the trainer explained to the participants how to do physical activity at home. Every 6–8 weeks, the exercise program was reviewed and updated. Physical performance measures were administered at baseline, 12-month, and 18-month training follow-up and after the 6-month de-training period. The training-induced adaptations were evaluated with the 6-min walking test (6MWT), sit-and-reach test, wand test, and 30-s chair stand test. In addition, weekly physical activity was calculated.

Results: After training at 18 months, statistically significant improvements were found in 6MWT ($p \leq 0.05$), with no significant differences between groups ($p > 0.05$). In the other tests, an improvement was found in both groups but not statistically significant. Furthermore, in 6MWT training-induced improvements remained above baseline after the detraining period. On the other hand, in the wand test there was a statistically significant decrease in shoulder mobility ($p \leq 0.05$). No significant differences were observed between groups after training or detraining ($p > 0.05$).

Conclusions:

Administration of a MIHT or SOGT workout improves functional status in women with postmenopausal osteoporosis in both settings. Furthermore, these gains are largely preserved after the cessation of the prescribed exercise.

PP12A—Fibromyalgia and functional training: strategy to improve aerobic power

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Purpose: Fibromyalgia is a disorder characterized by widespread musculoskeletal pain accompanied by fatigue, sleep, memory and mood issues. Researchers believe that fibromyalgia amplifies painful sensations by affecting the way your brain and spinal cord process painful and nonpainful signals. Aim of the study was to investigate and create an aerobic exercise protocol to reduce pain and improve physical fitness.

Methods: Six women affected by fibromyalgia have been enrolled on this study. Age was between 40 and 65 years old. Functional Training was administered with a Training Lab Italia Protocol® (CTLIP) built as circuit training. Aerobic Power was evaluated at T0, T1 and T2 with a 6 min walking test. Effort was evaluated with a Borg Scale.

Results: Our data showed the improvements of aerobic power ($p < 0.05$). In addition effort, was decreased at the end of each session of training ($p < 0.05$) as seen with Student's *t*-Test outcomes.

Conclusions: Our project suggest that literature confirm the benefits of exercise practice in patient affected by fibromyalgia. The dose-response of exercise to avoid the increase of the pain after the training session, needs a specific program with a Frequency Intensity Time and Type (FITT) related to interval training methods.

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PP12B—Spatial decrease in muscle activation induced by acute passive static stretching: a possible neuromuscular compartmentalization of the gastrocnemius muscle

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Purpose: Recently, spatial adaptation of muscle excitability during sustained muscle voluntary contractions (MVC) up to fatigue has been reported, suggesting a functional muscle compartmentalization. Acute passive stretching (PS) can induce a reduction in surface electromyography (sEMG) amplitude; however, it is not clear whether PS may decrease motor-unit activity heterogeneously, similar to what occurs with fatigue. Therefore, the aim of the study was to evaluate possible heterogeneity in muscle activation following PS intervention in the gastrocnemius muscle.

Methods: Thirty healthy men (age 24.3 ± 2.4 years, height 179.3 ± 6.0 cm, body mass 76.2 ± 6.9 kg) underwent a 5-min PS intervention (5'45 s on/15 s off). Before (PRE), immediately after (POST) and after 5 (POST₅) and 10 min (POST₁₀), participants

performed MVCs of the plantar-flexor muscles. Spatial muscle activation was recorded by means of high-density sEMG (HD-sEMG) in the *gastrocnemius medialis* and *lateralis* of the stretched and of the non-stretched contralateral limb. The HD-sEMG root mean square (RMS) and its centroid were calculated.

Results: HD-sEMG RMS was reduced in POST, POST₅ and POST₁₀ in both medial ($p \leq 0.045$ in all) and lateral ($p \leq 0.012$ in all) gastrocnemius of the stretched limb, while the centroid shifted toward a more caudal direction ($p \leq 0.048$). Interestingly, the same behaviour was found in the contralateral limb in POST for both muscles (both $p = 0.004$). No differences were found in control.

Conclusions: The uneven spatial decrease in muscle activation following acute PS suggests differences in neuromuscular organization of the *gastrocnemius* muscle.

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PP12C—Effects of supervised or home-based training interventions guided by an exercise facilitator to improve functional capacity and quality of life of patients with end-stage kidney disease: preliminary results of a non-randomized trial

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Purpose: End stage kidney disease (ESKD) exposes patients to progressive deconditioning and high cardiovascular risk. The effectiveness of exercise in reversing this status is reported in literature, but patients' participation is limited by several barriers. We hypothesized that an exercise specialist in the dialysis center may improve patients' introduction to exercise by offering and explaining them different training options.

The study aims to report the changes of functional and psychological parameters measured after execution of the different programs.

Methods: In this pragmatic non-randomized trial (NCT04282616 [1]) within the 119 contacted patients, 83 opted to participate. Each patient was offered to choose one of the following three-month low-intensity programs: (i) advised physical activity increase (ADV); (ii) structured home-based walking exercise (HB); (iii) in-hospital (pre/post dialysis) supervised walking and resistance training (SUP); (iv) performance assessment only (CO). The following outcomes, collected at baseline (T0) and at the end of the programs (T3) were considered: mobility (measured with the 6-min walking test, 6MWT), walking speed (10-m walking test, T10m), strength of lower limbs (5-time sit-to-stand test, 5STS) and quality of life (SF-36 questionnaire).

Results: Currently, 63 patients completed the study (ADV $n = 0$; HB $n = 21$; SUP $n = 36$; CO $n = 6$). At baseline, patients who opted for SUP compared to HB were older (71 ± 11 vs 65 ± 15 $p = 0.09$), had more comorbidities (Charlson index 7 ± 3 vs 6 ± 2 ; $p = 0.11$) and

lower exercise capacity (6MWD: 254 ± 116 vs 282 ± 121 m; $p = 0.40$).

All patients performed the prescribed training sessions with similar adherence and without adverse events. After three-months, both groups significantly increased 6MWD, T10m, 5STS and SF-36 scores. The between-group comparison did not highlight significant differences for all parameters: 6MWD (SUP: $+26 \pm 24$ m; HB: $+45 \pm 31$ m; $p = 0.17$); 5STS (SUP -1.7 ± 2.1 s; HB: -2.7 ± 2.2 s; $p = 0.34$); T10m (SUP $+0.1 \pm 0.2$ m/s; HB: $+0.2 \pm 0.2$ m/s; $p = 0.26$) and physical functioning domain of SF-36 ($+11 \pm 13$ vs $+8 \pm 9$ $p = 0.56$). The sequent analyses corrected for baseline imbalances between the two groups, confirmed the equal effectiveness of the treatments.

Conclusions: Structured home-based or supervised exercise in the dialysis center proved to be equally safe and effective in improving mobility and functioning of ESKD patients, although the supervised option seems to be preferred and more suitable for frailer subjects. The continuation of the trial may confirm these preliminary data.

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PP13A—How much exercise should the pregnant woman get? a case report of 28 weeks of training

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Purpose: Regular physical activity in all phases of life, including pregnancy, promotes health benefits. Pregnancy is an ideal time for maintaining or adopting a healthy lifestyle. In addition to tailored exercise for special population such as pregnancy, needs to have some rules and a specific guidelines that nowadays are still not focused as F.I.T.T program. Aim of the study was to investigate and report one case report of pregnant woman in 28 weeks of training with a personal trainer.

Methods: 30 year-age old woman have been enrolled on this study during entire pregnancy period. Health status was evaluated with Get Active Questionnaire for Pregnancy (GAQP) each trimester. Exercise built as Circuit Training Lab Italia Protocol® (CTLIP) with 2 training session of weeks, was evaluated with Borg Scale. Exercise protocol was administered matching time and perception of effort. To take in account safety of woman, exercise and evaluation were assessed by Training Lab Italia (Italy) a laboratory structured with standard conditions as temperature and non traumatic-flooring followed by Expert Personal Training and Medical Doctor.

Results: Our data suggest that huge positive impact of physical activity and exercise protocol was significant as results of T0 and T1 of GAQP ($p < 0.05$). Mobility, strength and aerobic power was significant at the end of intervention ($p < 0.05$). Effort during the birth was decreased as reported by medical doctor and Numeric Rating Scale ($p < 0.05$) confirmed by Student's *t*-Test analysis.

Conclusions: Women with uncomplicated pregnancies should be encouraged to engage in aerobic and strength-conditioning exercises before, during, and after pregnancy. Additional research is needed to study the effects of exercise on pregnancy-specific conditions and outcomes and to clarify further effective behavioral counseling methods and the optimal type, frequency, and intensity of exercise.

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PP13B—Overuse injuries in kitesurfing

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Purpose: Kitesurfing is one of the world's fastest-growing Olympic aquatic sports. However, previous scientific literature on this sport has mainly focused on acute injuries 1. Therefore, this study aimed to capture a picture of the burden of overuse injuries in kitesurfing.

Methods: Active kite-surfers regularly completed an online questionnaire describing the health of their shoulders, lower back and knees and any injury-related symptoms. We adopted the focused-on-symptoms approach validated by Clarsen et al. 2. We separated acute from overuse injuries in the dataset based on telephone interviews. The self-reported number of hours spent practising kitesurfing was collected, as was the primary kitesurfing discipline each participant engaged in. We analysed the data using SAS (Statistical Analysis Software, Cary, NC) version 9.4 for analysis. Relationships between the binary status of having reported an injury or not and having reported a severe injury or not were tested for association with BMI using logistic regression (PROC LOGISTIC). Approval to conduct this study was given by the institutional Ethics Committee of the second author, and all participants gave informed consent.

Results: Forty-three participants (age: range 21–55, mean: 39, SD: 8.9; BMI: range 15–19, mean: 23 SD: 2.8) completed a total of 304 questionnaires, covering a total period of 2,096 distinct person-days. Person-days of reduced participation related to shoulder, lower back and knee problems were 8%, 3% and 8% of the total, respectively. Performance was limited due to shoulder, lower back and knee problems in 11%, 22% and 16% of person-days, respectively. In 20 overuse injuries, it was possible to apply the Orchard Sports Injury Classification System OSICS10; they included: shoulder muscle strain (4), knee subluxation, biceps tendon lesion, patellar tendinopathy, pain post PCL reconstruction, pain post ACL reconstruction, lumbar pain nor otherwise specified (5), Patellofemoral impingement (2), Piriformis syndrome (2), pain post shoulder surgery, iliotibial band syndrome.

Conclusions: Overuse injuries emerged as a significant predictor of reduced participation, decreased performance and discomfort in kitesurfing. The prospective survey method captured a picture of overuse injuries in kitesurfing not previously described. Epidemiological data reported in this paper are essential to underpin the creation of specific training programs to prevent injuries and improve comfort and performance in this sport.

Acknowledgements: This study has benefited from the support of the international association **EXTREMESPORTMED**—www.extremesportmed.org

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PP13C—Exercise-based secondary prevention program positively improves functional parameters in older outpatients after acute coronary syndrome. Findings from the pipeline study

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Purpose: Despite benefits of physical activity are well-recognized in secondary prevention programs, patients with acute coronary syndrome (ACS) are less likely to attend traditional center-based interventions. The purpose is to examine the efficacy of a center- and home-based secondary prevention program in improving exercise capacity and behavior of patients affected by acute coronary syndrome.

Methods: This is a secondary analysis from the PIPELINE study. A sample of 59 patients (mean age 76 years) was analyzed. Main outcomes were stable changes in self-reported weekly leisure-time physical activity (wLTPA), walking speed (WS) and estimated cardiorespiratory fitness (eCRF, VO₂peak). Intervention program consisted of 6 individual on-site sessions including motivational interviewing to reach exercise goals. These preliminary results are referred to the first 4 visits (6 months). Exercise prescription was based on the results of a moderate and perceptually regulated treadmill walk test to estimate VO₂peak. Functional variables were assessed during each visit after discharge.

Results: Follow-up at 1-, 2-, 3- and 6-months, was completed by 79, 69, 64 and 59 patients respectively. wLTPA significantly increased during the follow-up period (median METs/h/week 2.5, 11.2, 12.0, and 13.4 at baseline, 2-, 3-, and 6-months, respectively; P < 0.0001). These results were associated with increasing median WS (2.8 ± 1.1, 3.2 ± 1.2, 3.7 ± 1.1, 4.0 ± 1.1 km/h, respectively, P < 0.0001), and VO₂peak (16.7, 17.4, 18.8, 20.5 mL/kg/min, respectively, P < 0.0001).

Conclusions: This early and individualized exercise intervention improves long-term adherence to a physically active lifestyle, walking capacity and eCRF in older patients after ACS. Results may provide valuable insights for the development of more feasible and effective exercise-based secondary prevention programs.

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PP14A—Muscle damage biomarker after downhill running: the urinary titin fragment

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Purpose: In recent years, trail running, ultra-trail or alpine running engaged more and more people. A specific aspect of these kinds of competitions is the down-hill running (DHR). Some biomechanical

features of DHR differ from flat running (FR). In particular, during DHR the amplitude of the ground reaction force, at the heel impact at the beginning of the stance phase, and the following eccentric contraction of the thigh muscles are more intense than during FR. As a result, the involved muscles present cellular damages and well known delayed muscle soreness (DOMS). There are multiple explanations to this damage, one of the most accepted is the sarcomere damage at the level of the Z-disk mirrored by the urinary concentration of the titin-N-terminal fragments (UTF). The objective of this study is to compare the DOMS perception and the UTF concentration during the recovery phase after DHR.

Methods: 45 young adults (YO: 23 ± 3 yrs. weight 71 ± 10 Kg and height 176 ± 9 cm) performed 30 min of DHR on a treadmill (slope: -10% , $\approx -5.7^\circ$). The speed was adjusted to correspond to 65–70% of the FCmax. DOMS were evaluated with the aid of the Borg CR 1–10 scale at 48 and 72 h after DHR. Moreover, before DHR (PRE) and after 48–72 h two 1 ml urine samples were collected in eppendorf tubes and stored at -20°C . One sample was used to analyze urinary creatinine levels. The second tube was employed to measure UTF concentrations via an ELISA assay using a specific kit. Urine samples were thawed, centrifuged and diluted by 1:10–1:20–1:50 for PRE–48h–72h samples, respectively. Then, samples were processed for ELISA assay and obtained UTF concentrations were normalized relative to urinary creatinine.

Results: DOMS statistically decreased from 4 ± 2 at 48 hours to 2 ± 1 at 72 hours after DHR ($p < 0.001$). The UTF mean concentration significantly increased ($p < 0.001$) during the recovery phase; it slightly increased from the baseline (4.7 ± 3.2 pMol/mg/dl) at 48h after DHR (8.1 ± 5.9 pMol/mg/dl) with a peaks at 72h (16.9 ± 14 pMol/mg/dl). No significant correlation was observed between the peak of DOMS and the peak of UTF concentration.

Conclusion: The difference in the time mark of the DOMS and UTF peaks and the lack of correlation between them suggest that the two parameters may monitor muscle damage processes with different dynamics and significance. Future studies with more time marks during recovery will contribute to clear up the recovery process of the muscle after DHR.

PP14B—Telemedicine in extreme sports

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Purpose: The diffusion of telemedical technologies could provide the most significant advantages in outdoor sports that do not require a regulated playing field and may expose them to environmental variables and challenges in medical assistance. This systematic review describes the kind of interventions (e.g. consultation, data transmission) and the solution adopted. The aim is to stimulate further technological solutions and experiences promoting telemedicine in sports practice in outdoor environments.

Methods: We searched the MEDLINE PubMed, Scopus, Web of Science, and Cochrane electronic databases, adopting a PICO strategy; and the PRISMA checklist. Two researchers independently reviewed the results. A specifically designed four-item telemedicine-focused scoring system was set up to evaluate the studies qualitatively.

Results: Out of 2,715 unique citations initially identified, 16 papers were included in the present review, and their quality was double-

blindly assessed using a specifically designed four-item scoring system. Telemedicine was used in high mountain sports (37.5%; $n = 6$), winter sports (18.7%; $n = 3$), watersports (25%; $n = 4$), and long-distance land sports (18.7%; $n = 3$). Telemedicine has been used for: monitoring vital signs and data transfer,

teleconsulting,
executing remote-controlled instrumental diagnosis and imaging-guided procedures.

The radio-transmitted electrophysiological data can be used in outdoor sports to analyze sport-specific muscle activity patterns, including complex and non-cyclical sporting gestures.

These data may help identify less than optimal techniques to promote focused training, improve performance and reduce injury risk.

Moreover, in seasonal sports practised on the water or the snow (i.e., windsurfing and alpine skiing), these data can help to set up a proper dry-land training modality.

Conclusions: Telemedical technologies may be used to diagnose and treat sport-related and environmental conditions, including emergencies in extreme environments. By highlighting sport-specific, non-cyclical sporting gestures in outdoor sports, physiological and pathological responses in extreme climatic conditions, and harsh environments, telemedicine may result in better preparation and management of sports practice, leading to performance improvement and injury prevention.

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PP14C—Can a brief multi-component outdoor exercise intervention improve physical fitness and quality of life in subjects with CVDS?

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Purpose: Cardiovascular diseases (CVDs) is a class of diseases that are related to the heart or blood vessels including stroke, heart failure, hypertension, coronary artery diseases, heart arrhythmia, peripheral artery disease, and atherosclerosis. Regular physical activity, including systematic exercise, is an important component of therapy for most CVDs and is associated with reduced cardiovascular and all-cause mortality. However, little is known about the effects of exercise performed in an outdoor environment. Therefore, this study aimed to assess the effects of a brief multicomponent outdoor exercise intervention on physical fitness and quality of life (QoL) in subjects with CVDs.

Methods: Eleven male ($n = 6$) and female ($n = 5$) adults (age 66.7 ± 10.1 years; BMI 29 ± 4.2 kg/m²) suffering from CVDs voluntarily participated in the study and performed a 6-week supervised exercise program (~ 60 min, 2d-wk). Participants had not previously been engaged in other exercise activities over the last 3 months and were

free of any serious medical conditions, according to ACSM and AHA. Each session included a combined progressive training of cardiorespiratory, resistance, mobility and breathing exercises. Physical fitness was assessed via a 30'' sit-to-stand test, timed up and go test, 2' step test and handgrip strength test. The level of physical activity was evaluated with the International Physical Activity Questionnaire-sf, whereas the quality of life (QoL) with SF-12 and WHOQoL-brief.

Results: After intervention, lower limb strength and endurance were significantly increased ($p < 0.001$), similarly significant improvements in aerobic capacity ($p < 0.05$) and functional mobility ($p < 0.001$) were observed. A significant increase in levels of physical activity was detected ($p < 0.05$), whereas no significant change in the handgrip force, BMI and QoL were observed. Finally, in the physical component of SF-12, higher scores were found ($p < 0.05$).

Conclusions: The supervised multicomponent exercise program, performed in an outdoor setting, improved physical fitness without causing adverse effects and health problems. However, the QoL and the psychological component did not show any changes. Findings suggest that a brief outdoor exercise intervention improves physical fitness, in patients with CVDs, whereas improvements in the QoL and the psychological component could require more time. Finally, to establish a cause-effect relationship, a controlled study would be needed.

P15A—Clinical yoga therapy for the cardiovascular and respiratory fitness in older adult: cross sectional study applied to the updated ACSM guidelines American college of sport medicine

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Purpose: The aim of the study is to verify the hypothesis that the cardiovascular and respiratory fitness can be strengthened through the clinical Yoga therapy adapted to the new updated guidelines of the ACSM American College of Sport Medicine

Methods: The experimental hypothesis is linked to the lifestyle of the asymptomatic sedentary subject with mild diseases of the cardiorespiratory system and the ACSM recommendations on exercise testing and prescription for the elderly population. The structure of the survey originates in the latest ACSM guidelines for the elderly population and is based on the effects of an 15-week program, administered from February to June 2022, lasting 60 min, two meetings a week, for the practice of 20 Yoga Asana exercises which aim to increase cardiorespiratory strength, as well flexibility of the cervical and lumbar spine, hamstrings and calf muscles and improve control of the posture, static and dynamic balance, and breathing. Twenty volunteer individuals were recruited with mean age $64.4 \pm$ standard deviation 4.5 years, mean weight 63.25 ± 5.75 kg, mean height 164.39 ± 1.58 cm, of which five men and fifteen women without previous experience with the method

Results: During the Clinical Yoga therapy (CYT), heart rate (HR) and rate of perceived exertion according to Borg scale 0-10 (RPE-CR10) were monitored at each exercise to determine the estimate of the maximum volume of oxygen consumed per minute (VO2Max) and energy expenditure (EE) with linear regression equation. VO2Max was estimated using the submaximal Astrand-Ryhmig step test. The mean values and SD for HR and RPE were calculated for each exercise and the percentages of the mean values for HRmax and RPEmax in each exercise showed a significant, strong and positive correlation ($r = 0.82$; $p = 0.001$). In 10 exercises the HR value was 60% higher than HRmax, the mean values of EE and VO2Max are

respectively $216.91 \pm (78.91)$ kcal and 34.49 mL (Kg min)⁻¹ $\pm (3.5)$

Conclusions: The dose response effect of the clinical Yoga Therapy reaches the levels of cardio vascular and respiratory fitness and EE required by the new ACSM guidelines, if practiced 3 times/week, by promoting positive changes on the quality of life and on the levels of physical inactivity that can be easily raised with a structured program of physical activity from mild to moderate intensity, with safety

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References: ACSM Guidelines for Exercise Testing and Prescription, 11th Ed. 2021; ACSM Clinical Exercise Physiology 1th Ed. 2019

PP15B—The walking group: can the kinesiologist make the proposal effective for subjects with physical exercise prescription(PEP)?

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Purpose: Walking groups are an opportunity to increase physical activity levels in the elderly and people with health problems⁽¹⁾. Despite the opportunity of PEP, this population may have limited possibilities for inclusion in physical activities. Indeed the walking speed of the group is an element that can determine the dropout. Through the division into different walking groups, adapted to individual abilities, this problem can be prevented and adherence can be increased. With this study, we present the experience of a single center, the “Esercizio Vita Medical Fitness” (EVMF) “Palestra della Salute”(PS), in walking groups organization.

Methods: The participants included in this study were evaluated and divided into three groups on the basis of the 1-km treadmill test (1-TWT)⁽²⁾. According to walking speed (WS) participants were organized into “group A” (WS:4–4.7 km/h) “group B” (WS:4.8–5.4 km/h) and “group C” (WS: above 5.5 km/h). A walking session of at least 70 min divided in the warm-up, paced walk and cool-down was organized and supervised by a kinesiologist every week for each group. Data regarding Charlson Comorbidity Index (CCI), Body Mass Index (BMI), Cardiocirculatory Functionality Index (CFI) and walking speed (WS) of each group were then collected and compared.

Results: From May to August 2022, 111 participants were included in the study. 12 of them underwent to drop out and so were excluded from the analysis, 99 subjects (65 F) completed the study. The mean age of the analyzed population was 61 ± 9 y.o. with a mean BMI of 25 ± 4 kg/m², 67% of them had at least one comorbidity, and 47% more than one. Among the participants, n.67 regularly attended the EVMF PS and n.62 with PEP. The groups were respectively composed: Group A: 25 subject with: CCI = 3.1 ± 1.4 , CFI = 80.3 ± 8.9 ; WS: 4.33 ± 0.2 km/h. Group B: 31 subject with: CCI = 2.8 ± 0.8 ; CFI = 91.8 ± 8.3 ; WS = 5 ± 0.2 km/h. Group C: 42 subject with: CCI = 2.4 ± 1.1 ; CFI = 97.4 ± 11.2 ; WS = 5.6 ± 0.2 km/h. The study will be completed on 30 September 2022with final processing.

Conclusions: The walking group is an activity that includes opportunities for physical activity, social interaction and recreation. Introducing the figure of the kinesiologist as a director of this orchestra allows to better organize the experience, reduce frustration and so the dropout and maximize the effect on the physical and mental health of participants.

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PP15C—A predictive model of falling risk and frailty condition in the elderly

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Purpose: Fall events are challenging for the elderly, caregivers, and the community in which they live. Prevention strategies should be constantly improved to manage fall events, as they are known to be risk factors for disability, hospitalization, and mortality. Also, frailty condition has been previously linked to the prevalence of falling risk, even though there is not a consensus on the frailty diagnosis. Therefore, we aimed at creating a screening and predictive protocol of fall events and frailty condition in the elderly as a replicable model in clinical settings.

Methods: Fifty subjects (17 males and 33 females) were recruited (mean age 76.9 ± 3.69 years) and underwent a complete anamnesis (screening for fall history, medical equipment use, etc.) and battery of geriatric tests and questionnaires. Bioimpedance analysis was conducted to obtain body composition; posture was analysed through stabilometric platform; gait performance included a battery of standardized tests (10-meter walking test, six minutes walking test, timed up and go test). After 12 months, subjects were interviewed to check for fall events. Non-parametric analysis was used for comparisons between fallers and non-fallers and between able and frail subjects. ROC curves were obtained to identify the predictive value of falling risk and frailty.

Results: Fall group showed higher sway area ($p < .05$) and speed ($p < .01$) as compared to non-fallers. Duration and speed values of timed up and go test were also significantly higher in fallers ($p < .05$). Able and frail groups did not differ in stabilometric parameters; however, significant differences were found in 10-m and six minutes walking tests (lower values in frail group, $p < .01$). Of note, timed up and go test duration resulted significantly different between able and frail subjects ($p < .05$). ROC curves showed that path length (area under the curve, $AUC = 0.678$), sway area ($AUC = 0.727$), and sway speed ($AUC = 0.778$) were predictive factors of fall events ($p < .05$), whereas the six minutes walking test was found to be a predictor of frailty condition ($AUC = 0.840$). Timed up and go test was predictive of both frailty ($AUC = 0.702$) and fall events ($AUC = 0.681$).

Conclusions: We conclude that stabilometric analysis and gait performance tests should be included in a screening protocol addressed to the elderly as they show predictive values of fall events and an objective tool to recognize frailty condition at early stages.

PP16A—Repeated submaximal explosive contractions of dorsiflexor muscles effect the rate of force development and maximal voluntary force

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Purpose: Fatigue can be defined as a symptom of tiredness or weakness, underpinned by a complexity of physiological and psychological processes¹. It is unknown how submaximal, explosive contractions effect peripheral adjustments owing to the fatigue

response. In many daily and sporting activities, the time required to develop maximal force (≥ 300 ms) is longer than the time available to develop force². The rate of force development (RFD) reflects the ability to rapidly increase muscle force after the onset of an explosive voluntary contraction and is well-known to decrease when in a state of fatigue³. Considering the relevance for daily life and sporting demands that require rapid changes in submaximal force, the aim was to understand the effect of fatigue on quick contractions, targeting submaximal forces.

Methods: After a familiarization visit, 19 participants (31 ± 6 yrs; 75 ± 12 kg; 3 F), performed a fatiguing task. The participants were seated with their dominant ankle inserted in the bespoke dynamometer. Following a warm-up, participants performed two maximal voluntary contractions interspersed by 120 s to assess the maximal voluntary force (MVF). The fatiguing protocol consisted of a series of explosive contractions, interspersed by 4 s, with a holding phase of 6 s at 70% of MVF until task failure.

Results: The fatiguing task lasted 413 ± 327 s. The MVF decreased by 35% ($p < .001$) at the end of task. The peak force dropped by 14% and the time to peak force increased by 119%. The peak RFD decreased by 43% and time to peak RFD increased by 18%. The RFD assessed at 50, 100, and 150 ms, dropped by 36, 44, and 40%, respectively (all $p < .05$). A stepwise linear regression analysis showed that RFD declines at 50, 100, and 150 ms was explained by MVF decline for 23, 25, and 19%, respectively ($R^2 \geq 0.188$; all $p < .05$).

Conclusions: The effect of a fatiguing task reduced RFD capacity, with a trend in line with the MVF drop. Indeed, the decline of RFD is partially explained by the decline in MVF therefore other mechanisms may influence the RFD decline. Moreover, the time to peak both of force and RFD augmented to prove that the participants, after the task, became both weaker and slower. This study demonstrates that the explosiveness and MVF are strongly affected after repeated submaximal explosive contractions with holding phase until task failure.

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PP16B—The role of physical activity, sleep and diet in overweight and obese adult population

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Purpose: Overweight and obesity compromise health, leading to significant long-term consequences, including the development of several chronic diseases. Overweight, and obesity in particular, are

rapidly growing public health problems, so acting on lifestyle habits may be the best strategy. The purpose of the present study is to assess the relationship between body mass index (BMI) and lifestyle habits, such as physical activity levels, chronotype, sleep and adherence to the Mediterranean Diet (MD) in an overweight and obese adult population.

Methods: 744 participants (516 females, 70%, 228 males, 30%; 49.4 ± 12.7 years) who spontaneously attended the International Centre for the Assessment of Nutritional Status (ICANS), University of Milan were recruited for the study. Participants filled out the *Godin Shephard Leisure-Time Physical Activity Questionnaire* (GSL-TPAQ), the reduced version of the *Morningness–Eveningness Questionnaire* (rMEQ), the *Pittsburgh Sleep Quality Index* (PSQI) and the *Mediterranean Diet Adherence Screener* (MEDAS), to assess physical activity levels, chronotype, sleep and MD, respectively. Data were analyzed with SPSS version 27.

Results: Based on the scores obtained from the questionnaires, the participants were classified as inactive ($n = 257$, 34%) and active ($n = 487$, 66%), Morning-types ($n = 237$, 32%), Neither-types ($n = 421$, 57%) and Evening-types ($n = 86$, 11%), bad sleepers ($n = 338$, 45%) and good sleepers ($n = 406$, 55%), and not adherent ($n = 593$, 80%) and adherent to MD ($n = 151$, 20%). On the total sample the correlation analysis showed that higher adherence to the MD ($r_s = -0.13$, $p < .001$), higher levels of physical activity ($r_s = -0.12$, $p < .001$), more hours spent in bed ($r_s = -0.07$, $p < .05$), and more slept hours ($r_s = -0.11$, $p < .001$) significantly reduced the BMI. Furthermore, higher PSQI score, feature of a bad sleeper, significantly increased BMI ($r_s = 0.08$, $p < .01$).

Conclusions: These findings show the importance of promoting strategies, such as multidisciplinary interventions including physical activity, sleep and diet counseling, in order to reduce the onset of overweight and obesity.

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PP16C—Effect of different types of activities on glycemic control, heart rate and perceived effort in adults with type 1 diabetes

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Purpose: Regular exercise for adults with T1DM offers several benefits: it improves body composition, cardiovascular and endothelial function, and reduces daily insulin requirements. On the other hand, adults with T1DM often experience rapid changes in blood glucose levels after exercise resulting in loss of control and fear of hypoglycemia. Therefore, our aim was to control changes in blood glucose levels in adults with T1DM by monitoring exercise intensity according to established outcomes, such as heart rate and perceived exertion.

Methods: We enrolled 26 adults with T1DM (age 35 ± 12 years; 14 females). Participants were recruited during an educational and training camp. Participants were asked to measure blood glucose

level, rate of perceived exertion (RPE, which goes from 1 to 5) and heart rate before and after each session. We calculated the heart rate maximum percentage and the differences of glycemia, heart rate and perceived effort from the beginning to the end of each activity. The activities performed by the participants were: walking, cycling, high-intensity interval training (HIIT), 12-min run test (12'RT) and relay running.

Results: We reported the following changes in the blood glucose level: walking (-14.82 ± 33.69), cycling (-31.71 ± 65.83), HIIT (-13.94 ± 33.36), 12'RT (-11.68 ± 51.07), relay race (-11.24 ± 14.00); in heart rate percentage: walking ($16.57 \pm 10.64\%$), cycling ($3.29 \pm 17.93\%$), HIIT ($16.45 \pm 22.21\%$), 12'RT ($33.51 \pm 23.81\%$), relay race ($22.27 \pm 25.92\%$); and in RPE: walking (2.28 ± 1.57), cycling (1.36 ± 2.21), HIIT (3.64 ± 3.34), 12'RT (4.72 ± 2.39), relay race (1.00 ± 1.22). Our results also showed that the percentage change in heart rate is positively correlated with perceived exertion.

Conclusions: Our results showed that glycemic changes can be controlled by monitoring activity intensity with heart rate percentage and RPE. Our results also showed that the participants of the camp correctly perceived the intensity of training activities, which could help them to better monitor blood glucose levels before, during and after exercise sessions.

PP17A—Reliability of energy system contributions during wingate anaerobic test

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Purpose: The energy system contributions during Wingate Anaerobic Test (WAnT) was estimated to be predominantly anaerobic. The purpose of this study was to verify the reliability of mechanical parameters and energy system contributions during WAnT.

Methods: Ten healthy male subjects (age 23.7 ± 0.7 yrs., body mass 73.1 ± 4.2 kg, stature 1.75 ± 0.06 m, mean \pm SD) performed a WAnT in 3 different days separated by at least 2 days of recovery. The analysed mechanical parameters of the WAnT were: peak power (PP), average power (AP), minimum power (MP) and fatigue index (FI). The metabolic equivalents of oxygen consumption were calculated as aerobic metabolism from oxygen uptake during the 30 s exercise phase (VO_2), lactic and alactic anaerobic energy sources were calculated from net lactate production (VO_2La) and the fast component of the kinetics of post-exercise oxygen uptake (VO_2PCr), respectively. The total energy cost (VO_2TOT) was calculated as the sum of the three energy sources and the percentages of each contribution were also calculated. Intra-class correlation coefficients (ICC) were determined for all variables.

Results: The ICC for the mechanical parameters were: PP (0.890), AP (0.973), MP (0.944) and FI (0.749). The ICC for the absolute energy system contributions were: VO_2 (0.797), VO_2La (0.735) and VO_2PCr (0.665), while for the relative contributions were $VO_2\%$ (0.829), $VO_2La\%$ (0.763) and $VO_2PCr\%$ (0.731).

Conclusions: The mechanical parameters of the WAnT showed high to very high reliability. The energy system contributions during WAnT can be properly estimated as they have shown a moderate to high reliability.

PP17B—Elite and non-elite young Italian soccer players: differences in body composition and physical performance

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Purpose: Soccer is a team sport that requires frequent changes in the type of movements, speed, direction, and technical-tactical tasks. It is one of the most famous and played sports and for this reason, the scouting process in juvenile categories is very selective in high-level teams. Specific body characteristics and physiological capabilities (such as cardiorespiratory endurance and muscular strength) are searched. Although these aspects are generally assessed through testing of soccer players, it is still unclear which traits should possess elite young players. Therefore, the object of this study was to value the differences in physical characteristics and physical abilities among the players of two Italian youth teams of different competitive levels and understand the main factors that differentiate them.

Methods: Two youth soccer clubs participated in the cross-sectional study. A total of 162 children attending soccer were measured, 98 belonging to the F.C. Bologna team (elite) and 64 to the U.S. Russi team (non-elite). Participants were divided into four age categories according to their ages (Under 12, Under 13, Under 14, and Under 15). Anthropometric characteristics, circumferences, and skinfold thicknesses were collected and body composition parameters (FM, FFM, %F) were calculated. To evaluate the physical performance three motor tests the countermovement jump, 15 m straight-line sprint, the Yo-Yo Intermittent Recovery Test Level 1, and repeated sprint ability were assessed. In addition, the Bioelectrical Impedance Vector Analysis (BIVA) was performed. Finally, a linear discriminant analysis was conducted to determine which factors better discriminate between an elite and a non-elite football team.

Results: Many differences were observed in body composition between and within each football team's category, especially in triceps skinfold ($P < 0.05$), %F ($P < 0.05$), and all performance tests ($P < 0.01$). The canonical correlation was 0.717 ($F(7, 128) = 19.37$, $P < 0.0001$), and the coefficients that better discriminated between the two teams were 15 m sprint (-2.39), RSA (1–26), suprailiac skinfold (-0.5) and CMJ (-0.45).

Conclusions: As hypothesized, elite soccer team players present a better body composition and greater physical efficiency. Also, both physical performance and BIVA outcome could be relevant selection criteria to scout among younger soccer players.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

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PP17C—Keep calm and keep rowing: the psychophysical effects of a dragon boat program in breast cancer women survivors

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Purpose: Breast cancer is the most prevalent cancer, but thanks to early diagnosis and new therapies the survivor rate is high. In this scenario, physical exercise has been accepted as a safe and efficacy coadjutant treatment capable of improving patients' quality of life. Among the different types of physical exercise, the Dragon Boat (DB) discipline has become more popular in the last years also among women with breast cancer thanks to its psychophysical benefits. The present randomized control trial aims to depict the effects of a DB program on body composition, physical function, and some psychosocial aspects such as the perception of body image in women with a previous diagnosis of breast cancer.

Methods: Thirty-two women (57.88 ± 7.88 years; BMI 27.86 ± 6.38 kg/m²) with a previous diagnosis of breast cancer and consequent removal surgery were recruited and randomized into two groups. Eighteen subjects were included in the Dragon Boat group (DB), while the others were collocated in the control one (CG) following a home-based non-supervised training program. All participants were tested at baseline and after 12 weeks of the exercise program and body composition, handgrip, 30 s chair stand test, 6 min walking test, and shoulder mobility were assessed. Participants also filled out the BAS-2, PFS, and SF-12 self-report questionnaires and cooperation scale.

Results: After 12 weeks no changes in body composition were found in any groups. In the DB group there was a significant improvement in the 6-min walk test ($+6\%$; $p = 0.11$) and in the 30-s chair stand test ($+30\%$; $p = 0.11$) compared to CG. No significant effects were found in the psychological questionnaires.

Conclusions: The proposal of Dragon Boat is a safe protocol for women who have been operated on for breast cancer since there was no evidence of lymphoedema. The present study highlights that 12 weeks of DB activity can improve aerobic capacity and lower limb strength which are two important outcomes correlated with a higher life expectancy. According to recent studies, we hypothesized that to produce significant changes related to the upper limb, well-being perceived, and the appreciation of one's own body, longer periods of constant exercise may be needed.

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PP18A—The effect of aging on force expression

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Purpose: Aging is characterized by a general decline in physiological and anatomical structure, with impairments in neuromuscular transmission, a loss of muscle mass and a shift in fiber type. All these changes lead to a loss in strength and the phenomenon of sarcopenia. We investigated the difference in force expression between healthy active young and elderly men during isometric single-leg knee extensor maximal contractions, specifically we investigated how central and peripheral components of maximal force change with aging. We hypothesized that the differences in the expression of maximal force are not primarily associated with the muscle decline, but instead the greatest limitation is encountered at corticospinal level.

Methods: Isometric maximal voluntary contractions (MVCs) of 28 healthy active men were evaluated (18 Young + 10 Old). Peripheral nerve stimulation (PNS), to assess voluntary activation through the interpolated twitch technique, and transcranial magnetic stimulation (TMS), to estimate the corticospinal excitability, were given during

the MVCs. A resting twitch (RT) was delivered immediately after the contraction, at rest, to measure the contractility of the muscle. The TMS intensity using the active motor threshold and the electromyography of rectus femoris were assessed. Data were normalized for the lean muscle mass of the thigh, measured by densitometry.

Results: The MVC was significantly higher in young men compared to healthy older adults (500 ± 124 vs. 384 ± 63 N, $p = 0.013$), but normalizing the MVC for the thigh lean mass, the results showed no significant difference (69.1 ± 14.3 vs. 62.2 ± 9.5 N/kg, $p = 0.204$). The RT showed significant differences both when non-normalized (171.7 ± 33.1 vs. 126.3 ± 19.5 N, $p = 0.001$) and normalized (23.9 ± 4.5 vs. 20.4 ± 2.5 N/kg, $p = 0.043$). The voluntary activation of the muscles was higher than 90% in both groups ($p > 0.05$), like the corticospinal tract that showed similar activities (AUC/MEP: 0.3 ± 0.2 vs. 0.3 ± 0.1 , $p = 0.969$).

Conclusions: Compared to young men, older healthy active people express lower absolute but not relative (normalized for thigh lean mass) force. Active older adults do not show impairments in the central components of maximal force, reflected by the voluntary activation and the corticospinal excitability. From the peripheral point of view, the forces variances are highly dependent on the muscle mass, but an impairment in muscle contractility is present. Further investigations are needed to understand the magnitude of it.

PP18B—Degenerative meniscus tear treatment: effects of a tele-exercise program carried out using a tablet application with a wearable sensor. Case report

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Purpose: Tele-exercise (TE) has proved to be a suitable alternative healthcare system in delivering physical care to people who live with pain and disability. Conservative exercises has recently been recognized as the first-line treatment for degenerative meniscus tear (DMT); however so far the efficacy of TE for this pathology has never been investigated. The aim of the study was to investigate the effects and the feasibility of a TE program, for people suffering from DMT, carried out using a tablet application.

Methods: A 42 years old woman, suffering from DMT, was recruited at the Orthopedic Department of the University Hospital “Istituto di Cura Città di Pavia”, Pavia, Italy. She underwent a 4-week TE program of two 14 days microcycles which included three workouts per week with increasing difficulty as she increased her capability. The program was administered and remotely supervised by using KARI (Euleria Health, Rovereto, IT), an application for tablets which is connected via bluetooth to a wearable inertial sensor and streams data to a web management system. A test battery composed of Active Range of Motion of knee flexion (AROM), Numerical Rating Scale (NRS), 9 Stair Climb Test (9SCT), 30 s Chair Stand test (30sCST), Timed Up and Go (TUG), 6 Minutes Walking test (6MWT), Knee injury and Osteoarthritis Outcome Score (KOOS) was administered at the beginning (T0) and at the end (T1). At T1, the Technology Acceptance Model (TAM) was administered to assess how participant accepted and used the technology employed and her attitude to reuse it. Minimal Clinically Important Difference and Minimal

Detectable Change were used to evaluate statistically significant differences.

Results: At T1 all the outcomes improved respect to T0: AROM (115° vs 95), 9SCT (10.88 s vs 14.19), 30sCST (13 reps vs 9), TUG (6.28 s vs 10.6), 6MWT (471 m vs 414), NRS (3 up to 10 vs 7), KOOS (pain: 58% vs 36 ; other symptoms: 75% vs 61 ; function in daily living: 81% vs 68 ; function in sport and recreation: 15% vs 15 ; knee related quality of life: 50% vs 44), TAM score of 26.2 up to 28 . Except the 9SCT all results are statistically significant.

Conclusions: TE program improved clinical status, pain and activities of daily living. Kari was found to be easy to use and well accepted. Case report seems to confirm the effectiveness and the feasibility of using a TE program, based on a tablet application, for the treatment of DMT. This could be a low-cost solution to support the treatment even once the out-patient course is ended.

PP18C—Fibromyalgia and functional training: strategy to improve aerobic and strength on upper limbs

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Purpose: Fibromyalgia is a disorder characterized by widespread musculoskeletal pain accompanied by fatigue, sleep, memory and mood issues. Researchers believe that fibromyalgia amplifies painful sensations by affecting the way your brain and spinal cord process painful and nonpainful signals. Aim of the study was to investigate and create an aerobic exercise protocol to reduce pain and improve physical fitness. On the other hand, we were also investigated and created a strength exercise protocol focused on upper limbs.

Methods: Six women affected by fibromyalgia have been enrolled on this study. Age was between 40 and 65 years old. Functional Training was administered with a Training Lab Italia Protocol® (CTLIP) built as circuit training. Aerobic Power was evaluated at T0, T1 and T2 with a 6 min walking test. Effort was evaluate with a Borg Scale. Fitness of Older Adults test and monitoring were evaluated at T0, T1 and T2 to compare the difference in upper limbs strength. Pain was evaluate with a visual analog scale (VAS).

Results: Our data showed the improvements of aerobic power ($p < 0.05$). In addition effort, was decreased at the end of each session of training ($p < 0.05$). Furthermore, we found improvements of strength in the upper limbs between T0, T1 and T2 ($p < 0.05$). In addition to pain was decreased at the end of each session of training ($p < 0.05$).

Conclusions: Our project suggest that literature confirm the benefits of exercise practice in patient affected by fibromyalgia. The dose-response of exercise to avoid the increase of the pain after the training session, needs a specific program with a Frequency Intensity Time and Type (FITT) related to interval training methods.

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PP19A—Interaction between strenuous endurance exercise and sympathetic activation on sympathetic vasoconstriction responsiveness and aortic stiffness

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Purpose: Endurance exercise challenges sympathetic neurovascular regulation by blunting the sympathetic transduction into vascular resistance and receptor responsiveness. Such an alteration can lead to blood pressure control dysfunctions, especially in endurance athletes, as well as to different cardiovascular strain after exercise in response to standardized stress factors. We assessed whether sympathetic vasoconstriction is blunted immediately after a strenuous half-marathon and whether such a change affects cardiovascular strain in response to a sympathetic stimulant. Such assessment takes on relevance considering the growing popularity of strenuous, long-distance endurance races.

Methods: Before and within 20 min following the race, 11 recreational runners underwent two leg vasodilator maneuvers, one in basal conditions and the other during handgrip exercise-induced sympathetic activation (SYMP), to assess the sympathetic-mediated blunting of leg vasodilation. Subjects provided several measurements, including: femoral blood flow and mean blood pressure to calculate leg vascular conductance (LVC), and beat-by-beat aortic pulse wave velocity (aPWV) recorded through an innovative methodology to assess aortic stiffness, and haemodynamics changes.

Results: The mean leg vasodilation over the 60 s after the vasodilator maneuver was similar post-race vs pre-race without SYMP (5.1 ± 1.7 vs 4.8 ± 1.3 mL/min/mmHg; $p = 0.62$), but was reduced during SYMP (5.9 ± 2.5 vs 4.2 ± 1.5 mL/min/mmHg; $p = 0.002$). The aPWVs pre- and post-race were not significantly different (7.5 ± 0.8 vs 7.8 ± 0.8 m/s $p = 0.34$; pre- vs post-race). SYMP increased the baseline aPWV post-race (7.8 ± 0.8 vs 8.4 ± 0.8 $p = 0.003$; rest vs SYMP) but not pre-race (7.5 ± 0.8 vs 7.9 ± 0.9 $p = 0.21$).

Conclusions: Reduced leg vasodilation during SYMP after but not before exercise reveals that sympathetic vasoconstriction triggered by a standardized stimulant is augmented immediately after a half-marathon compared to at rest. Concurrently, the same stimulant augments aortic stiffness to a greater extent post-race than pre-race, suggesting a greater post-exercise stiffening of central artery segments and higher cardiovascular strain triggered by the same external task. This data reveal the need for further investigations into the interaction between endurance exercise and stressful stimuli on cardiovascular risk.

PP19B—Microbiota and physical exercise

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Purpose: To analyze the relationship between physical exercise and gut microbiota. The main purposes of this thesis are (1) to investigate the way in which gut microbiota can influence athletic performance and viceversa and (2) to go deeper in the knowledge of gut-brain axis and gut-muscle axis.

Methods: For this systematic review a comprehensive literature research was performed using PubMed electronic database. The main words of research were “gut microbiota” and “physical exercise”. Recent articles were preferred in the research.

Results: A relationship between exercise and gut microbiota has been confirmed. Physical exercise, if done wisely, can positively affect microbiota's health. In fact strenuous exercise can alterate gut microbiota omeosthesis. Moreover, intestine is able to act as an endocrine organ and systemically influence the organism.

Conclusions: Nevertheless literature confirm the relationship between gut microbiota and physical exercise lot of research is still needed. Future research should investigate factors such as different dietary habits, type of training protocols and possible comorbidities.

Keywords: Microbiota, Physical activity, Exercise, Health, Dysbiosis, Gut-brain axis, Gut-muscle axis

PP19C—Fibromyalgia and functional training: strategy to improve strength on upper limbs

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Purpose: Fibromyalgia is a disorder characterized by widespread musculoskeletal

pain accompanied by fatigue, sleep, memory and mood issues. Researchers believe that fibromyalgia amplifies painful sensations by affecting the way your brain and spinal cord process painful and nonpainful signals. Aim of the study was to investigate and create a strength exercise protocol focused on upper limbs to reduce the symptoms.

Methods: Six women affected by fibromyalgia have been enrolled on this study. Age was between 40 and 65 years old. Functional Training was administered with a Training Lab Italia Protocol®(CTLIP) built as circuit training. Fitness of Older Adults test and monitoring were evaluated at T0, T1 and T2 to compare the difference in upper limbs strength. Pain was evaluate with a visual analog scale (VAS).

Results: Our data showed the improvements of strength in the upper limbs between T0, T1 and T2 ($p < 0.05$). In addition to, pain was decreased at the end of each session of training ($p < 0.05$).

Conclusions: Our project suggest that literature confirm the benefits of exercise practice in patient affected by fibromyalgia. The dose-response of exercise to avoid the increase of the pain after the training session, needs a specific program with a Frequency Intensity Time and Type (FITT) related to interval training methods.

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PP20A—Maximal force in sex difference: a preliminary viewpoint

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Purpose: Males and females have profound anatomical and physiological differences. Males present higher force expression, usually 30–75% greater than females. Some of the physiological determinants of maximal force are the muscle cross-sectional area (CSA), contractility properties and motor unit recruitment. Despite the larger males' CSA, females recruit more motor units, with a greater discharge rate at maximal and submaximal intensities. This study aims to

understand the maximal force expression in males' and females' lower limbs, and we hypothesize a greater absolute and relative isometric force in males.

Methods: Isometric maximal voluntary contractions (MVCs) of the dominant leg in 20 young healthy subjects (10 M + 10 F) were recorded and interpolated with peripheral nerve electrical stimulations (PNS) to assess neuromuscular properties of the muscle, such as voluntary activation (VA), and resting twitch (RT). The quadriceps' muscle extensors cross-sectional area (CSA) was determined from panoramic ultrasound scans.

Results: Males were significantly stronger than females (475 ± 132 vs. 380 ± 89 N, $p = 0.039$), but when expressed relative to muscle CSA, the difference disappeared (5.3 ± 1.3 vs. 5.0 ± 2.0 N/cm³, $p = 0.69$). Significant variations between groups were seen in the RT's absolute values (172 ± 33 vs. 116 ± 21 N, $p < 0.001$), though these disparities vanished following normalization (1.9 ± 0.4 vs. 1.6 ± 0.6 N/cm³, $p = 0.17$). The RT slopes indicated faster contraction (3.3 ± 0.7 vs. 2.1 ± 0.4 N/s, $p < 0.001$) and relaxation. (-1.9 ± 0.4 vs. -1.1 ± 0.3 N/s, $p < 0.001$) for the males. However, the contraction time (65 ± 7 vs. 69 ± 9 ms, $p = 0.37$) was not significantly different, with a trending shorter half relaxation time for males (69 ± 7 vs. 80 ± 16 ms, $p = 0.052$). The VA of the muscles was higher than 90% in both groups ($p > 0.05$).

Conclusions: Our data partially confirm our hypothesis and agree with earlier reports of significant sex differences in maximal isometric force. The greater force of males, on the other hand, is mostly related to their bigger muscles. Males' muscles generated higher force in the same amount of time and relaxed at a faster rate. These results align with the previously reported greater fibers type II frequency and CSA of males, characterized by superior power generation, faster calcium kinetics and faster shortening-relaxation velocities.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP20B—Cartilage, physical activity, and sport relationship: a systematic review

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Purpose: The natural aging process, the work background but also the sport practiced affects cartilage. Sports and physical activities with different loads at angles, speeds and intensities can modify the cartilage composition and structure. Consequently, the adaptations and structural modifications generated by sports and physical activity practice are important and this review aims (1) to synthesize the current evidence on this topic; (2) and to propose a standard operating procedure for an exercise program to maintain knee joint health.

Methods: Pubmed, Web of Science and Scopus were searched to collect original and English-written articles. After this, the duplicates were removed and the articles were screened against the eligibility criteria. Results were collected in tables and the main outcomes were discussed narratively.

Results: Articles were collected until 2022 and from the initial number of 62,198 A final number of 55 studies have been included after the screening process. It emerged that running, swimming, ballet and handball were not correlated with detrimental structural or molecular cartilage deterioration; instead, soccer, volleyball, basketball, weightlifting, climbing and rowing showed signs of cartilage alteration that could be early predictive degeneration signs. Related to

the second objective, aerobic, strength, flexibility, postural balance, and mobility interventions were detected to decrease the risk of cartilage degeneration. Different protocols and types of interventions were adopted by the authors included.

Conclusions: Physical activity interventions have mainly positive outcomes on cartilage structure while different sports induce different cartilage modifications. A Standard Operating Procedure was also proposed for a physical intervention focalized on cartilage wellness that could be adopted as an intervention in the clinical setting.

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PP20C—Autism and exergaming: positive technology as a therapeutic resource

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Purpose: Exergames, or active videogames, connect movement to virtual reality, allowing for an increase in levels of fitness while maintaining a cognitive demand associated with playful and interactive aspects. Subjects with Autism Spectrum Disorder (ASD) could benefit from this engaging and inexpensive instrument (Lima, et al. 2020).

Methods: Some articles connected to the theme of exergaming and its potential for autistic subjects were analysed and compared by consulting major academic collection databases including PubMed, ScienceDirect e Google Scholar (Edwards et al., 2017; Rafiei Milajerd et al., 2021).

Results: Exergaming can be a useful tool for reducing physical inactivity, screen time and repetitive behaviours, for improving executive functions, certain motor skills and the perception of one's abilities in individuals with this type of disability. In three quarters of the articles analysed, 100% of the people were diagnosed with ASD. All the results showed improvements in the samples taken into account, half of these in executive functions.

Conclusions: This review presents the foundation for a positive vision of exergaming as a tool for promoting physical activity in subjects with ASD. Strong and weak points were discussed and could be used as a basis for future, more targeted research.

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PP21A—Effects of whole-body cryotherapy on exercise performance and subsequent fast recovery

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Purpose: Whole-body cryotherapy (WBC) has been reported to maximize physical recovery after intense exercise and reduce muscle damage. In addition, as exercise, also WBC affects the cardiovascular system. Considering the strong influence of the autonomic nervous system on cardiovascular responses, we studied the effects of WBC and exercise regards to (i) sympathovagal balance assessment; and (ii) successive R-waves on the electrocardiogram (RR interval) before and after the exercise protocol.

Methods: ECG was recorded in 28 healthy adults who underwent rest (5 min), all-out effort on a cycle ergometer (~ 30 s), and following recovery (5 min). After 30 days, WBC (3 min, - 150 °C) was applied, and the whole procedure was repeated. Sympathovagal balance was evaluated by measuring HR variability power in the low and high-frequency bands and by time domain (RR interval and the root mean square of successive differences between normal heartbeats, lnRRMSSD) before and after exercise. These parameters were evaluated in ultra-short-term steady rest and recovery phases (3 min). Total exercise duration was split into the time needed to reach peak power output (t_{PEAK}) and the time to exhaustion (t_{EXH}). The post-exercise exponential decay of HR was characterized by its delay from exercise cessation (t_{DELAY}) and by its time constant (OFF).

Results: ANOVA on HR parameters confirmed that exercise and WBC treatment changed HR and RR values in specific conditions. In both situations, exercise significantly lowered RR interval ($p < 0.001$) while increased HR ($p < 0.0001$). In analogous, the WBC treatment increased RR interval and diminished HR only at rest (724 ms to 765 ms, $p = 0.023$; and 85.1 to 80.6 bpm, $p = 0.03$; respectively) without changes in the recovery phase. From the autonomic nervous standpoint, both lnRMSSD and lnLF/HF did not change in rest and recovery phases influenced by WBC ($p > 0.05$). In contrast, the exercise reduced only the lnRMSSD in control and WBC situations ($p < 0.001$) without changes in lnLF/HF ($p > 0.05$). In parallel, paired t tests indicated that WBC increased t_{EXH} ($p = 0.0122$), keeping a similar t_{PEAK} ($p > 0.05$) but reducing t_{DELAY} ($p = 0.0027$) following the exercise, which may be corresponded to speeding up the HR recovery but without significant reductions on OFF.

Conclusions: This suggests that WBC may be exploited to boost exercise performance and its fast recovery (lower t_{DELAY}) by improving the readiness before exercise. However, these changes did not reflect a more immediate vagal reactivation after exercise.

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PP21B—Can combined exercise training reduce work-related burnout symptoms and psychological stress in the helping professions?

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Purpose: Burnout is considered an occupation-related psychological syndrome consisting of emotional, physical, and cognitive exhaustion. In the 11th version of the International Classification of Diseases, Burnout has been defined as a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed. Physical activity could be an effective treatment for reducing occupational burnout. This study aimed to evaluate the effects of eight-week Combined Exercise Training on burnout symptoms and perceived stress among workers in the helping professions.

Methods: Sixty subjects (45.1 ± 7.3 years; $n = 30$ policemen, $n = 20$ physicians and $n = 10$ psychologists) suffering from burnout were randomly allocated into an intervention ($n = 30$, 15 M, 15F) or waitlist control ($n = 30$, 15 M, 15F) group. The intervention group performed a combined circuit resistance training and agility training (60 min, 3d-wk⁻¹) at a local fitness center. At baseline and after the intervention, the Maslach Burnout Inventory and Perceived Stress Scale were administered.

Results: Results showed that the intervention group significantly reduced emotional exhaustion, depersonalization, and perceived stress, and increased personal accomplishment ($p < 0.001$). The magnitude of the effects was large, revealing changes of crucial practical relevance. Adherence and satisfaction with the intervention were high. No significant changes were found in the control group.

Conclusions: The findings support the evidence that Combined Exercise Training may reduce occupational burnout and psychological stress in the helping professions. Thus, Combined Exercise intervention could constitute a relatively simple and inexpensive alternative compared to pharmacotherapy or psychotherapy in the treatment of occupational burnout.

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PP21C—Whole-body vibration for the physical activity training: an umbrella review

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Purpose: Whole-body Vibration (WBV) is a supplementary method for the training widely adopted in the healthcare setting because it is safe, less tiring, and less time-consuming. This training requires a vibration platform stimulating the muscular and the bone apparatus through vibrative oscillations at high frequency. Although this instrument was introduced around 1960 and a huge number of studies has been published, the protocols adopted are different and do not allow data comparison. Consequently, the objective of this umbrella review was to analyze the protocols previously published and to propose a specific training procedure for WBV.

Methods: All systematic reviews and meta-analyses of randomized controlled trials published on WBV were included in this study. Only English-written studies were included if published in peer-reviewed and international journals. The manuscripts were searched on the electronic databases PubMed, Web of Science, and Scopus till 25 March 2022. The quality evaluation of the studies included has been performed. Data were analyzed narratively.

Results: After the screening process, a total of 14 studies were included in this review. Heterogeneity between the studies has been detected related to the frequency, magnitude, and amplitude intensity. Furthermore, the review analyzed included protocols in which participants performed static and dynamic exercises, barefoot or with shoes. Other differences were in the training intensity, session duration, weekly frequency, and vibration characteristics.

Conclusions: WBV has different protocols that make it difficult to compare the data, thus limiting current research in this field. Consequently, a specific training procedure was created for WBV training. It was focalized on improving or maintaining bone mineral density and muscle strength. Guidelines for frequency, magnitude, and amplitude were proposed.

PP22A—Force-length relationship and muscle shape changes during mvcs in parkinson's disease patients

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Purpose: Although Parkinson's disease is a degenerative disorder of the central nervous system, the strength deficit of the affected limb can be partially explained by peripheral (1) and muscle-tendon mechanical alterations (2). Since these factors impair strength expression also in the elderly (3), the aim of this study was to investigate the relative contribution of age and pathology in determining the reduction in force expression in Parkinson's disease patients (PD), focusing on muscle architecture alterations.

Methods: Eleven early stage patients (UPDRS < 40), 10 middle age (CM) and 10 young controls (CY, 25 ± 2 years) participated to the study; data were collected on the dominant limb in controls and in both the affected and non-affected limb in patients (PDA and PDNA, respectively). All groups were matched for body mass, stature and physical activity (IPAQ); PD and CM were also matched by age (67 ± 6 and 70 ± 5 years, respectively). Participants performed a series of maximum voluntary fix-end contractions (knee angles: 15, 30, 45, 60, 75, 90°) during which the torque of the quadriceps muscles and the architecture of the vastus lateralis were recorded by means of a dynamometer and an ultrasound apparatus, respectively. Fascicle length (FL), muscle thickness (MT) and pennation angle (PA) were assessed in two conditions: at rest and during contraction.

Results: Quadriceps force increased as a function of knee angle ($p < 0.01$) with significant differences between groups ($p < 0.01$). Peak force (CY = 4.8 ± 1.4 kN; CM = 3.8 ± 1.5 kN; PDNA = 3.1

± 0.6 kN; PDA: 3.0 ± 1.2kN) was, however, attained at the same knee angle (75°) and fascicle length (8.5–9 cm) in all participants.

PA decreased and FL increased as a function of knee angle ($p < 0.01$), with significant differences between groups ($p < 0.01$). The decrease in FL from rest to contraction was associated with an increase in PA and a decrease in MT in all groups ($p < 0.01$). Changes in FL and MT were, however, lower in PD compared controls ($p < 0.01$), with no differences between the affected and non-affected limb.

Conclusions:

The strength deficit in PD patients could be, partially, related to impaired architectural muscle changes during contraction. Compared to paired age controls, the smaller variations in FL and MT in PD reflect an impairment in muscle shape changes that could be attributed to a larger muscle stiffness (3) which, in turn, is a consequence of their hypertonicity (4).

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PP22B—Measuring body region movement in students attending university lectures through accelerometers

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Purpose: University students spend a lot of time sitting in classroom lectures, which can be detrimental for their health. Activity breaks may help to interrupt sedentary time, but due to classroom norms, they can be difficult to implement. However, students may remain active while seated by taking advantage of fidgety body movements. Typical fidgety behaviors have been linked to increased energy expenditure, metabolic and vascular health and may be measured across multiple body regions using accelerometers. Quantifying fidgety movements can aid in the understanding and development of strategies for reducing risks associated with prolonged seated inactivity in classrooms.

Methods: A mixed group of fifteen adult students (Age: 23.5 ± 2.88, BMI: 23.9 ± 2.38, right & left dominant limbs) wore triaxial accelerometers (wGT3X-BT ActiGraph, Pensacola, Florida, USA), initialized at 30H (10 s epoch-length) on the anterior trunk (AT), right waist (RW), and right ankle (RA) regions of body for first 45 min of uninterrupted lecture. Accumulated movement at each region was converted into vector magnitude (VM) activity counts (using Actilife v. 6.13.4) and cross-analyzed using Shapiro–Wilk, Friedman tests, and post-hoc analysis (using jamovi 2021 v.2.2).

Results: Statistical tests revealed a difference in the amount of accumulated movement among the three body regions ($\chi^2 = 8.40$ $df = 2$, $p = 0.015$). In terms of VM counts, sample's median was highest at the ankle region, followed by the trunk and waist regions (Median RA = 2779 > Median AT = 1495 > Median RW = 785) which denotes a trend in the amount of movement accumulated during the lecture time. Pairwise comparisons showed that median 'difference' was notable between the ankle and waist regions (RW-RA: $\chi = 3.118$, $p = 0.004$) and mild between the trunk and waist regions (AT-RW: $\chi = 2.494$, $p = 0.019$). Measurement medians were

similar between the trunk and ankle regions (AT-RA: $\chi = 0.624$, $p = 0.538$).

Conclusions: Although limited, these data showed that ankle movement was higher than that of trunk or waist regions. This may be due to a relatively wider range of motion of lower limbs in a sitting position. Even though one region leads others, movement was present altogether, which may be superior to a complete inactivity.

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PP22C—Statistical tool to select which players to put on the field during a wheelchair basketball championship

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Purpose: Game performance in Wheelchair Basketball (WB) is represented by season statistics in terms of winning records, average points from both field-goals and free throws, rebounds, assists, and steals per match. How to optimize the factors contributing to the success of game performance and how to select players are primary concerns of the coaches and the technical staff. In order to explore the factors contributing to the success of the matches, Cluster Analysis was applied in WB game performance data.

Methods: Data related to a complete regular season of the top Italian WB Championship (101 athletes of 8 different teams and 56 matches) were considered for analysis. Seven scores of the athletes’ performance were considered (i.e., the number of free-throw points made [FTM], number of two-point field-goals made [P2M], number of three-point field-goals made [P3M], total points made per match [PTS = FTM + P2M + P3M], number of steals [ST], number of rebounds [REB] and number of assists [AS]). These seven scores were normalized by the time spent in the field by each player during each match and the most suitable number of clusters was determined by the hierarchical ward clustering method. The k-means clustering technique with the defined number of clusters was then performed to determine cluster membership for each participant.

Results: Based on data related to the first round of the Championship (i.e., 28 matches), two cluster solutions to explain about 35% of the total variance was considered to produce the optimal cluster size for detailed groups whilst maintaining meaningful differences between the clusters. Cluster 1 was composed of high level performing athletes, while Cluster 2 was composed of low level performing athletes. Based on data related to the second round of the Championship, the regression analysis conducted with the performance of each team (winning or losing), showed that teams with the better team performance (Adjusted R-squared = 0.48 and P = 0.035) were those where

players belonging to Cluster 1 had played more time during the second round of the championship.

Conclusions: The results of the present study provides a practical tool for WB coaches based on statistical techniques to support tactical decisions. This helps answer the question: “By what criteria can I select which players to put on the field during a WB championship?”.

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PP23A—Levi muscle index, a new bioimpedance parameter for the evaluation of muscle mass in soccer players

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Purpose: The assessment of muscle mass in athletes is used because it directly correlates with sports performance. Vector bioimpedance assessment is a growing method of assessing body composition in athletes because it is independent of predictive formulas containing body weight, ethnicity, age, and sex. The study aims to propose a new parameter (Levi Muscle Index, LMI) that evaluates muscle mass through raw bioelectrical data.

Methods: 664 male footballers underwent bioimpedance assessment during the regular season. LMI was correlated with body cell mass (BCM) and phase angle (PA) to establish efficacy.

Results: The footballers were 24.5 ± 5.8 years old, 180.7 ± 5.9 cm tall and weighed 76.3 ± 7.1 kg. The relationships were: LMI-BMI: $r = 0.908$, $r^2 = 0.824$, $p < 0.001$; LMI-PA: $r = 0.704$, $r^2 = 0.495$, $p = 0.009$ and PA-BCM: $r = 0.491$, $r^2 = 0.241$, $p < 0.001$.

Conclusions: The results obtained confirm that LMI could be considered a new parameter that provides reliable information to evaluate the muscle mass of athletes. Furthermore, the higher LMI-BCM relationship than PA-BCM demonstrates specificity for muscle mass evaluation in athletes regardless of body weight, ethnicity, age, and sex.

PP23B—Patterns of physical activity among university staff and students during the COVID-19 pandemic: implications for mental health

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Purpose: On March 11, 2020, the WHO declared COVID-19 a pandemic Restrictive containment and mitigation measures were introduced by public authorities to avoid the spread of the disease and the collapse of the national health care system. Some mandatory restrictions, however, might be stressful and impact the population’s

mental health and psychological well-being. Hence, the present study examined psychological distress during the COVID-19 crisis and its relationship with physical activity (PA) patterns among University staff and students.

Methods: Our study assessed changes in lifestyle behaviors and psychological well-being of staff and students ($n = 1123$) from the University of Pavia, Italy, during the COVID-19 outbreak using a cross-sectional, web-based survey. Psychological distress was assessed using the K6 scale, which ranges from 0 to 24, with scores of 13 points or higher reflecting poor mental health. Self-reported changes in average daily time engaged in PA during the COVID-19 crisis were also assessed. We used binary logistic regressions to estimate the ORs (95% CIs) for the association of PA patterns (categorical, independent variable) with psychological distress (categorical, dependent variable), with the confounding factors considered.

Results: Chi-squared tests (χ^2) revealed that the majority of the individuals reported significant reductions ($P < .01$) in average daily time engaged in PA ($n = 557$; 49.5%) during the COVID-19 crisis. Logistic regression results revealed that individuals reporting reductions in PA were more likely to develop psychological distress (OR 1.55, 95% CI 1.08–2.23, $P = .01$) than individuals reporting any change in PA. Regarding confounding factors, females (OR 0.34, 95% CI 0.25–0.47, $P = .01$) and older individuals (OR 0.95, 95% CI 0.94–0.96, $P = .01$) were less likely to experience psychological distress than those males and younger, respectively. Those with a higher education level were also more likely to experience psychological distress than those who had just finished high school (OR 1.58, 95% CI 1.13–2.20, $P < .01$). Individuals who had higher BMI values increased odds of psychological distress (OR 1.04, 95% CI 1.00–1.08, $P < .03$).

Conclusions: Data suggests a significant relationship between changes in PA during the COVID-19 pandemic and psychological distress among University staff and students. Promoting PA behavior is likely to protect against declining mental health in the studied population.

PP23C—Secretome derived from exercised skeletal muscle shows high levels of cathepsin b and leads to axonal outgrowth, increased synthesis of neurofilament-I and electrical activity modification of human motor neurons

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Purpose: Recent studies have revealed the importance of the muscle–brain axis in conveying the effect of exercise to the brain through the secretion of various peptides by skeletal muscle (i.e., myokines). Among these myokines, cathepsin B passes through the blood–brain barrier and enhances BDNF production and processes as neurogenesis. However, studies investigating the effects of cathepsin B on brain focus mainly on hippocampal neurons, and data on the effect of this peptide on other neuron types are lacking. Thus, we aimed to evaluate the effect of the conditioned media derived from electrically stimulated C2C12 myotubes on human iPSCs-derived motor neurons (MNs). Our hypothesis was that an increase in cathepsin B would

correlate with motor neurons morphological and functional modifications.

Methods: Myotubes were electrically stimulated using a multi electrode array device (Maestro Edge, Axion Biosystems) to mimic the mechanical stimuli imposed by exercise. Conditioned media from myotubes was then added to the motor neurons culture. Cathepsin B measurement was performed using ELISA method, while morphological changes and Neurofilament L expression were assessed by microscopy and quantified by image analysis system (Evos 7000 equipped with Celleste Image Analysis Software, Thermo Fisher). In addition, the effect of the myotubes supernatant on the MNs electrophysiological features was analyzed by measuring spike and burst activities (Maestro Edge, Axion Biosystems).

Results: Cathepsin B levels were higher in the conditioned media derived from stimulated myotubes compared to control. Morphological analysis showed an increased axonal thickness and sharp axonal modifications in motor neurons treated with the media from stimulated myotubes. Moreover, immunofluorescence analysis demonstrated a significant increased expression of Neurofilament-L (NFL) while electrophysiological analysis highlighted an increased spiking and bursting activities in the experimental condition.

Conclusions: Conditioned media derived from exercised skeletal muscle showed increased levels of cathepsin B and leads to sharp human motor neurons modification when added to the culture medium. These results indicate that myokines contained in the media derived from exercised skeletal muscle stabilize a crosstalk with motor neurons and cathepsin B is at least partially involved in these modifications. However, it remains to be shown to what extent cathepsin B is a determining factor in exercise-induced modifications in motor neurons.

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PP24A—Insulin prevents H2O2-induced oxidative stress in myoblast cells by activation of PKB / AKT

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Purpose: Exercise is associated with an increase in oxygen uptake by skeletal muscle, utilized into mitochondria for substrate metabolism and ATP production, resituating in increased ROS formation, shifting the cellular environment from a reduced to an oxidized state, independently of physical activity types (aerobic, anaerobic, or resistance) [1]. However, training can have positive or negative effects on oxidative stress, depending on training load [2], activated antioxidant systems and trophic factor inductions [3]. Considering the direct correlation between the mechanism of generation of oxidative species and insulin resistance, it is important to explore antioxidant potential of insulin and its intracellular pathway in muscle cells.

Methods: A myoblast cell line, C2C12 treated with H2O2, provides an exercise- like in vitro models to study ROS production due to workout [4]. Cells were treated with hydrogen peroxide (H2O2) or insulin at various concentrations for various periods of time, or with insulin and H2O2 for various periods of time.

Results: H₂O₂ has a negligible cytotoxic effect at doses of 0.20, 0.5, 1, and 1.5 μM concentration according to cell viability assay; an effect attenuated by insulin treatment (0.5 $\mu\text{g}/\text{ml}$). Also, insulin significantly

decreased ROS production H_2O_2 - induced. Pretreatment with a specific phosphatidylinositol 3 kinase inhibitor or wortmannin abolished the protective effect of insulin. Insulin strongly activated the putative downstream effector Akt.

From the wound healing test, we found that H_2O_2 increased cell migration capacity by $20.65 \pm 18.3\%$, and by $30.61 \pm 13.65\%$, in cells pretreated with insulin, also. While insulin alone decreased the migration rate. According to the role of MMPs in cell migration, zymography analyses showed a decrement by 52.56% of the MMP2 activity in cells treated with insulin.

Conclusions: Then, insulin shows increased survival and decreased ROS levels, motility and MMP2 activity, in myoblast C2C12 cells under stressed condition, suggesting a protective effect against myoblast injury induced by H_2O_2 /oxygen species. It would be useful to study in deep the molecular mechanism regulated by insulin in cells stressed by physical exercise.

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PP24B—“Breath again”: a pilot project for the validation of a respiratory gymnastics protocol, based on yoga and feldenkrais, for healthcare professionals with post- COVID-19 conditions: a qualitative analysis

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Purpose: SARS-CoV-2 infection can compromise lung function, causing symptoms such as fatigue, dyspnea, low mood, and a lowered quality of life. The proposed respiratory gymnastics exercises are based on Yoga and Feldenkrais. These two disciplines help increasing physical performance by means of awareness of one’s own body and breath; as a result, people who practice such discipline improve their psychological wellbeing. The goal of the “Breath Again” pilot project is to create a protocol of breathing exercises, aiming to improve the awareness of breath, establishing a healthy habit, which can improve health-related quality of life.

Methods: Selected healthcare professionals were divided in two groups. Each group participated in six sessions in a six-weeks period, between October 2021 and December 2021. The first session and the last session involved data gathering and questionnaires. The sessions entailed Yoga and Feldenkrais activities. Personal diaries were also used as qualitative assessment tools. The diaries involved homeworks to be carried out individually from one session to the next. All the dairies were analysed following a mixed methodology: top-down, starting from theory and objectives; and bottom-up, starting from actual data present in the journals.

Results: The analysis was carried out on 16 participants (age 44.89 ± 10.12). Almost all participants seemed to be aware of their own breath (location of breath within the body, duration, phases, differences). Almost all professionals encountered some challenges and experienced fatigue during the sessions. All participants gave a positive response about the exercises; they highlighted that the course gave them sensations such as wellbeing, calm and pleasure. The participants provided feedbacks on facilitators, which help the

creation of a habit, such as homeworks, and barriers, which hinder the creation of a habit, such as the lack of time.

Conclusions: Using the “Breath Again” diaries and homeworks is pivotal for establishing a habit and to promote a change in personal behaviour. Almost all participants were able to experience awareness of their own breath, both during the course and at the end. Fatigue was common to all participants, indicating that overcoming some initial obstacles is necessary to be able to establish a new habit, and to reach higher levels of wellbeing.

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PP24C—Object weight evaluation during the observation of eccentric and concentric movements

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Purpose Concentric and eccentric movements show different pattern of the motor system activity at both peripheral and cortical level (1). This difference might influence the way individuals perceive the actions that involve those kinds of movements. The purpose of this study was to test the role of the type of contraction in the perception of object weight during an action observation.

Methods Thirty-five volunteers [age: 24 years (21.5–26)] were enrolled. They were required to perform a weight-discrimination video task, which consisted in the observation of a couple of videos on which an actor lifted a box in concentric and eccentric condition. The observer had to evaluate in which video the box was heavier. The video showed 7 different loads (0, 2.5, 5, 7.5, 10, 12.5, 15 kg); the 7.5 kg-video was showed every trial as the reference. Responses were used to build a psychometric function for each participant in the two conditions. Just Noticeable Difference (JND), the Threshold, the lower and upper asymptotes of the function, which provide information about the ability to judge lightest and heaviest objects, were compared in the two conditions. Proportion of “Heavier” responses at each load was compared between the two conditions.

Results The threshold was significantly higher ($p = 0.04$) in Eccentric than in Concentric condition, suggesting that in Concentric condition participants showed a greater ability in recognizing heavy than light loads, while the opposite happened in Eccentric condition. This was confirmed by the following results. The upper asymptote was significantly lower ($p = 0.01$) in Concentric than in Eccentric condition. Furthermore, the proportion of Heavier responses at 12.5 kg was higher than in Eccentric condition ($p = 0.03$). Differently, in Concentric condition, at 2.5 and 5 kg, the proportion of Heavier responses were significantly higher (always $p < 0.001$), indicating that it was more difficult for the participants to discriminate the lower weights than in Eccentric condition. No significant effect was found for JND showing similar ability to discriminate the minimum differences between the weight of the stimuli in the two conditions.

Conclusions The ability to evaluate the weight of the object involved in the observed action was influenced both by the type of contraction and the entity of the weight.

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PP25A—Scoliosis online: feasibility study of a tele exercise program

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Purpose: In Italy, the pandemic of COVID-19 imposed the interruption of non-urgent health services. Tele-exercise (TE) has proved to be an effective and satisfactory alternative in supporting the administration of exercise in subjects with Adolescent Idiopathic Scoliosis (AIS). During the lockdown period, the Department of Pediatric Orthopedics of the University Hospital “Città di Pavia” (Pavia, Italy) supported AIS patients with the project “Scoliosis Online”, to reduce negative effects on the biopsychological component. The aim of the study was to evaluate adherence, perceived pleasantness, and level of satisfaction with the technology used to administer the TE in a group of adolescents with AIS.

Methods: Between 14 and 20th April 2020, 7 female with AIS (14.14 ± 2.34 years old) were recruited and grouped by type of scoliotic curve: Italic S (5) or right single thoracolumbar (2). From 28th April (T0) to 26th June (T1) they carried out a bi-weekly exercise program using a real time meeting application (Meet, Google LLC, Mountain View, CA, USA). Since the self-correcting movement (SCM) is essential in the postural training of a person with scoliosis, participants were provided with a link to watch the video of the right execution of the SCM on their own. For each online training session, the participants made 6 exercises, the first was always the SCM. To assess adherence, trainer wrote date and time of each completed session in an Excel file. Alike, at the end of each session, Feeling Scale (FS) was used by each participant to express her perceived pleasantness. At T₁ the Technology Acceptance Model (TAM) was administered to evaluate how participants accepted and used the technology employed and their attitude to use it again.

Results: Results, expressed as mean and standard deviation, were: completed sessions 7.71 ± 3.86 out of 15, FS total score 4.07 ± 0.33 out of ± 5 and TAM total score 23.51 ± 3.88 out of 28.

Conclusions: Perceived pleasantness was very high as were the scores related to the technology. Adherence to the program achieved positive, but low, values. Results could lead to girls habit of using social platforms and technologies. In times of normality, face-to-face mode remains the gold standard. However a TE program can be useful to support children with AIS who have travel problems.

PP25B—The erasmus + sport eumove project: learning units about healthy life styles promotion for children and adolescents

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Purpose: School years are crucial for educating youth about healthy behaviors and lifestyles; however, there is an increasing percentage of children and adolescents that fail to maintain healthy lifestyles. European Union has financed the Erasmus + Sport *Let's Move Europa* project to design an innovative digital tool for promoting healthy lifestyles in school children from 8 to 16 years old. The University of Bologna is partner of the project and has the responsibility to create a specific intellectual output focused on Learning Units (LUs) about Healthy Lifestyle in particular physical activity, sleep and nutrition to be integrated in the school program by teachers. **Methods:** We conducted semi-structured focus groups (FGs) with 17 teachers from primary and secondary schools located in Bologna province (Italy). All FGs were recorded, transcribed, anonymized, and analyzed through inductive thematic analysis. The investigation aimed to identify facilitators/barriers of the intervention and possible solutions, identifying time frames and locations, suggestions for engaging the different stakeholders (teachers, students and families). After the FGs we co-designed the LUs about healthy lifestyles.

Results: We enrolled 17 teachers (15 females + 2 males, mean SD age 49.5 ± 11.6) in this preliminary phase. The LUs were created based on the latest scientific evidence and the FGs output. Each LU addresses a specific topic and is tailored differently for primary and secondary school. The layout includes a general goal with specific information and classroom activities. The second contained “healthy homework” or “challenges” to be accomplished at home, engaging families in the construction of a healthy routine. All the activities were designed to be feasible and sustainable. Each LU includes a final discussion phase to understand students’ feedback about proposed homework and learning content.

Conclusion: FGs were crucial to creating and adapting LUs on the needs of different stakeholders in order to co-design an effective intervention. “Healthy homework” and “Challenges” can be a good strategy to engage students to pursue healthy habits also outside the school setting involving families and parents. In conclusion the EUMOVE project can be a new strategy to integrate knowledge about sleeping, nutritional and physical activity habits into the school curriculum to promote healthy lifestyles among students and their families.

PP25C—Attentive processes and blood lactate in the sambo

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Purpose: Sambo is a martial art and combat sport that originated in the Soviet Union. There are two main stiles, Sport Sambo and Combat Sambo which resembles modern mixed martial arts. Very little

literature is available about physiological aspects of Sambo and, in particular, on the possible effects on cognitive domains. The purpose of the present research was to determine if there is a correlation between a blood lactate increase and the intensity and/or selectivity of attentions.

Methods: Sixteen male athletes practicing Sambo for at least 5 years participated voluntarily in the study. Each athlete had to sustain, with an interval of one week, both a Sport Sambo match and a Combat Sambo match, each lasting 5 min. Blood lactate levels as well as attentive capacities were evaluated at three different times: at rest, i.e., 5 min before the start of the session (pre), at end of the session and 15 min after its conclusion. Reaction time protocol was used to evaluate the intensity of attention, whereas divided attention was assessed for analyzing the selectivity of attention together with errors and omissions.

Results: Concerning Sport Sambo, blood lactate was 1.66 mmol/L (± 0.55 SD) before the session, reached a mean value of 3.40 mmol/L (± 0.45 SD) at the end of the session (end) and returned to values similar to initial ones (a mean value of 1.98 mmol/L (± 0.37 SD) after 15 min (15-end). None of the attentive parameters examined, showed statistically significant differences. Conversely, for Combat Sambo, it was found a significant increase in blood lactate levels that went from 1.66 mmol/L (± 0.55 SD) before the session (pre), to 4.76 mmol/L (± 0.60 SD) at the end (end) and then back to values similar to those observed before the session 15 min after its conclusion (15-end), i.e., 1.97 mmol/L (± 0.37 SD); however, after a Combat Sambo session increases in blood lactate were associated with significant worsening of attentional mechanisms.

Conclusions: In conclusion, in all the participants, the worsening of attentional mechanisms was observed only after the Combat Sambo session in which blood lactate values exceeded 4 mmol/L. This figure, also known as the Onset of Blood Lactate Accumulation (OBLA), is commonly used to determine the anaerobic threshold.

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PP26A—Looking for easy exercise options for postprandial blood glucose management

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Purpose: Elevated post-meal glycaemic levels are associated with an increased risk of cardiometabolic disorders. While postprandial exercise has proven to be effective for improving the post-meal glucose response, adherence to this exercise practice is still low. Hence, this study investigates the effects of exercise types that may facilitate exercise adherence on the post-meal glucose response.

Methods: Twenty-three healthy, active, young individuals performed one of two studies (12 participants in Study 1 and 11 in Study 2), with four protocols each. All protocols lasted three hours. At the beginning of each protocol, a standardised breakfast (1 g of CHO per kg of body weight) was consumed. In both studies, participants performed 30 min of exercise, starting 15 min after the meal, or remained seated (CON).

Specifically, in Study 1, 30 min of walking (WALK), intermittent step exercise (iSTEP) or intermittent isometric wall squat (isoSQUAT) were performed. In Study 2, 30 min of walking (WALK), neuromuscular electrical stimulation alone (P_NMES) or combined with voluntary muscle contraction (VC_NMES) were performed. iSTEP, isoSQUAT, P_NMES and VC_NMES were performed with cycles of 30 s of work and 60 s of rest. Glycaemia was regularly assessed during the three hours and the positive area under the curve (iAUC) was calculated at one, two and three hours, for both studies.

Results: In Study 1, the glucose peak was significantly reduced in WALK and iSTEP compared to CON ($p < 0.011$), while no effects were observed for isoSQUAT. In addition, WALK significantly lowered the iAUC at one hour compared with CON and isoSQUAT ($p < 0.047$). In Study 2, a significant reduction of the glucose peak was found in WALK compared to CON, P_NMES and VC_NMES ($p < 0.010$). A reduction of the peak was also observed in VC_NMES compared with CON and P_NMES ($p < 0.010$). The glucose iAUC was significantly reduced at one and three hours in WALK and VC_NMES compared with CON and P_NMES ($p < 0.048$).

Conclusions: Thirty min of postprandial walking are effective in reducing the post-meal glucose response. Alternative strategies, as iSTEP and VC_NMES are similarly effective for improving glycaemia after a meal. The possibility of choosing among different options may be important for increasing adherence to exercise as tool for managing postprandial glycemia.

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PP26B—Changes in sporting activity induced by the COVID-19 pandemic: a pilot study on high school students

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Purpose: We hypothesize that the COVID-19 pandemic, with all the inconveniences it has caused, has also led to a change in the lifestyles of adolescents and in their way of conducting sporting activities, even of a curricular nature, even more so being this is the only subject forbidden in school and which has had a notable upheaval for a long time compared to its classic forms. This work presents the first results of a pilot study conducted in high school students on the changes induced by the COVID-19 pandemic on school sports and physical education. The project was born from the observation of a change in the habits of adolescents with regard to extracurricular sports practice and curricular physical education due to the changes in teaching provision imposed by the Ministry due to the COVID-19 pandemic.

Methods: The research sample is made up of students from Manzoni State High School in Caserta. The results presented refer to a sample of 300 students. The students were given a battery of tests aimed at investigating Self-esteem, Self-efficacy, body appreciation, body function, well-being, motor/sports activity performed, motivation to perform physical activity, and above all their perception of discomfort about not being able to carry out both extracurricular and curricular

physical activity during the pandemic. The tools used were, among others, the Rosenberg Self Esteem, the Self Efficacy, the Body Appreciation Scale-2, the Exercise Regulations Questionnaire, and an ad hoc questionnaire designed to detect interest in physical education during the pandemic.

Results: These first results, mainly of a descriptive nature, refer to factorial and correlational analyses. In particular, a principal component analysis was carried out on the data found. The analysis identifies three factors that cover 73% of the explained variance. These three factors have been called: passion for sports, motivation for sports, and depression in the inability to perform. A second analysis concerns the correlations between the scales. Some correlations between items on the scales that show an overall articulated profile of the experience of carrying out sporting activities during the pandemic were significant. Particularly important is the consideration of the positive correlation ($R = .326$; 0.01 two-tailed) between passion for sports and the level of Self-efficacy and Self-esteem ($R = .327$; 0.01 two-tailed).

Conclusions: The first data presented and discussed here help to outline the characteristics of the sample on which the research is carried out. As a percentage, the values that indicate a weakening of interest and passion for sports are dominant and form the basis for subsequent research that animates debate and reflections.

PP26C—The role of crowd support on home advantage during covid-19 restrictions on Italian football competitions. Comparison between 2018–19 and 2020–21 seasons of the Italian Serie A and Serie B championships

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Purpose: The home advantage (HA), described as the home team winning 50% or more of the games they have played, affects football competitions, especially for the presence of crowd support. Even though several studies demonstrated that HA is influenced by the crowd, the empty stadia caused by COVID-19 restrictions offered unique situations to explore and quantify HA. For these reasons, our aim was to investigate the possible influence of fans' support during the major Italian football competitions (Serie A and Serie B) between the 2018–2019 series (with crowds) and the 2020–2021 series (without crowds).

Methods: We conducted an observational study with the data from the last three seasons of the Italian football championship A–B series, analyzing a total of 2.964 individual game scores. To quantify the HA, the number of points won at home was calculated as a percentage of the total number of points won considering all the matches. Moreover, we investigated the HA between Champions League (UCL)-qualified teams, Europa League (UEL)-qualified teams, and relegated teams. The comparison between the two seasons was made using the Mann–Whitney non-parametric test.

Results: In every season and for every team classification, HA was found (scored points > 50% in home matches). We reported a difference in HA median score for Serie B. Additionally, a difference was found in Serie A for middle-ranking HA median scores in the two

seasons compared ($p = 0.017$), which was similarly found in Serie B ($p = 0.009$). The number of penalties in home matches was lower in the season with a crowd compared to one without a crowd ($p = 0.001$). In addition, we compared home vs. away matches for each season (with/without crowd) and only in the season with a crowd (2018–2019) we observed a lower mean number of penalties in home matches compared with away ones.

Conclusions: In conclusion, as the HA does not disappear in empty stadiums, there must be other contributing factors such as players' motivation, travel to reach the game destination, and other statistics of the game (such as shots and offensive and defensive actions). Even though we did not find any reduction in the HA without a crowd, we found that the referees were biased by the presence of the crowd, which, in a single game, could be advantageous to the home team.

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PP27A—Assessment of neuromuscular damage in COVID-19 post-intensive care syndrome patients

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Purpose: Following hospitalization, Covid-19 post-intensive care syndrome (PICS) patients acquired prolonged physical, mental and cognitive impairments due to the symptoms of the disease, prolonged immobility and neuromuscular complications. The study aims at evaluating the correlation between functional variables i.e. the maximal voluntary contraction (MVC), and electrophysiological variables i.e. the compound muscles action potential (CMAP) and the motor unit number index (MUNIX), to determine a strategy for assessing neuromuscular damage and fatigue in COVID-19 PICS patients both during and post-intensive care unit (ICU) hospitalization.

Methods: Fifty-one critically ill patients (37 males, 14 females) were recruited from the ICU of Spedali Civili Hospital in Brescia and underwent a follow-up assessment at 3-, 6- and 12-months following ICU discharge. The protocol consisted of a stimulation and a voluntary protocol. During the stimulation protocol, the CMAP was estimated by stimulating the common peroneal nerve (CPN). During the voluntary protocol, patients performed submaximal isometric foot dorsiflexions at 30, 50, and 70% MVC. The MUNIX was calculated using the CMAP and the surface electromyographic interference patterns (SIP) recorded during the isometric contractions. The CMAP and the SIP were derived from the HD-sEMG signals recorded from the TA with a 64-channel matrix placed over the belly of the tibialis anterior.

Results: The mean variations in MVC between 3- and 6-months follow-up (10.75%) and between 6- and 12-months (16%) following COVID-19 ICU discharge were paralleled by changes in CMAP for the same period (+ 10.85% at 6 compared to 3 months, and + 1.09% at 12 compared to 6 months). The linear regression analysis showed a

moderate correlation between MVC and CMAP ($R^2=0.20$; $p < 0.001$) and between MVC and MUNIX ($R^2=0.18$; $p < 0.001$).

Conclusions: The MVC was significantly correlated with CMAP and MUNIX estimations. The correlation between functional and electrophysiological variables allows to longitudinally assess the neuromuscular damage in COVID-19 PICS individuals and opens the possibility for an early clinical evaluation of non-collaborating patients admitted to the ICU and their subsequent follow-up.

PP27B—Physical exercise and action plan for health promotion in the workplace

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Purpose: Among the seventeen "Sustainable Development Goals" established in 2021 by the United Nations (UN) as a priority to be achieved by 2030, goal number three is "Health and well-being", including 3.4: reducing premature mortality from non-communicable diseases by one third through the prevention, treatment and promotion of mental health and well-being. In this study we decided to develop an action strategy for the promotion of health and physical exercise in the workplace within two companies participating in the Workplace Health Promotion (WHP) project of the Tuscany Region. We want to check if this strategy shows positive effects on the performance of physical activity (AF) in terms of its increase and whether or not it affects the quality of life of the participants.

Methods: Thirty company employees participated in the informational and motivational interview on AF. The Sports Doctor outlined first the general benefits and recommendations and then described the specific and individual ones drawn up by the Ministry of Health. We also provided the participants with brochures including the recommendations previously described. The kinesiologist then provided, described and asked the participants to try executing the standardized exercise protocol, especially designed, to be carried out during work breaks. The performance of physical activity was analyzed through the Global Physical Activity Questionnaire (GPAQ). Quality of life was monitored through the Who-Five Well-Being Index (WHO-5) questionnaire. The physical and medical-pathological characteristics were investigated through an anamnestic questionnaire.

Results: The results showed that the action strategy, also thanks to the exercise protocol, stimulated the participants to a significant increase in AF ($p = 0.028$) and improvement of quality of life ($p = 0.015$).

Conclusions: We recommend that the action strategy be introduced in upcoming institutional projects aimed at promoting health in the workplace, also involving the professional figures of the Sports and Exercise Physician and the Kinesiologist of preventive and adapted motor activities.

Acknowledgments: (non obbligatorio).

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PP27C—Understand the exercise-related affective experiences to counteract the pandemic of physical inactivity in children. Analysis on 508 middle school students

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Purpose: Physical inactivity and sedentary behaviour among children and adolescents are increasingly common problems, with negative consequences on cardiovascular, metabolic, and cognitive health. Investigating the Affective-Exercise-Experiences in this population could be the key if we want to design effective and efficient behavioural interventions to favour an active lifestyle.

Methods: Following written informed consent signed by parents, the IPAQ-A¹ and

AFFEX² questionnaire were administered to 508 students (49% female) aged 12.4 ± 1.0 . AFFEX is a 36-items questionnaire useful for measuring the pleasant or unpleasant valence that has been associated with exercise practice. Results are expressed in score related to ten subdomains: *attraction, calmness, competence, empowerment, energy, honour, interests, likegroup, pleasure and showoff*. The IPAQ-A was administered to investigate the level of physical activity performed during school periods and leisure time.

Results: All the students involved in the study have correctly completed the questionnaires administered. Males do not differ from female peers in both age and BMI. Data from IPAQ-A questionnaire shows that males are more physically active than females, considering both moderate and vigorous intensity activities ($p < 0.0001$), but females spend more time in walking activity than males ($p = 0.0015$). The AFFEX questionnaire shows significant differences between males and females for all the subdomains except for *calmness* and *competence* sphere. Multiple regression analysis shows that only the time spent in vigorous exercise significantly affect all the subdomains score ($p < 0.0001$).

Conclusions: AFFEX has proved to be easy to use and understand in a population of young people, and sub-domain score has exhibited a strong correlation with self-reported exercise behaviour. This questionnaire could be considered a novel tool able to reflect the association between exercise experiences over a lifetime and their affective responses. Future studies will be needed to understand if changes in affective exercise experiences can predict the subsequent adoption of an active lifestyle.

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PP28A—Exersarco: home-based physical activity to counteract sarcopenia in older people

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Purpose: Sarcopenia, a disorder characterized by age-related muscle loss and reduced muscle strength, is associated with decreased individual quality of life, as well as a high risk of death. The primary aim of this project is to evaluate the effect of a six-month home-based resistance training program on physical performance and muscle health in older subjects.

Methods: This is a three-arms randomized-controlled study conducted at the IRCCS Istituto Ortopedico Galeazzi enrolling 36 older participants (age: 60 and 80 years) that have been allocated to either an experimental group performing a six-months resistance exercise intervention (EXE; n = 12), an experimental group performing a six-months resistance exercise intervention plus an intake of amino acids (SUPPL; n = 12) or a control group (CON; n = 12). At the beginning (PRE), and after 6 months (POST), participants were assessed for muscle strength (Chair Stand Test, Maximum Isometric Strength of knee extensors and flexors, Handgrip Test and One Repetition Maximum (1RM) by Leg-Press), balance and gait capacity (Mini-BESTest), body composition by dual energy X-ray absorptiometry (obtaining Appendicular Skeletal Muscle Mass Index, ASMMI), magnetic resonance imaging of thigh to evaluate Intra Muscular Adipose Tissue (IMAT) and muscle Cross Sectional Area (CSA) and sleep monitoring by actigraphy.

Results: Currently, 27 subjects completed the study. The two-way ANOVA was used to test intra-group and inter-group differences for all variables. Preliminary results showed that EXE and SUPPL significantly improved the Chair Stand Test (EXE: PRE = 12.78 ± 3.23; POST = 16.11 ± 3.41; p = 0.0039. SUPPL: PRE = 12.25 ± 2.82; POST = 15.63 ± 4.565; p = 0.0205. Effect of Time p < 0.0001, Group n.s., Interaction n.s., Subject p < 0.0001) whereas no significant differences were observed in CON. In addition, SUPPL improved 1RM (PRE = 141.4 ± 38.1 kg; POST = 168.6 ± 51.5 kg; p = 0.0313. Effect of Time p = 0.002, Group n.s., Interaction n.s., Subject p < 0.0001) and Handgrip Test (PRE = 19.73 ± 9.35 kg; POST = 25.76 ± 9.97 kg; p = 0.017. Effect of Time p = 0.009, Group n.s., Interaction n.s., Subject p < 0.0001). No significant differences were found on ASMMI, IMAT and CSA.

Conclusions: It is well known that exercise plays a crucial role in maintaining good physical health. Data of this study demonstrated that home-based physical activity could be an alternative method from traditional training practices, as it increases the maximal and submaximal strength of the lower and upper limbs.

PP28B—Health-oriented interventions in primary and secondary school: preliminary results from the “physical snack” project

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Purpose: In the last few years multicomponent interventions — aimed at the promotion of active lifestyles and analysis of the relationships between the increase in levels of physical activity and the effects on physical fitness, executive functions, academic performance, and psychological-relational factors related to the practice of motor activity, have become increasingly common. In the school setting, physical activities can be promoted during the curricular lessons, recess, and intervals between consecutive lessons. Simple frontal teaching, traditionally theoretical and static, can be integrated with “active” teaching through physically active lessons, active breaks and active recess. The Active Breaks represent an opportunity to extend the practice of motor activity during curricular time, alternating the too many sedentary moments with a short-term physical activity, allowing to enhance physical activity levels and develop some components of physical fitness. This study aims to assess the effects of the active breaks and physical activity lessons for the development of physical fitness schoolchildren aged 8–14 years.

Methods: The “Physical Snack” Project involves a total 765 children (399 males, 11.20 ± 1.72 yrs age; 366 females, 11.32 ± 1.76 yrs.) from three primary and secondary schools in the Foggia province. The experimental activities took place from March to June 2022, in the following organizational methods:

active breaks;
physically active lessons;
active breaks before and after school.

The assessment involved anthropometric characteristics and the following physical fitness test: standing long jump, medicine ball throw 2 kg, 6-min walking test, sit ups, 10 × 5 shuttle run and hand grip.

Results: The preliminary results of physical fitness assessment evidence similar scores in motor performances pre and post interventions. The analysis showed better performances statistically significant in standing long jump (p < .05) and 6-min walking test (p < .01).

Conclusions: The preliminary results of the “Physical Snack” project highlighted that motor tasks (and the ways in which they are proposed by teachers) should be based on a solid methodological-didactic structure to *intentionally* develop some components of physical fitness. The improvement of physical fitness - as a health status indicator - through active breaks and “active” school interventions in schoolchildren can promote further opportunities to encourage and expand the time spent in physical activity.

PP28C—How peripheral vision help athletes in perceiving important cues: the role of microsaccades in the blind- pass strategy

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Purpose. During a match, perceiving the best solution passing the ball to the right direction is in many cases the best way to score. Athletes with a wide attentive focus make better tactical decisions than athletes with a narrow breadth of attention. For this reason, the aim of our study was to investigate whether a player in possession of the ball, engaged in avoiding the opponent interception, can consciously perceive an unmarked teammate using the blind-pass

strategy to make the pass. A blind-pass strategy (also called no-look pass) are performed when a player looks in one direction but shoot or pass the ball to another direction.

Methods. Twenty-four male basketball players (21.04 ± 3.0 yrs.) were subdivided in two groups, 12 experts (Serie B) and 12 novices (Serie D). In a basketball court, eye movements of the athlete in possession of the ball were recorded binocularly (EyeLink II). In the meantime, his hand movement was recorded with one inertial sensor (Cometa Systems) placed on the right hand. He had to make a blind-pass to the right or to the left, based on the raised hand of the teammate located sideways (one to the left and one to the right), meanwhile an opponent tried to obstruct the pass unaware were the ball will be sent.

Results. Movement time initiation showed not significant differences between groups ($p = 0.10$), as well as for passing direction ($p = 0.83$). Microsaccade orientation revealed a significant difference between groups during the passing to the right ($p < 0.01$) but not when the passing was to the left.

The analysis of the saccades inside $1\text{--}3^\circ$ of visual angle showed that novices made more saccades of greater amplitude (3.2 vs. 2.7°) and faster peak velocity (168 vs. $133^\circ/\text{s}$) than experts.

Conclusions. External attentional processes (i.e. environmental cues received by senses), have been assumed to underlie and determine the quality of decision-making in sport. Results of the present study show that expert players take advantage of microsaccades when the orientation of attention differs from the orientation of gaze position, such as during the blind-pass strategy, used to deceive the opponent.

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PP29A—Boxing training for parkinson patients. A neuroplastic approach

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Purpose: Parkinson’s Disease (PD) is a neurological disorder with a vast array of symptoms and physical features. Various studies have found improvements in balance, gait, and activities of daily living following a boxing program. The aim of this study is to investigate the benefits of non-contact boxing on participants with PD.

Methods: This was a cross sectional study completed in a laboratory setting. 15 participants were included in this study, 3 women and 12 men with an average age of 70 ± 5.3 . Inclusion criteria was, participants needed to have a diagnosis of PD, be able to complete ADL’s with or without the help of an assistive device, and be available for the entire course of the study. The intervention consisted of a one-hour session twice a week for a total of 24 sessions. The time up and go test (TUG), and reaction time test (RT) via Senaptec Sensory

Station was measured before after the intervention. The intervention consisted of multimodal aspects of motor learning and neurocognition to improve patient function and increase adaptation of the patients nervous system. These included, *contextual interference* (responding with correct exercise to visual prompts requiring working memory), *sensory reweighting* (challenging proprioceptive, visual and vestibular processing for spatial awareness), *unanticipated reaction* (rapid boxing maneuvers to light stimuli) and *differential learning* (change movement pattern under changing sensory or environmental parameters). The dependent variables were hand RT, and TUG. To evaluate the impact of the intervention Hedge’s g effect sizes were used because of the small sample size and interpreted as 0.0–0.3 as small, 0.4–0.5 as medium, and 0.6–0.8 as large. A repeated measures ANOVA was conducted for each dependent variable with the within-subjects factor time (pre and post intervention). Alpha level was set at 0.05.

Results: Dominant hand was significant pre- and post-intervention ($F_{1,14} = 9.66$, $p = 0.008$, $\eta^2 = 0.41$, $1-\beta = 0.82$) with RT decreasing after the intervention (mean difference = -34.27 (-57.92 , -10.61)) indicating that individuals improved their dominant hand reaction time. Non-Dominant hand was also significant pre and post intervention ($F_{1,14} = 5.78$, $p = 0.031$, $\eta^2 = 0.29$, $1-\beta = 0.61$) indicating an improvement in the individuals non-dominant hand reaction time. There was not significant difference between time points for TUG ($p = 0.06$).

Conclusions: Results revealed that RT improved bilaterally following the intervention. With the documented correlation between slow RT and fall risk, this result could have significant impact on this population of people by potentially helping decrease that risk. The TUG approached a significant effect but a larger study will be required to determine if the intervention has improvements on this measures. The results of this study demonstrate that non-contact boxing may be an appropriate therapy for patients with PD.

PP29B—Survey on the change in the number of registered athletes in developmental age. Differences between different sports in veneto

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Purpose: In the last two years, because the restrictions due to the Covid-19 pandemic, the world of youth sport suffered several limitations, not allowing practicing sport freely. Accordingly, it was hypothesized that sport participation among children and adolescents have been reduced and that, at the same time, outdoor sport activities have had greater adhesion respect indoor ones. The aim of this research was to carry on a quantitative and qualitative investigation on a representative sample of sports affiliate to several sport national federations in Veneto region, in order to get data on the sport adhesion trend for children and adolescent in the last five seasons.

Methods: A total amount of 240 sport associations was recruited for this research. We collected the number of registered athletes of each association during the last five seasons (since 2017/2018 to 2021/2022), creating three age clusters: 3–5, 6–10, 11–18 years respectively. A total amount of 12 sports was analysed, divided in indoor/outdoor and individual/team sports. The analysed sports were: field and track athletics, tennis, cycling, skating, swimming, gymnastics, soccer, rugby, baseball, volleyball, basketball, water polo.

Results: The general trend for each sport showed a slow but progressive decreasing in sport participation even before the 2019/2020 and the 2020/2021 seasons. For the whole sample, the 2020/2021

season was the worst one for sport participation. Although the 2021/2022 season showed a positive trend in terms of registered athletes, it must be underlined that the total number is still 7% less respect the 2017/2018. Indoor sports showed a higher negative trend respect outdoor sports and the 6–10 age cluster was the most affected. Specific trends are provide for each sport but the most affected at all was swimming, probably because the government choice to close for a longer time the swimming pools.

Conclusions: The presented data show some problems about sport participation. The Covid-19 pandemic got worse the sport participation but a negative trend was observed even before the pandemic. This scenario is a very critical one and these data should be food for thought for sport professionals, families, for politician and for anyone who is involved in health management. Our data are specific for this area of Italy; therefore, we hope to create a comparison with other Italian regions, in order to get a clear idea of the Italian sports participation trend among youth and adolescents.

PP29C—Cognitive-motor inference in table tennis

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Purpose: In several sports, such as table tennis, athletes face high cognitive and physical demands concurrently, and this situation can impair performance via a phenomenon called cognitive-motor interference (Le Mansec et al., 2012). This study investigated how table tennis athletes can manage single- and dual-task situations.

Methods: Thirteen expert table tennis athletes with national and international experience were recruited (Mage = 20.4; SD = 5.3 y.o.). Participants performed three single-tasks and two dual-tasks. The single tasks

consisted in performing the Auditory Free-recall Memory Task (MT) and two table tennis tasks: Easy Task (ET) or Difficult Task (DT; Le Mansec et al., 2012). In ET and DT, participants had to return a series of throws from a robot machine. In the MT, participants just had to store 20 words and recall them at the end of the tasks. In the dual tasks, participants simultaneously performed either ET or DT with the MT (MT + ET and MT + DT). The NASA-TLX questionnaire was filled up after each single or dual task to assess perceived physical (PD) and mental demands (MD).

Results: Significant differences were found among the different sessions (MT; MT + ET; MT + DT; $p < 0.001$). MT performance was superior when compared with MT + ET and MT + DT. No significant differences between MT + ET and MT + DT were found. Considering only the first five words of MT, significant differences were found for the following task: MT vs MT + ET; MT vs MT + DT. Conversely, nonsignificant differences between MT + ET and MT + DT were found. However, when considering the last 5 words, MT performance was better when compared with MT + ET and MT + DT. Moreover, MT + DT performance was better than MT + ET performance. Mental demand was significantly different among the sessions ($p < 0.001$). MT's physical demand was significantly higher than all the sessions except the MT + DT. Physical demand was also different across the sessions ($p < 0.001$). MT's physical demand was lower compared with all the other sessions. Moreover, the difference between MT + ET and ET was nonsignificant. Whereas, DT's and MT + DT's physical demands were higher compared with all the sessions. However, mental demand in DT and MT + DT was not different.

Conclusions: Results indicate significant cognitive-motor interference even in expert table tennis players: the more difficult the

table tennis task becomes, the fewer words are remembered. These data are also supported by the higher PD and MD in MT + DT compared to all the other sessions.

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PP30A—The effect of low-impact boxing on balance in patients with Parkinson's disease

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Purpose: Parkinson's disease (PD) is a neurological disorder with a vast array of physical and nonphysical symptoms, including balance disorder. The aim of this study is to evaluate how a low-impact boxing intervention modify static balance in patients with PD.

Methods: This was a cross sectional study completed in a laboratory setting. 15 participants were included, 3 women and 12 men with an average of 70.3 ± 5.3 years. The intervention occurred over a three-month time frame consisting of a one-hour session twice a week for a total of 24 sessions. It consisted of multimodal aspects of motor learning and neurocognition and it included contextual interference (responding with correct exercise to visual prompts requiring working memory), sensory reweighting (challenging proprioceptive, visual and vestibular processing for spatial awareness), unanticipated reaction (rapid boxing maneuvers to light stimuli) and differential learning (change movement pattern under changing sensory or environmental parameters). Static balance was measured using a Kistler force plate before and after the intervention. The assessment lasted for 10 s in double leg stance with eyes open and without shoes. Test was performed on a firm surface as well as a 5 cm foam pad for a total of three separate trials for each condition. Ground reaction forces (x, y, and z planes) and moments of force (x, y, and z planes) were measured. Center of pressure (CoP) displacement in the x and y planes as well as total CoP displacement were calculated for the firm and foam conditions. The dependents variable were x CoP, y CoP, total CoP. Hedge's g effect sizes were calculated for each dependent variable. Additionally, the difference between firm and foam was calculated between each dependent variable at each time point. Nine repeated measures ANOVAs were calculated for with the within subjects factor time and the dependent variables and Alpha level was set at 0.05 for all analyses.

Results: None of the dependent variables were significant between pre and post intervention ($p > 0.05$). However, there were medium effect sizes for x CoP firm (ES = 0.41), total CoP firm (ES = 0.4), y CoP foam (ES = 0.43), and total CoP foam (ES = 0.42) indicating the intervention had a moderate effect on static balance. All other effect sizes were small.

Conclusion: The results indicated that there was no significant difference between balance pre- and post-intervention. While the results of this study may not have been statistically significant, there is still value in using low-impact boxing as a non-pharmacological option to aid in the inherent decline of PD. The results indicate that the intervention had a moderate effect on static balance.

PP30B—How (un)sustainable are sporting events? The case- study of the national university championship in cassino

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Purpose: Regardless sport has been recognized by the United Nations as an important player in sustainable development, to date, research on environmental sustainability of small and medium-sized sporting events is limited and there is a clear lack of effective methods of environmental impact assessment. Consequently, the purpose of this case study was to evaluate the impact of a multi-sport university event that was held in Italy in May 2022.

Methods: A literature review was performed to identify an appropriate method to study the case and the areas of interest to be explored. This document attempts to quantify and analyze the environmental impact associated with participation in the National University Championship by evaluating as input source transport, waste and accommodation. A questionnaire was designed for athletes (n = 502), companions (n = 24), managers (n = 25) and coaches (n = 84) to gather information about transport and accommodation, while the information on urban waste was obtained through data provided by the municipality of Cassino. Interviews were also conducted with some executives (n = 3) to assess the measure to which sustainability is taken into account by the central organization.

Results: The quali-quantitative analysis of the different research tools allowed to detect different information, in line with others, the results indicated that one of the analyzed inputs that had a great impact is determined by travel behavior. In addition, a moderate level of commitment to environmental sustainability has emerged from the sports body in charge of organizing university sports activities.

Conclusions: Often the measurements, evaluation and analysis of environmental sustainability within the sports sector are rare due to the difficulty of collecting data, the complexity of data, and the lack of a standardized method. This study contributes to the literature in this research's area highlighting a methodological framework for assessing a sporting event with data that can be obtained quickly and with very limited costs. It also allows to identify the activities that have contributed most to the environmental impact so as to be able to outline guidelines that the organization could adopt in order to create future sporting events that may have less impact on the environment. Further analyzes are underway in order to translate the data collected into Carbon Footprint, facilitating comparisons of different sporting events.

PP30C—Decision-making in young athletes: how do sports children adapt to a non-sports uncertain environment?

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Purpose: Physical and sports activities could enhance cognitive function in children and adults (1,2). However, the possibility of improving the high- order cognitive function, such as decision-making, is under debate.

The study aims to fill this gap by testing decision-making processes featuring young open- and closed-skill sports athletes. In addition, fluid intelligence was monitored for its possible effect on these tasks. **Methods:** Thirty-five young high-level athletes (13 Track and Field Athletes [TFA] and 22 football players; M_{age} = 11.03, SD = 1.33y.o.) were recruited.

We involved a perceptual decision task under uncertainty (i.e., low-medium- high uncertainty) where participants had to score as many points as possible. Their performance and decision confidence were analyzed. Two indexes (i.e., Spatial Error (SE) and Gain) evaluated performance. At the same time, implicit decision confidence was assessed through the bet on their decision and through the comparison with an Optimal User Model (SD-Error). Raven- APM(3) assessed fluid intelligence.

Results:

SE was better in low uncertainty compared to medium and high uncertainty. Again, it was better in medium uncertainty compared to high uncertainty. However, nonsignificant differences between the two groups in each level of uncertainty were found. The confounding factor “intelligence” was nonsignificant.

Gain analysis revealed the factor “uncertainty” was significant ($F=97.19$, $p<.001$). The greater the uncertainty, the fewer points gained. Even if the interaction “group x uncertainty” was significant ($F=7.77$, $p<.001$), nonsignificant differences between the two groups in the three uncertainties emerged. The confounding factor “intelligence” was nonsignificant.

Confidence analysis showed that the two groups behaved differently among the three levels of uncertainties ($F=8.42$, $p<.001$). Football players modulated the bet according to uncertainty and bet more points than TFA. SD-E analysis confirmed that football athletes were closer to the optimal model than TFA.

Conclusions: The SE and Gain performance was similar between the groups. However, implicit confidence and SD-Error showed that football players were better at managing the environment than TFA. This discrepancy could be due to the pay-out matrix adopted. Thus, in the subsequent studies, the involvement of different pay-out matrices will help to understand these results better. Furthermore, the recruitment of sedentary children will better understand the effect of sports practice on high-order cognitive processes.

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P31A—A comparison between the percentage and the typology of injuries incurred in artistic and rhythmic gymnastics

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Purpose: In artistic gymnastics athletes need to sustain, for prolonged periods of time, high impact stamina, for which they must possess elevated resistant strength and joint mobility. In rhythmic gymnastics, besides strength, athletes need to be highly flexible. Throughout the competition one wants to intensify their expressive ability as well as the elegance of the technical gesture. The aim of this research is to underline the typical traumas and to compare them.

Methods: The study is based on bibliographic research of scientific texts and articles that deal with studies concerning individuals who practise artistic gymnastics (men's and women's) and rhythmic gymnastics without introducing any kind of filter regarding age, sex or level of preparation. Most of the results concern women's artistic

gymnastics, which is probably due to the higher number of practitioners.

Results: Regarding women's artistic gymnastics it has been revealed that most acute injuries affect the lower part of the body, while chronic injuries involve the lumbar spine region. It has been found that males are more subject to injuries in the upper body, in particular in their shoulder joints. As far as rhythmic gymnastics, the majority of articles examined chronic backaches, while the few studies of acute injuries affirm that the most afflicted areas are the back and lower part of the body. The most frequent type of acute trauma is a sprained ankle. Athletes of these two sports, considered at the same level of competition, injure the same parts of the body but in different ways.

Conclusions: The need to put preventive measures in place to reduce the risk of injury to these gymnasts throughout their athletic careers is evident. Among these should be the improvement in athletic equipment and the development of a more efficient pre-practice warm-up.

Acknowledgments: (non obbligatorio).

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PP31B—The social accountability on educational goal of sports associations as a form of public good on local communities: an exploratory study

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Purpose: The study's aim is to understand stakeholders' perceptions of the educational issues of youth football and the social accountability that youth football, understood as a public good, can produce in local communities, even in extra-sports terms.

Methods: The work is based on a survey conducted through a questionnaire submitted to a sample characterized by 8 presidents and trainers of amateur sports associations in the province of Salerno. The questionnaire consists of two thematic sections: The first one presents 6 items aimed at assessing football's educational and social value and the main critical issues related to it. The second one presents 4 items and assesses the social accountability resulting from the presence of a professional football club participating in the first division championship in a territorial context. The collected data were analysed using Fisher's exact test to check the correlation between the answers given by the respondents

Results: From a first elaboration of the data, it can be said that there is a concordance of opinions between the 2 categories, presidents and trainers, regarding the most relevant educational aspects related to the practice of football, the ways of promoting social inclusion, the contribution that football club makes to the economic development of the territory and the major critical issues involving the youth sector of U.S. Salernitana 1919 even if the p value, being higher than 0.05, does not show significance. However, two significant relationships emerge. The first one is between the question related to the main positive effect related to playing sports, and the second one is related to the main critical issues related to playing football, $p = 0.02$. The second significant relationship was found between the question related to the main educational objectives, to be pursued by the educational project of football academies, and the question of how fair play could be mainly promoted in football academies $p = 0.01$.

Conclusions: These results note the full awareness of stakeholders in the potential positive social effects of the presence of football sports clubs in the territory, even considering the study's sample limitations and the research's territorial goal

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PP31C—The effect of systematic physical intervention in Parkinson's disease: a case report

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Purpose: The aim of this study is to analyze the potential role of systematic physical intervention and to assess the effect on balance, gait and motor performance in a patient with Parkinson's disease.

Methods: A 60-year-old female with 2.0 stage Parkinson's disease in the Hoehn and Yahr scale underwent a physical intervention.

The observation period was divided into two steps: (1) a systematic physical intervention consisting of one hour session three times a week for five months; (2) a neurocognitive movement program consisting of one hour and a half session three times a week for 6 months. The woman underwent an evaluation at the beginning and at the end of the treatment. The balance and the risk of falls were assessed with the Berg Balance Scale (BBS), the mini-Balance Evaluation Systems Test (mini-BESTest) and the Falls Efficacy Scale (FES), while the physical capacity was assessed with the Timed-10-Meter Walk Test.

Results: In BBS, before treatment the patient had a low risk of falling; after treatment the score improved by 12%. In mini-BESTest the score improved by 18% remaining out of the risk of falling. In Timed 10 Meter Walk Test the patient reported a 49% decrease in walking time. In FES, before the treatment the patient has a score below the cut-off and she is able to safely perform certain actions without falling; after the treatment there is a 50% decrease in insecurity in activities and movements.

Conclusions: The data suggest that an individualized motor and neurocognitive treatment plays an important role in the improvement of the quality of their life through the prevention of complications and the reduction of the degree of disability.

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PP32A—A low-intensity home-based exercise program prevents renal function decline in patients with peripheral artery disease and chronic kidney disease and: an observational study

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Purpose: Patients with peripheral artery disease (PAD) may present a significant renal function worsening related to renal artery stiffness. At the same time, patients with chronic kidney disease (CKD) show a considerable risk of PAD increase. In both diseases, exercise therapy is recommended by the guidelines. The aim of this longitudinal observational study is observe at long-time the trend of kidney function parameters in patients with concomitant PAD and CKD at 5-years follow up, whether they were or not exposed to a home-based low-intensity exercise program.

Methods: Within 2013 and 2015 sixty-six patients at KDOQI stages III-IV and PAD at Rutherford's stage I-III were included. Thirty-two patients received a home-based walking program composed of two daily 10-minute interval walking at a weekly increasing speed (Exercise, EX) [1,2]. The remaining 34 patients underwent usual nephrological care (Control, CO). Primary outcome was kidney function, yearly measured with estimated glomerular filtration rate (eGFR) over 5 years. Secondary outcomes included admission to dialysis, all-cause hospitalizations and PAD-related revascularizations.

Results: At baseline the two groups were matched for age, nephropathy, diabetes, comorbidities and PAD severity. In Ex group, eGFR showed almost stable values (Baseline: 29 ± 2 ; 5-year: 26 ± 5 mL/min/1.73 m²), whereas a progressive significant decreasing trend was observed for Co group (baseline: 30 ± 2 ; 5-year 18 ± 3 mL/min/1.73 m²), with a significant between-group difference ($p = 0.002$). In Ex group no patients were admitted to dialysis during the follow up period, instead of five patients of Co group who started dialysis treatment ($p = 0.025$). Co group showed a significant higher risk for both all-cause hospitalizations (hazard ratio: 1.77; 95% CI 1.05–2.97; $p = 0.031$) and lower limbs revascularizations (hazard ratio: 2.59; 95% CI 1.11–6.02; $p = 0.027$).

Conclusions: A home-based low-intensity exercise program was feasible in CKD-PAD patients and effective in preventing the decline of kidney function as well as in promoting long-term clinical outcomes.

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PP32B—evaluation of physical strain of door-to-door waste collection operators. Study protocol

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Purpose: Door-to-Door waste collection system ensures the highest level of differentiation of urban waste. The manual collection operations, have an unfavorable impact on the health of collectors, increasing the number of professional diseases and work accidents. This study wants to investigate the physical effort of Door-to-Door waste collectors during their work shifts from a cardiovascular point of view and aims to implement the actual health safeguarding tools.

Methods: The study group will involve 10–15 healthy male refuse collectors aged 25 to 50. The selected subjects will firstly complete a ramp-like protocol cardiopulmonary exercise test (CPX) for directly measured maximum oxygen consumption (VO_{2max}). Then the subject will be monitored on field, for the duration of an entire shift, with a Polar H10 heart rate monitor. The heart rate recording will monitor the collection itineraries of different types of waste, done by a single operator truck. The work strain will be evaluated through two parameters, both based on the VO₂-HR relationship: ventilatory thresholds overrun and Relative Aerobic Strain (RAS) as % of VO_{2max}.

Results: Evaluation of physical strain through the study of oxygen consumption could provide an indicator of the effort required by a waste collection shift. We expect to categorize itineraries based on the required effort. Any recorded heart rate peak during the shifts will be investigated, and action will possibly be taken to modify or eliminate the causes.

Conclusions: The assessment of the strain could be a valid tool to implement personalized solutions to facilitate a more efficient and safe employment of workers. The work strain assessment could also offer to the enterprises new methodologies to design health protection. Work with high metabolic demand can lead to physical and mental fatigue, increase in work injuries, decrease in work performance, higher risk for cardiovascular diseases and early retirement.

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PP32C—Activity pacing to monitor physical activity in people living with HIV (PLWH) using wearable devices

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Purpose: The aim of this study was to improve fitness and health parameters in PLWH through activity pacing of physical activity monitored by digital devices.

Methods: This was a randomized, open-label, pilot study, in which participants trained using a health band and a dedicated application on their mobile phone (Philips) to record step number and heart rate. The study consisted of an initial 2-week observational phase, followed by a personalised, activity pacing-based 16-week training program. Participants were randomly included either in the Experimental Group (EG), where they had visual feedback of their training parameters via digital devices, or in the Control Group (CG), with no feedback. As primary outcome, we compared between the two groups the proportion of participants with a 18-week improvement from baseline of $\geq 15\%$ of 6MWT performance. Secondary outcomes were improvement from baseline of 6MWT, body composition (body mass index (BMI), fat and fat free mass, waist and hip circumference) and laboratory parameters (total, LDL and HDL cholesterol, triglycerides, glucose, insulin, HOMA-Index, Hb1Ac, leukocytes, haemoglobin, creatinine).

Results: 24 subjects were enrolled and 19 (79%) completed the program (EG = 9; CG = 10). Unfortunately, the great majority of participants experienced major technical issues related to health band/app pairing, data recording or transmission, which prevented to differentiate between EG and CG, and eventually to assess the study outcomes. Indeed, the proportion of participants who improved 6MWT performance of $\geq 15\%$ was similar between groups (33.33% in EG and 40% in CG). Considering the EG and CG as a whole group, we observed a significant improvement in 6MWT performance (median 504.0 vs. 549.0 m, $p = 0.007$) and in total cholesterol (median 188 vs. 186 mg/dL, $p = 0.020$), with no significant changes in the other variables.

Conclusions: Overall, physical activity was followed by improvement of fitness and total blood cholesterol after 18 weeks. However, technical issues did not enable to assess whether use of digital devices could help to improve fitness and health parameters in PLWH by providing direct feedback to participants and guiding activity pacing.

PP33A—Exercise during prehabilitation in breast cancer: a preliminary review

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Purpose: Prehabilitation in oncology describes a process on the continuum of care that occurs between the time of cancer diagnosis and the beginning of acute treatment (Brahmbhatt et al., 2021; Silver & Baima, 2013) in order to increase the ability to cope with the upcoming physiological stress of the specific cancer-related therapy (Palma, 2021). This systematic review aims to evaluate the impact on health-related outcomes of different exercise prehabilitation programs in women diagnosed with breast cancer.

Methods: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist was used for this review. Standard databases (Pubmed and Scopus) were searched for studies published on exercise in breast cancer prehabilitation from their inception to August 1, 2022.

Results: 63 studies were initially identified, and 7 met the inclusion criteria. These studies were characterized by great heterogeneity. Specifically, 5 studies implemented physical exercise alone and 2 studies multimodal intervention. Exercise program duration ranged from 1 week to 70 days. Type of exercise includes resistance training (3 studies), a combination of resistance and aerobic exercise (2 studies), and non-supervised shoulder ROM exercise (2 studies). Outcomes analyzed in the different studies were feasibility measures (such as recruitment rate, adherence, attrition); 2 studies, functional status (shoulder functional status and ROM, handgrip and aerobic

functional capacity); respectively 4 studies and 1, quality of life (anxiety, depression, stress...); 2 studies, biomarkers; 1.

Conclusions: This review shows that exercise programs can have potential health benefits and are feasible and safe to perform in women with breast cancer during prehabilitation period. Certainly, larger randomized controlled trials to underline the potential long-term benefits and the best frequency time volume and intensity of the prehabilitation exercise programs in this population are still necessary.

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PP33B—Dynamic ecological approach (heuristic learning) versus cognitive approach (prescriptive teaching) for improving the fundamental of passing in basketball: pilot study

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Purpose: Cognitive approach aims to consolidate motor patterns through prescriptive teaching; dynamic ecological approach aims to develop contextually appropriate behaviour through heuristic learning. This dual paradigm differentiates linear pedagogy, which is characteristic of cognitive approach, from non-linear pedagogy, which also includes dynamic ecological approach. Teachers/coaches prefer prescriptive teaching in which they can have the learning of their students/athletes under their control; this represents a problem as several studies show. The objective is to measure the effectiveness of the two approaches with specific application of dynamic ecological approach paradigm in basketball teaching in learning a basketball fundamental, given the absence of specific studies.

Methods: 40 students (years 15 ± 0.5) were divided into two groups: first group ($n = 20$) was subjected to a protocol based on the cognitive approach; second group ($n = 20$) was subjected to a protocol based on ecological-dynamic approach. The protocols lasted 6 weeks. The first protocol involved, among other things, the performance of 4 exercises relating to the passing gesture to be repeated for 3 sets and 10 repetitions. The other protocol was divided into 4 phases: circle time was used in the first and last, free warm-up in the second, and in the third phase there was a 5 vs. 5 confrontation with the objective of reaching the basket area through precise passes. The data were acquired by means of AAHPERD Basketball Passing Test. The data were processed with Student's t-test for dependent and independent samples to measure the differences between pre- and post-protocol and to test the differences between the two approaches.

Results: In both groups, there were significant improvements in passage skill ($p < 0.01$), so both protocols are considered effective. The protocol based on dynamic ecological approach showed a greater effect (+ 6.3%). However, no statistically significant differences

between the results of the two protocols used ($p = 0.51$) were revealed by t-test analysis for independent samples.

Conclusions: The study provided positive evidence with respect to the effectiveness of both protocols, greater for the dynamic ecological approach, although it did not show appreciable significance in the latter. Therefore, the study should be expanded and deepened in light of the limitations of the convenience sample recruited and replicated in school contexts.

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PP33C—“Palestra della salute“ on the ground: is exercise prescription virtuous?

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Purpose: Over the past 10 years, physical exercise has been promoted in Emilia Romagna through “Palestra della Salute” (PS), places where people with chronic diseases (CD) can start a structured physical exercise program. Patients can be referred, under medical prescription, to a specific and qualified trainer such as the kinesiologist. However, the literature has shown a limited propensity of doctors to undertake this type of treatment (1) (2) (3). The aim of this study is to describe and to analyze the activity of promoting physical exercise in people with chronic illnesses carried out by the “Esercizio Vita Medical Fitness” PS in the area of Ferrara (Italy).

Methods: The following fitness promotion activities were carried out by the “Esercizio Vita Medical Fitness” PS: a survey to assess doctors' knowledge regarding exercise in people with CD was sent to all general practitioners (GPs) and specialists (MDs) in the Ferrara area; all doctors who replied were then informed about the possibility of prescribing exercise in patients with CD; a supervised walking group and an information campaign on social networks such as Instagram and Facebook were organized by the PS. All accesses to the PS and walking group were then recorded and analyzed by assessing the channel through which the patient was directed to the gym activities.

Results: In 10 months of activity of promotion 296 medical doctors (76% GPs; 24% MDs) were contacted, of which 48 (16%) had replied to our survey (72,9% GPs e 27,1% MDs) of them 38 have participated to our course about prescription of physical exercise in PS. A total of 111 people (M: 37, F: 74) were recruited in the walking group, of whom 56% were on medical prescription. The social media campaign reached an important social interactions through PS website, Facebook and Instagram.

Conclusions: The project that we have begun demonstrate that is possible to introduce to the concept of “healthy training” as a medicine for people with CD. Despite we would like to have more popularity above medical doctors, some of them came to learn about the reality of PS and agreed with the benefits that this type of treatment can offer to people with CD. Activities such as the walking

group and social networking allow a health exercise program to spread across the community.

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PP34A—Boosting physical fitness at home during COVID-19: learning from the past to face the present

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Purpose: the beneficial effects of physical activity (PA) to enhance overall aspects of health and to counteract the detrimental effects of aging process are well documented. To contain the airborne infection, during the COVID-19 pandemic, several restrictions were imposed. Those limitations resulted in lifestyles' changes and increasing in sedentary behaviours with severe health consequences such as reduction in endurance capacity, loss of muscle strength, becoming overweight and the onset of chronic disease, especially in older subjects. As one of the few possible ways to stay active are home-based programs, this study aimed to investigate evidence dealing with the home-based PA programs' effects in older adults, focusing on postural control, fall prevention, mobility, strength and Quality of life (QoL) before and during the COVID-19 pandemic.

Methods: the computer search for English language literature was conducted. Studies assessing home-based PA programs before and during the COVID-19 pandemic outbreak (from January 2004 to November 2021) among older population were included in the review. Keywords included: 'home-based physical activity programs', 'COVID-19', 'quality of life', 'balance and falls', 'mobility', 'strength-resistance training', 'chronic diseases', 'technological device' and 'older adult'.

Results: studies suggested that before COVID-19, multicomponent home-based programs (balance, mobility and strength-resistance) played a key role in preventing and managing chronic diseases in older living. Regarding older living with limitations as hospitalized or long-term care residents, neurological diseases or disability home-based represented a safe way to stay active. During COVID-19 confinement, the proliferation of on-line PA classes with or without the supervision of experts allowed older to carry out regular PA. In particular, multicomponent home-based programs based on balance, and functional exercises resulted in improved QoL, walking speed and mobility and reduce the rate of falls in older adults.

Conclusions: before and during COVID-19, home-based PA programs represented an alternative, effective, enjoyable and new method for apparently healthy older adults, or those with specific chronic diseases, to stay/maintain physically active. Additionally, the use of technological devices as tablets, smartphone and exergames represent the future of health fitness in engaging PA at any time of the day, especially for frail population

PP34B—The execution of the grooved pegboard test in primary school children: an exploratory research

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Purpose: Manual dexterity (MD) is an individual's ability to coordinate the fingers and manipulate objects in a timely manner. It develops from early childhood to adolescence and perfecting is important for improving motor skills, hand function, and eye-hand coordination. However, few studies have investigated MD in children. This study aimed to explore MD in children in dual-tasks (DT) activities by measuring the Grooved Pegboard Test (GPT) performance during a cognitive and motor task. A further aim of the study was to investigate the training effect in the GPT in children.

Methods: A number of 44 children (23 males and 21 females; height: 123.49 ± 7.39 cm; weight: 28.87 ± 8.99 kg) from the first and second grades of a primary school were enrolled for the study. In order to study the presence of a training effect, each participant performed five trials of the GPT with 1-min of rest between trials. Then, the GPT was performed in DT. In detail, each participant carried out two trials of the GPT with an additional secondary task, i.e., one GPT with a cognitive task (Counting Test, CT) and one GPT with a motor task (Finger Tapping Test, FTT). For the first DT trial, the participants during the execution of the GPT had to simultaneously count from zero to ten and then from ten to zero, never stopping, until the board was filled with pegs. For the second DT trial, the participants while performing the GPT had to tap the other hand's index finger against the table repeatedly. All the GPT were performed with the dominant hand and the performances were measured as the time to fill the board with pegs.

Results: Data were not normally distributed. Friedman's test showed a significant difference ($p < 0.0001$) between the five GPT trials (GPT1, GPT2, GPT3, GPT4, GPT5). The Dunnett's multiple comparisons test showed a significant difference between GPT1 and GPT3 ($p < 0.01$), GPT1 and GPT4 ($p < 0.0001$), and GPT1 and GPT5 ($p < 0.0001$). The comparison between GPT5 and GPCT, as well as GPT5 and GPFTT showed no significant differences.

Conclusions: Our results suggest that DT activities does not affect MD performances in children probably because of their high synaptic plasticity or because of the difficult of the additional secondary task. For this reason and considering the lack of studies in the literature, future studies should investigate MD by giving children the GPT with a more difficult DT.

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PP34C—Menstrual irregularities and stress fractures in Italian elite track and field athletes

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Purpose: High level athletes are more likely to develop injuries and hormonal dysfunction: because of the intense mental and physical demand they are exposed to stressors that can cause overuse injuries and menstrual dysfunction. The purpose of this study was to observe the relationship between menstrual irregularities and stress fractures in Italian elite track and field athletes.

Methods: Participants were 100 female high level (national, European, world and Olympic) track and field athletes specialized in jumps, hurdles, sprint, combined event, middle and long distance. They were asked to answer a questionnaire to identify risk of female athlete triad (LEAF-Q), a questionnaire about bone stress injuries and a food diary. According to LEAF-Q scoring, participants were divided into two groups: GRT (athletes at risk of the Triad) and GNRT (athletes not at risk of the Triad).

Results: The 47% of the total sample had at least one stress fracture and the 46% of the total sample has or had menstrual irregularities. There were some differences between groups according to age of menarche ($t_{08} = - 2.67$; $p = < 0.01$) and lowest BMI ($t_{08} = 2.69$; $p = < 0.01$). The GRT had more menstrual irregularities than the GNRT ($\chi^2 = 28.28$; $p = < 0.001$) and there were differences between track and field events in the probability of developing the Triad ($\chi^2 = 18.22$; $p = 0.02$) with a higher probability in long and middle distances. In the GRT there was a significant negative correlation between LEAF-Q scoring and actual BMI ($r = - 0.36$; $p = 0.025$) and lowest BMI ($r = - 0.37$; $p = 0.021$); moreover, a significant positive correlation was observed between age of menarche and number of bone stress injuries ($r = 0.75$; $p = < 0.001$) and multiple linear regression shows the age of menarche as a significant predictor of fractures ($r^2 = 0.56$; $p = < 0.001$) while it does not occur in the GNRT.

Conclusions: The result of the present study suggests that menstrual irregularities and bone stress injuries are common problems in elite athletes. Management strategies should be implemented to detect athletes at high risk of Triad, in order to enable early intervention and avoid injuries.

PP35A—Epidemiology of concussion in youth participants to action sports

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Purpose: Concerns related to susceptibility and concussion recovery in pediatric and adolescent population make it necessary to focus research on young athletes.

The present study examines the epidemiology of concussion in action sports (AS), defined according to Immonen et al¹.

Methods: A systematic review and meta-analysis of medical literature were performed using the standardized guidelines proposed by Harris et al.², the guidelines MOOSE³, and the PRISMA checklist⁴. A

protocol addressing the PICOS criteria was preliminarily registered to the PROSPERO system⁵. We included studies.

involving at least ten subjects, which aimed to study the incidence of injuries in youth athletes involved in AS. Meta-analysis was limited to studies reporting days of athletic exposure (DAEs) and conducted adopting the Der Simonian and Laird random-effects model. We calculated a pooled estimation of the incidence rates relative to single sports and the overall incidence of concussion across the discussed ASs. We generated a forest plot and calculated both Q and I² statistics. The software JASP 0.13.1 (significance: $p < 0.05$) was used.

Results: The selected studies were relative to seven sports: alpine skiing ($n = 10$), freestyle skiing ($n = 2$), snowboarding ($n = 12$), motocross ($n = 2$), dinghy sailing ($n = 1$), sliding sports ($n = 2$), skating sports ($n = 1$). Regarding the methodological quality, we have to report that 26.3% of the studies reported the definition of concussion while 36.8% presented age and gender-specific incidence rates. The pooled incidence of concussion per 1000 DAEs (8 sports/13 studies) was 0.33(95% CI 0.22–0.45); Q statistic: $p < 0.001$. The incidence of concussion ($\times 1000$ DAE) ranged from 0.30 in skiing to 39.22 in motocross.

Conclusions: The results of this study may help youth AS participants, their coaches and families to become aware of the concussion risk. They can also be used to steer future safety research and allow participants and governing bodies to develop relevant sport-specific safety policies concerning training, event organization, protective clothing, equipment, and other safety systems. Moreover, the awareness of the concussion risk in AS may improve concussion diagnosis, which is crucial because youth athlete is more susceptible to concussion and takes more time to recover. The main limitation of this study is the heterogeneity in the overall concussion estimate across the sports. It stems from differences between sports, the designs of the studies, and the different sources of data used as the denominator.

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PP35B—Life and soft skills related to physical-motor education in the national indications for the primary school curriculum for the integration of competence development goals

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Purpose: Physical-motor education (PME) can be a useful tool to promote life and soft skills in the school context (formal learning environments) in the same way as in competitive activities and sports promotion. Although these are recognized as important competences for the individual, seeing the key competences deliberated by the European Parliament in 2006 and 2018, there is currently no reference in the National Curriculum Indications for PME. The aim of the study was to present a brief review of studies concerning the effectiveness of PME activities to develop life and soft skills in primary school in the light of the introduction of the compulsory two hours a week of physical education by graduates in motor sciences.

Methods: The method was the literature review of specific studies on life and soft skills related to PME activities and the key competences.

Results: The table, containing scientific articles, topic, key competences and, lastly, life and soft skills, showed us that PME was found to be a discipline that promotes these skills.

Conclusions: Consequently, it would be useful to revise the National Indications that outline the aims for the development of competences and learning objectives of PME, adding the more specific part inherent to motor education, considering the systemic use of the motor sciences specialist teacher.

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PP35C—Functional assessment of muscle strength parameters after total knee arthroplasty with modified mechanical alignment technique

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Purpose: The total knee arthroplasty is the main treatment for the severe Arthrosis. Post-operative rehabilitation protocols are often too short and not focused on a complete functional recovery. This study aimed at monitoring the recovery of the muscle strength parameters of the main muscles of the lower limb in patients with a total knee arthroplasty with the modified mechanical alignment technique (TKAMA). **Methods:** 18 male subjects who had undergone TKAMA and who did not have a symptomatic arthrosis in the contralateral limb (age: 70aa±4aa; weight: 72Kg±11Kg) were selected. The protocol included isometric dynamography tests of the adductor muscles (ADD); abductor muscles (ABD); quadriceps on leg press (QUAD_CKC); quadriceps on leg extension (QUAD_OKC). The parameters of maximum voluntary isometric force (MVIF) and the rate of force development at 30, 50 and 90% of MVIF (RFD30; RFD50; RFD90) were assessed. The tests were performed at 3 and 6 months post surgery (3PS – 6PS). Patients followed a standard rehabilitation protocol until 3 months and then followed a functional training protocol until 6 months. For each variable, the values of the operated limb were compared to the uninvolved limb at 3PS and 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 ($p < 0.05$).

Results: The results show a statistically significant difference in all parameters investigated for the QUAD_CKC and QUAD_OKC tests performed at 3PS and for the QUAD_OKC test carried out at 6PS. The Side-to-side asymmetries are as follows: QUAD_CKC test at 3PS (MVIF: – 32%; RFD30: – 25%; RFD50: – 20% RFD90: – 25%); QUAD_OKC test at 3PS (MVIF: – 28%; RFD30: – 45%; RFD50: – 50% RFD90: – 28%); QUAD_OKC at 6PS (MVIF: – 15%; RFD30: – 27%; RFD50: – 25% RFD90: – 10%).

Conclusions: The results suggest that the quadriceps muscle strength have a critical role in the recovery process after TKAMA and that it can be improved up to six months post-surgery by a specific functional training program. Furthermore, the closed kinetic chain test may not highlight the persistence of deficits affecting the quadriceps that are more evident in the open kinetic chain test. The high Side-to-

side asymmetries for the RFD at 6PS could predict functional difficulties in daily activities. So the exercises for its improvement should also be taken into account in the functional recovery programmes.

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PP36A—What method could be used to monitor the performance of football players after the game? The example of creatine kinase (CK)

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Purpose: The recovery strategies, in football, as in many other sports, are increasing due to the higher number of matches in comparison with the past [Dupuy; Khaitin]. The football, recovery strategies can be divided into active and passive. The difference between them was that in the active methods the staff should decide how to differentiate the player's work based on hormonal/inflammatory parameters. The aim of this study is to explore the changing of levels of creatine kinase (CK) parameters after 24 h and 48 h post matches in football players. **Methods:** The group enrolled performed from 6 to 7 training sessions per week in addition to the official matches. The CK were acquired in 5 football players in 5 matches after 24 h and 48 h post activity. Data were collected before training as soon as the player will arrive at the training center. The variables collected were summarized through mean and standard deviation but also as median and interquartile range (IQR). Non parametric tests for paired data (e.g. Wilcoxon test) will be implemented to analyze differences in all the parameters collected.

Results: The sample of football players had a mean age and standard deviation of 28.00 years \pm 1.34 and median of 29 years IQR [27–29 years], mean weight of 79.00 \pm 10.10 kg and mean height of 182.00 \pm 6.68 cm. Other data on CK are actually under the phase of quality control.

Conclusions: The importance of studying CK after matches, as a possible biomarker of stress and inflammation, would lead to using it as a main parameter in sports recovery strategies as it is objective and, in this context, is easy to collect. Finally, this methodology could be used, if will give relevant results, to better plan the weekly planning of the players' training: for example, it can be used to find the correct training load for each player.

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PP36B—Effect of storytelling and enrichment physical activity in preschool children cognitive and motor development

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Purpose: Physical activity (PA) plays an important role in holistic development of children. The improvement of the muscular qualities will be reflected in motor coordination (MC), and in executive functions (EF). The goal of the study is to evaluate the effects of three models of PA on the motor and cognitive capacity of children.

Methods: 36 children from kindergarten (4.47 \pm 0.56 y.) of both sexes ($f = 20$) were involved in the experimental study. The Test Gross Motor Development 3rd Edition (TGMD-3) and the Trails-P test for cognitive assessment were administered before and after. Three types of intervention randomly were assigned to the children of the classes: (1) Standard PA (SPA), (2) Enriched PA (ENR), (3) Storytelling PA (STT). The trial lasted 8 weeks for once a week.

Results

Descriptive statistics and 1-way ANOVA were carried out, to highlight the significant differences ($p < 0.05$) among groups. TGMD-3 raw score increased in all groups at the end of the intervention: SPA(MC pre = 65.53 \pm 6.4, post = 71.42 \pm 8.37; $p = 0.011$) and ENR(MC pre = 66.88 \pm 6.93, post = 75.21 \pm 4.90; $p = 0.001$) STT(MCpre = 60.05 \pm 12.37, post = 70.35 \pm 7.89, $p = 0.001$). Pre-post delta analyses in groups shows greatest improvement in ENR(8,33). 1-way between-groups One-way ANOVA revealed NS difference in all cases (SPA – ENR $p = 0.495$; SPA – STT $p = 0.519$; ENR – STT $p = 0.645$). NS difference between-groups at baseline. Trails-p pre-post (time, s) significantly decreased in all group: respectively (SPA pre = 198.42 \pm 88.52, post = 139.95 \pm 39.03, $p = 0.003$; ENR pre = 237.61 \pm 127.18, post = 160.94 \pm 61.38, $p = 0.004$; STT pre = 233.80 \pm 74.02, post = 179.20 \pm 44.60, $p = 0.005$). Pre-post delta analyses in groups shows improvement in ENR(76,67). NS differences between SPA (139.95 s)—ENR(160.94 s, $p = 0.165$) and STT(179.20 s)—ENR($p = 0.207$), but only between SPA – STT ($p = 0.016$)

Conclusions: Starting from preschool, adequately planned PA leads to benefits, both at the motor and cognitive levels. This advantage seems to be reflected in motor skills for EF. A quality PA such as ENR can lead to more significant benefits, demonstrating that more is time involved in PA oriented towards EF involvement better is the results than a PA interspersed with storytelling.

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PP36C—Evaluation of postural stability and proprioception in subjects before and after total ankle replacement

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Purpose: Ankle osteoarthritis is a debilitating condition, which includes balance impairment, range of movements limitations and a consequence increased risk of falls. Conservative management is the first approach but for severe ankle osteoarthritis, total ankle replacement (TAR) should be taken into account. The aim of this study is to measure postural control and proprioception in subjects with primary TAR, before and nine months after the surgery.

Methods: A total of 17 subjects (12 male and 5 Female) aged 59.29 ± 10.83 years (body mass index = 28.20 ± 2.45 kg/m²) with ankle osteoarthritis admitted in the Istituto Ortopedico Rizzoli waiting for a TAR were recruited. Delos Postural Proprioceptive System (Delos S.r.l, Turin, Italy) was used to assess postural control and proprioception. All subjects performed the Static Riva test, which consists of maintaining a single leg stance with open and closed eyes (OE; CE). The parameter considered is the Stability Index (SI) which is a percentage score where 100% is a theoretical task performed with maximum stability.

Results: The SI of the operated limb decreased from $68.22\% \pm 18.65$ to $60.93\% \pm 18.86$ with opened eyes ($p = 0.16$) and from $37.09\% \pm 14.14$ to $34.24\% \pm 10.17$ with closed eyes ($p = 0.37$). The SI of the contralateral limb slightly decreased from $87.51\% \pm 4.10$ to $86.75\% \pm 6.03$ with opened eyes ($p = 0.53$) and from $53.19\% \pm 16.58$ to $52.16\% \pm 13.89$ with closed eyes ($p = 0.67$). Considering all tasks, the operated limb has significant lower results than the contralateral ($p < 0.001$). There is a strong correlation between the open and closed eyes results in the operated limb both before ($r = 0.79$; $p < 0.001$) and after surgery ($r = 0.63$; $p < 0.01$). Same correlations were found in the contralateral limb. Age and BMI did not influence the SI.

Conclusions: The static Riva test is an indicator of postural stability (open eyes) and proprioception (closed eyes). Subjects showed a consistent difference between limbs in all tests; therefore, we suppose that postural stability and proprioception are strongly influenced in a severe ankle osteoarthritis condition and 9 months after TAR is not enough to restore them.

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PP37A—Physical activity influence on cancer survivors' quality of life: a pilot investigation within the EU-4health oaccus project

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Purpose: Physical activity (PA) has been indicated by scientific research as one of the most powerful complementary approaches, to reduce the adverse effects and symptoms impacting Quality of Life (QoL) in cancer patients and survivors. The current study aims to compare QoL in healthy adults and cancer survivors, hypothesizing that cancer survivors would experience more benefits from PA than healthy people.

Methods: A short survey from OACCUs Project was run on 165 participants, of which 14 ones were cancer survivors. Therefore, a randomized sampling was performed, to create two equivalent samples. Therefore, the study was conducted on a final sample of 28 participants. Cancer survivors had different types of cancer (skin cancer, breast cancer, multiple myeloma, neuroendocrinal cancer, uterus cancer). A 2 (cancer vs. healthy) \times 2 (exercise yes vs. no) \times 3 (physical functioning vs. general health vs. role limitation due to emotional problems) was performed.

Results: The results indicate a significant difference in physical functioning between people exercising and not exercising (physical functioning, $F_{1,20} = 4.17$, $p = 0.05$), as well as healthy people and cancer survivors (physical functioning: $F_{1,20} = 30.21$, $p < 0.001$). A significant interaction between QoL and physical exercise emerged (physical functioning: $F_{1,20} = 4.75$, $p = 0.04$; general health, $F_{1,20} = 4.48$, $p = 0.04$; role limitation, $F_{1,20} = 4.29$, $p = 0.05$) indicating that cancer survivors exercising every week reported higher quality of life compared to sedentary cancer survivors and sedentary healthy people.

Conclusions: The current research will be conducted with a bigger sample to understand the minimum amount of PA for cancer survivors necessary to improve their QoL.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP37B—The effect of COVID-19 restrictions on motor skills and physical fitness in school-aged children

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Purpose: Covid-19 pandemic, along with the endemic lack of motor stimulation and progressively increasing rates of childhood obesity, has led to a drastic reduction in children's physical activity level, which resulted in psychological distress, increased risk of developing cardiovascular and metabolic diseases, and increased risk of mortality for children. For these reasons, our aim is to assess the pandemic's influence on the motor skills of school-age children by administering a series of physical tests on a group of children aged 8 to 11 years.

Methods: We recruited two groups of a total of 141 Caucasian children (68 female; 8–11 years old) in the same school in Northern Italy, near Milan. One group consisted of 72 children (35 female) that were tested in 2018, before COVID-19 pandemic, while the second group consisted of 69 children (33 female) tested in 2021 after COVID-19 pandemic. The tests conducted were standing broad jump (SBJ), 7 m Hop One Foot, 7 m Jump Two Legs, 10 × 5 m Shuttle Run, 20 m sprint, Medicine Ball Throwing 1 KG, Tennis Ball Throws and Catches. A t-test for independent samples was used to assess the differences between tests conducted in 2018 and 2021.

Results: Comparison of lower limbs strength tests revealed a decrease for both sexes in both the SBJ test (Boys: $p < 0.001$; Girls: $p < 0.001$) and the 7 m hop one foot (Boys: $p < 0.001$; Girls: $p < 0.001$), while in the 7 m jump two legs test there was a decline only for males (Boys: $p < 0.001$; Girls: $p = 0.13$). Results in running tests showed an increase in running time in the 10 × 5 m shuttle run for both sexes ($p < 0.01$), while no differences were found in the 20 m sprint ($p > 0.05$). No differences were found also in the upper limb strength tests in both sexes ($p > 0.05$).

Conclusions: Our results showed that the COVID-19 pandemic and its restriction affected the lower limbs' strength, speed-agility and coordination of school-aged children in Italy. These results could be a starting point for trainers to improve motor skills that have worsened in recent years due to the COVID-19 pandemic and improve children's lifestyles and health.

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PP37C—Workplace wellness: an observational study on the mutual associations between physical activity, musculoskeletal disorders, burnout and work performance

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Purpose: Poor cardiorespiratory fitness and insufficient physical activity (PA) are well-known risk factors for negative physical and psychological health outcomes, compromising adult work performance. Cardiovascular diseases, musculoskeletal disorders, and depression-related illnesses are among the costliest conditions affecting employees. This observational study aimed to explore the associations between PA, musculoskeletal disorders (MSD), burnout, and work performance in a sample of Italian white-collar workers.

Methods: An online survey was sent to the employees of three companies who volunteered to participate. The survey included: PA habits questions (frequency/duration); the Cornell musculoskeletal questionnaire; the Maslach Burnout Inventory (MBI), with three subscales; the Utrecht Work Engagement Scale (UWES) and the WHO Health and Performance Questionnaire (HPQ). Respondents were classified as “not meeting”, “meeting”, and “overcoming” PA guidelines, according to the WHO's recommendations. A multivariate analysis of variance was performed, with MSD, MBI, UWES, and HPQ as dependent variables, and the PA category as a fixed factor. Pearson's correlations were used to test associations between variables.

Results: 615 employees (M = 452; F = 163; Age: 42.2 ± 9.5 years) responded to the survey; 227 (36.7%) resulted in not meeting, 117

(19.0%) meeting, and 271 (44.1%) overcoming PA guidelines. Univariate results showed a significant protective effect of PA on MSD in neck and low-back ($p < 0.01$) and emotional exhaustion ($p < 0.01$), while exerting a positive effect on UWES ($p < 0.01$) and personal accomplishment ($p < 0.01$). Absolute work performance (worker's self-evaluation) was directly associated with work engagement ($r = 0.43$) and personal accomplishment ($r = 0.35$), while inversely associated with emotional exhaustion ($r = -0.26$) and depersonalization ($r = -0.27$).

Conclusions: PA practice seems to exert a positive effect on both physical and psychological health. Despite not showing a direct link with work performance, PA might exert a positive function by enhancing work-related psychological health among adult white-collar workers.

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PP38A—Exploring physical activity levels and barriers to physical activity among adults with type 1 diabetes mellitus

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Purpose: despite the positive effects of Physical Activity (PA), people with Type 1 Diabetes Mellitus (T1DM) showed higher rates of inactivity compared to those found in the general population. Our aims were to examine PA levels and to identify perceived barriers for the practice of PA among adults with T1DM.

Methods: 151 adults (18–65 years old—mean age 38 years, SD = 14; 53.6% of women; average time from diagnosis 22 years, SD = 13) with diagnosis of T1DM for greater than 1 year filled out the survey. The *Barriers to Physical Activity in Diabetes type 1* (BAPAD1; Dubé et al., 2006) was used to assess the perceived limitations to PA and the *Global Physical Activity Questionnaire* (GPAQ; Bull et al., 2009) to measure the levels of PA (physically active/inactive people) and sedentary time (not sedentary/sedentary people). Data were treated through descriptive analyses, measure of internal consistency and one-way ANCOVA, controlling for age, gender and time from diagnosis.

Results: 37.1% (n = 56) of participants resulted inactive (< 600 MET-minutes/week) and 36.4% (n = 55) sedentary (≥ 7 h/day spent in sedentary activities). The internal consistency of the BAPAD1, measured with Cronbach's alpha was 0.895. The mean score of the BAPAD1 was 2.6 points (SD = 1.3). The highest barrier scores were: fear of hypoglycemia (3.1 points, SD = 2.1), loss of control over diabetes (3.0 points, SD = 1.9) and low fitness level (2.8 points, SD = 1.9). As determined by the one-way ANCOVA ($F(1,90) = 3.90$; $p = 0.051$, $\eta^2 = 0.042$), the subgroup of participants found to be both Physically inactive and sedentary (3.0 points, SD = 1.3) perceived higher PA barriers compared to those Physically active and not sedentary (2.4 points, SD = 1.3).

Conclusions: from a practical perspective and in the day-to-day life of adults with a

chronic disease such as T1DM, removing key perceived barriers to PA and providing additional support/guidance for safe participation in PA may prove to be effective approaches to increase PA levels.

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PP38B—Effects of sport practice on children's coordinative abilities development

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Purpose: To assess whether the practice of different sports may affect children's coordinative abilities development.

Methods: A total of 95 children aged 11–12 years were involved in the study and were divided into 4 groups in relation to the sport they practiced: control group (n = 15), sports games with balls group (n = 38), cyclical endurance sports group (n = 18), technical-combinatorial sports group (n = 24). The four sub-tests of the Hirtz' battery assessed kinesthetic discrimination and response orientation abilities before and after 5 months of the specific sport training. Specifically, the backwards ball throw test was used to assess upper limb kinesthetic discrimination ability, the low jump test to assess lower limb kinesthetic discrimination ability, the hanging target throw test to assess upper limb response orientation ability and the orientation shuttle run test to assess lower limb response orientation ability.

Results: Upper and lower limbs orientation abilities significantly improved after the training period (4.0 ± 3.1 score vs 5.4 ± 3.0 score, $p = 0.0001$, pre vs post) (10.3 ± 1.4 s vs 9.2 ± 1.5 s, $p < 0.0001$, pre vs post), regardless of sports typology. Technical-combinatorial sports group showed significant lower scores of upper limb orientation ability test than the other three groups (technical-combinatorial sports group 2.8 ± 2.4 score vs control group 4.7 ± 3.5 score vs sports games with balls group 5.9 ± 2.8 score vs cyclical endurance sports group 4.8 ± 3.3 score, $p = 0.0002$, respectively). Moreover, technical-combinatorial sports group showed significant lower scores of lower limb orientation ability test than the other three groups (technical-combinatorial sports group 10.5 ± 1.4 s vs control group 9.8 ± 1.5 s vs sports games with balls group 9.3 ± 1.6 s vs cyclical endurance sports group 9.8 ± 1.3 s, $p = 0.0002$, respectively).

Conclusions: The technical specialization due to specific sports training affected the development of some coordinative abilities.

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PP38C—“Fitness and fatness” in children and adolescents: an italian cross-sectional study

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Purpose: Physical activity and physical fitness could counteract short and long-term health complications typical of childhood obesity, thereby improving the general health status.

Children with obesity have difficulties to maintain a healthy lifestyle because of several alteration that limit physical activity (PA) practice with a consequent worsening of quality of life compared to non-obese peers. Fitness and fatness are inversely related, in fact aerobic fitness levels are lower among children with obesity, because exercise results more difficult, and then inactivity hinders motor tasks performance and sport activities practice. Therefore, the present study aimed to investigate several components of fitness and their relationship with the degree of fatness in children.

Methods: 485 Caucasian children participated in the study (223 girls). The mean age of the sample was 9.5 ± 1.12 years. According to BMI z-score WHO classification, children were divided into three groups: underweight (UW; BMI-z score < -2), normal weight (NW; $-2 \leq$ BMI-z score ≤ 1 and overweight/obese when BMI-z score $> 1/2$ (OB). PF was assessed by the 9-item test battery designed to measure explosive power, leg muscle power, arm muscle power, upper body power, coordination, agility, speed and endurance. To determine possible relationship between markers of body fatness and physical fitness tests, a Pearson correlational analysis was performed. All quantitative data were summarized as mean and standard deviation (SD) and as median and IQR.

Results: A total of 471 Caucasian children (215 girls; 9.5 ± 1.12 years) completed the study. The relationship between anthropometrics' characteristics and physical fitness tests showed that weight and fat mass had high level of correlation with different physical fitness tests. In particular, OB children tend to show a low PF except for upper body power and explosive power (pushing medicine ball and standing broad jump). Conversely, UW children exhibited poor performance as per musculoskeletal power strength and explosive strength. Instead, the speed performances resulted to be greater in OB than in UW children.

Conclusions: In conclusion the present research has determined the importance of investigating the degree of fatness in relation with different components of fitness, in children and adolescents. This simple combination of proxies may cover an unexpectedly helpful screening of the youth population, for both health and performance.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP39A—Skinny fat: predicting body fatness in adolescents

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Purpose: The aim of this study was to improve body fatness estimation in adolescents by means of machine learning and a new anthropometric index. In particular, we wanted to assess whether it was possible to identify the large number of normal weight and overfat individuals (false negatives) that are commonly misclassified adopting the body mass index (BMI) alone in order to predict overfatness.

Methods: Anthropometric and demographic data about a large sample of adolescents were collected. Some traditional proxies for the estimation of body fat, like BMI, were subsequently calculated. All individuals were then classified as positive (fat) or negative (not fat) by means of the skinfold method. Some common machine learning algorithms were applied to the cleaned data, and classification performances were assessed by means of standard metrics.

Results: Machine learning improved prediction performances compared to base line classification using the most common index of body fatness.

Conclusions: BMI alone can be a misleading proxy for body fatness, at least in the adolescents age group, where a large percentage of false negatives is present. Machine learning can improve the prediction of overfatness, diminishing the rate of false negatives.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP39B—The positive effects of using music during athletic activity

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Purpose: The use of music has always been an integral and characteristic element of human life, serving both as sound accompaniment in the execution of the simplest and most common everyday actions and as motivational support during athletic activities. The aim of this study is to highlight the advantages that one gains in performing motor tasks when listening to music.

Methods: The study is based on bibliographic research of scientific texts and articles in which the positive effects on motor tasks achieved from listening to music are analyzed. These results act on both a psychological as well as a physiological level. The use of musical accompaniment is treated in three phases that make up both a practice session and a competition (“pre-task,” “in-task” and “post-task”).

Results: Utilized as a technique for research on concentration and psycho-physical balance before a sporting event, listening to music has highlighted how, as an auditory stimulus, it is able to facilitate the athlete in maintaining their state of concentration, in raising the evaluation of oneself and one’s control of emotions and thoughts. In the “in-task” phase, among the main effects created by sound stimulus on the quality of the performance, we find a reduction in the perception of fatigue, an increase in the athlete’s concentration compared to the motor task, an improvement in intersegmental coordination and a better degree of ability in dealing with levels of stress and anxiety.

Conclusions: The validity of music in the execution of physical exercise has been demonstrated by a large quantity of scientific evidence, thus bringing to light the positive variations of the psycho-physiological parameters of the athlete. The individual, thanks to the presence of sound stimulus during sports, is able to stay focused on carrying out the physical demands, diverting one’s attention from the perception of fatigue.

Acknowledgments: (non obbligatorio).

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PP39C—“The relationship between active mobility and mental health—a systematic review”

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Purpose: Evidence shows that Active Mobility (AM), defined as “walking and cycling for transport solely or in combination with public transport” (1), has a positive influence on physical health as it increases physical activity levels (2). However, its psychological effects are much less studied, even though both aspects of health are important. The objective of this review is to identify studies that have focused on the effects of AM on different mental health outcomes, to summarise what if anything has been learned, and to highlight possible future research objectives.

Methods: A Systematic Literature Review was conducted using data sources including PubMed, ProQuest, Web of Science, and Scopus. Inclusion criteria were:

primary studies

use of the English language

adult study sample

AM (defined as active means of travel/transport) as an exposure mental health factors as outcomes (depression, anxiety, self-esteem, stress, psychological well-being, subjective well-being, resilience, loneliness, quality of life, mood, brain health, life satisfaction, and sleep).

Results: The results from these studies are mixed and inconsistent, mainly due to the considerable variety of designs, definitions and measures used. A total of 52 documents were identified as relevant: 5 longitudinal, 2 quasi-experimental, 4 RCTs and 1 experimental study. We also identified 38 cross-sectional studies in this review. A total of approximately 23 outcome instruments were assessed (and multiple items created ad hoc based on the psychological literature), and seven groups of potential confounding factors (mainly sociodemographic). The experimental study showed that mental health improved in those people who used more active modes, compared to those who used motorised vehicles. Despite this, one RCT found that there were no differences between the intervention and control group when measuring the quality of life after a 3-months intervention programme.

Conclusions: The relationship between active mobility and mental health in adults is not yet clear. Future research is necessary on this topic in order to create a unified methodology to measure this relationship, obtain solid results and encourage the policymakers to build cities that facilitate active travel as a public health strategy.

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PP40A—Self-reported physical activity level, emotions, feelings and self-perception of older active woman: is the water-based exercise a better enhancer of psychophysical condition?

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Purpose: There is evidence that aquatic exercise programs can enhance the cardiovascular system, increase muscular strength, decrease body fat, and improve functional fitness and quality of life in older people. With aging also well-being and quality of life are enhanced by exercise but there is limited evidence on aquatic exercise efficacy. Indeed, the purpose of this study was to determine the effects of a supervised water fitness program on perceived well-being in older women.

Methods: The study group included 200 older women aged over 65 years. Participants were asked to fill out three questionnaires of multiple features to assess their amount of physical activity (PA) through the IPAQ-SF, subjective well-being through the Positive and Negative Affect Schedule (PANAS) and life quality related to mental and physical health status through the Short Form of health status questionnaire (SF-12). To assess the differences of IPAQ-SF, PANAS and SF12 between the two groups, Water fitness group (WFG) and Control group (CG), a Welch's T-Test was used.

Results: Our results showed differences in the amount of METs per week ($p < 0.001$) and METs of Vigorous activities ($p < 0.001$). The analysis did not show any differences in the METs of Moderate activities and the METs of Walking activities between the WFG and the CG. Results showed that PANAS positive ($p < 0.001$), PCS-12 ($p < 0.001$) and MCS-12 ($p < 0.001$) have higher values in the WFG compared to the CG, while PANAS negative has lower values in WFG compared to CG ($p < 0.001$).

Conclusions: In conclusion, since physical and mental conditions are at the base of elderly autonomy and well-being, we found that elderly active women practicing water fitness tend to have a better level of self-reported physical fitness and self-perception, and they also feel better than those who exercise in a land-based context. Considering the relevance of PA in this age for health reasons, water-based exercise should be promoted with adapted programs in our communities.

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PP40B—Key competences, social and motor skills of individual sports activities in primary school

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Purpose: The compulsory 2 h per week of movement education (ME) teaching in classes IV and V of primary school by specialists with a master's degree in sports sciences represents an opportunity to raise the levels of health, physical wellbeing as well as sports and social skills outlined in the National Curriculum Guidelines (NCG) for Primary School. However, as there is no reference in the section on competence development goals to what the European Parliament has called for in terms of key competences, there is a need for a study that elaborates on the scientific evidence regarding the transversal and interdisciplinary effectiveness of ME and Physical Education (PE). The aim is to connect educational and social objectives with key competences, indicating among these specific ones to finalise the scientific framework of the positive effects of ME, PE and sport. The study aims to extend the current scientific theoretical framework to the possible declination in NCG of the development goals extended to those key competences that can be developed through EM and individual sports.

Methods: An archive search of official and professional documents was conducted, extrapolating from the thematic nuclei of NCG for primary school those methodological elements that contribute to achieving the specific educational objective, the improvement of motor skills related to individual sports games and finally, to the social skills of key competences, with scientific elaborations that take into account the most up-to-date evidence.

Results: The analysis showed that the key competences that can be developed through individual sports are personal, social and learning to learn competence and Entrepreneurship competence. Individual cyclic sports that have a greater impact on personal, social and learning to learn competence include some athletics disciplines (running and walking) and swimming, as they promote physical and emotional wellbeing, the ability to cope with uncertainty by reflecting on oneself, and the effective management of time and information. Among the acyclic individual sports, on the other hand, tennis, boxing and fencing enable the development of entrepreneurship competence as they foster strategic thinking and problem solving, critical and constructive reflection.

Conclusions: In order to decline the 2 key competences in the NCG, different educational practices involving the use of new technologies, such as watching videos or tutorials, could be adopted for the generalist part of PE. The aim is to minimise verbal information, using other types of feedback, and allow pupils to explore and self-regulate. On the other hand, for the specialised part of the ME is necessary to offer stimulating contexts, unconstrained by external prescriptions, that foster the emergence of social skills and motor executive patterns freely produced in the environment to find adaptation.

PP40C—Anthropometric profile of youth soccer goalkeepers after the COVID-19 pandemic, according to the maturity offset

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Purpose: to investigate the anthropometric profile of young soccer goalkeepers in relation to the maturity offset after the COVID-19 pandemic.

Methods: Forty-two young male goalkeepers took part in the study. Body mass, height, sitting height, and waist circumference (WC) were measured to calculate body mass index (BMI), waist to height ratio (W/Hr), fat mass (FM), fat mass percentage (%FM), fat mass index (FMI), fat-free mass index (FFMI), and peak height velocity (PHV).

Participants were classified as pre-PHV ($n = 16$, age = 11.31 ± 0.94), circa- PHV ($n = 7$, age = 13.27 ± 1.02) and post-PHV ($n = 19$, age = 16.86 ± 2.00). The 85th BMI and 90th FM percentile were used to classify participants as overweight/obese, while the 90th WC percentile to identify abdominal obesity.

Results: the %FM was significantly different between groups and decreased from pre- to post-PHV groups (18.56 ± 0.92 , 16.99 ± 1.14 , 13.86 ± 1.66 , respectively; $p < 0.001$). Furthermore, BMI, FM, and FFMI significantly differed between pre-PHV vs. post-PHV groups (19.44 ± 2.93 vs. 22.34 ± 2.41 , $p = 0.017$; 8.30 ± 1.74 vs. 9.96 ± 1.40 , $p = 0.012$; 15.83 ± 2.33 vs. 19.25 ± 2.13 , $p < 0.001$, respectively). The WC was significantly different between pre-PHV vs. circa-PHV and post-PHV groups (66.26 ± 5.98 vs. 73.40 ± 8.66 and 76.39 ± 5.48 , $p < 0.001$). The FMI was significantly different between circa-PHV vs. post-PHV (3.71 ± 0.91 vs. 3.09 ± 0.48 , $p = 0.023$) and pre-PHV vs. post-PHV groups (3.62 ± 0.63 vs. 3.09 ± 0.48 , $p = 0.023$). The pre- PHV goalkeepers were significantly more likely to be overweight/obese than circa- and post-PHV goalkeepers ($n = 16$, $n = 7$, $n = 10$, respectively; $p < 0.001$). Compared with a similar sample assessed before the COVID-19 pandemic (Di Credico et al., 2020), the pre-PHV group showed a lower W/Hr (0.44 ± 0.04 vs. 0.46 ± 0.05 , $p = 0.014$) and the post-PHV group a higher WC (76.39 ± 5.48 vs. 74.09 ± 4.47 , $p = 0.036$). Furthermore, the pre-PHV group showed a higher prevalence of children at abdominal obesity risk (62.5% vs. 33.3%) compared with previously published data.

Conclusions: The current study shows a relationship between the maturity offset and goalkeepers' anthropometric profile. The COVID-19 pandemic seemed to affect the abdominal obesity risk of pre_PHV children, whereas the effect on other anthropometric variables is less clear.

Reference: Di Credico et al., 2020. <https://doi.org/10.3390/ijerph17218247>.

PP41A—Trends in means and distributional characteristics of cardiorespiratory endurance performance for Italian children (1984–2010)

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Purpose: Cardiorespiratory endurance (CRE) is the ability to perform continuous, rhythmic, large-muscle, whole-body physical activity, and is considered an important marker of current health and a predictor of future health. Since it's important for health, temporal trends in CRE should reflect corresponding trends in population health and assist with promoting and evaluating public health policies. For this reason, the aim of this study was to examine temporal trends of CRE performance for Italian children between 1984 and 2010.

Methods: A total of 5303 children aged 11–13 years from a single Northern Italian middle-high school were tested across the 1984–2010 period. CRE was measured as 1000-m and 12-min run test performance, while the Body mass Index was calculated to assess the anthropometric trends. Temporal trends in means were estimated

using linear regression, and analysis was stratified into separate test-gender groups (e.g., boys tested on the 1000-m run).

Results: We found small to moderate declines in mean 1000-m running speed (trend: -0.13 m/s) and mean 12-min running speed (trend: -0.19 m/s). There were small to moderate temporal differences between boys and girls, with moderate to large declines for boys (trend: 1000-m, -0.59 m/s; 12-min, -0.89 m/s) and negligible to small declines for girls (trend: 1000-m, -0.08 m/s; 12-min, -0.40 m/s). There was also a small increase in BMI (trend: $+1.5$ kg/m² over the entire period).

Conclusions: In conclusion, we found declines in mean CRE performance for 11-to 13-year-old Italian children which are suggestive of corresponding declines in construct CRE and population health. Such trends were probably influenced by declines in vigorous physical activity levels and increases in sedentary behaviors.

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PP41B—An exploratory study to evaluate the effectiveness of an inclusive physical education online course on the self-efficacy of pre-service support teachers toward inclusion of pupils with disability in physical education

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Purpose: to verify whether a 15-h Inclusive Physical Education online course (IPE) improves the self-efficacy towards the inclusion of pupils with disabilities in physical education of pre-service teachers enrolled in the specialization course for support activities (TFA).

Methods: the Self-Efficacy Scale for Physical Education Teacher Education Majors toward Children with Disabilities (SE-PETE-D) (Block et al., 2013) was used to evaluate pre-service support teachers' self-efficacy toward pupils with intellectual disabilities (ID), Physical Disability (PD), and Visual Impairment (VI). It was first translated into Italian using the back-translation method (Brislin, 1986) and adapted to the support teacher's profile. Then, it was administered before (T0) and after (T1) the IPE to a sample of 124 TFA students (26.6% Male; Age: 37.5 ± 8.2 yrs). To determine the factor structure of the SE- PETE-D, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed separately for each of the three subscales. To verify differences in the scores of SE-PETE-D between T0 and T1, the Student's t-test for paired samples was computed.

Results: The results of EFA revealed 3 dimensions for each of the 3 scales of the SE-PETE-D. Subsequent CFA confirmed these results (ID: $\chi^2 = 75.968$, $p < 0.001$, $df = 39$, CFI = 0.97; TLI = 0.96, RMSEA = 0.087, SRMR = 0.037; PD: $\chi^2 = 97.492$, $p < 0.001$; $df = 51$, CFI = 0.97; TLI = 0.96, RMSEA = 0.086, SRMR = 0.030; VI: $\chi^2 = 69.661$, $p < 0.001$; $df = 32$, CFI = 0.97; TLI = 0.96, RMSEA = 0.097, SRMR = 0.029). The internal consistency, as measured by Cronbach alpha was optimal for all dimensions (from $\alpha = 0.89$ to $\alpha = 0.94$). Furthermore, consistent with the results of other research, students with a degree in motor science ($N = 25$; 20.2%) showed

significantly higher levels of self-efficacy (from $t = -2.737$; $p < 0.01$ to $t = -7.201$; $p < 0.01$) (Selickaite et al., 2019). Paired t-test analyses revealed statistically significant differences for all dimensions of the SE-PETE-D between T0 and T1.

Conclusions: Data are consistent with other research (Block et al., 2016) and suggest that the IPE online course improves the efficacy of pre-service support teachers toward inclusion in physical education.

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PP41C—The UP150 approach: the use of conscious physical exercise to enhance motivation and psychophysical well-being at the workplace

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Purpose: In modern society, the desk-workers category is characterized by high health risks related to sedentary behaviors and stress. Therefore, the classic work/office paradigm must be modified to reach the workers' needs of psychophysical health at the workplace. In this wake, the UP150 project represents an alternative to address the employee's needs. It promotes physical activity based on effort perception during the usual workflow, as well as active pauses by specific architectural changes, a dedicated App and professional figures as wellness coaches. Indeed, in previous research, the UP150 project has already been demonstrated to improve the participants' motor efficiency and reduce mental demand compared to a control group. The present study is the last step of preliminary actions planned to assess benefits from the UP150 concept, which purpose is to examine the workers' perception and agreement with such an approach.

Methods: In order to gain an in-depth understanding of the experiences and representations of the participants in the UP150 trial, a qualitative study was conducted. All the workers involved in the UP150 program were interviewed before (asking information about the company structure and workers' habits) and after (asking the participants' perceptions regarding how experienced the program) the trial. All the material was transcribed verbatim, and a content analysis was conducted according to the IPA (interpretative Phenomenological Approach).

Results: From the preliminary survey, the prevalently young (under 40) and generally active (57%) workers declared to be motivated to exercise but hindered in physical exercising due to lack of time and excessive workload. After eight weeks intervention, the qualitative analysis confirmed and supported the quantitative outcomes previously investigated. Participants reported beneficial effects on their wellness (53%) and psychophysical (89%) status due to the UP150 project. Moreover, the intervention was well evaluated by the

employees for whom architectural changes (58%), the App (79%) and the wellness coaches (84%) promoted motivation. Lastly, participants reported an improvement in the workplace social environment due to the interactions stimulated by the active breaks (74%).

Conclusions: In conclusion, the UP150 project efficiently promoted physical exercise based on perceived exertion and addressed the employees toward the assumption of healthy behaviors fitting the physical literacy paradigm.

PP42A—Fitness and performance of children divers

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Purpose: Competitive diving requires strength, agility, balance, timing, courage, and quickness for which an accurate evaluation of training is paramount, both for training planning and for injuries prevention. A detailed profile of children physical fitness allows the determination of the underlying performance qualities but also of a wide range of attributes associated with health-related quality of life.¹

Methods: Forty children aged 5–10 were evaluated on multi-component aspects of physical fitness. 20 (D: 10 M, 10 F) attended a diving school, 20 (C: 10 M, 10 F) were same age sedentary peers. The test battery comprised 4 items: sit-and-reach (flexibility of hamstrings and lower back: SR), standing broad jump (lower limbs strength: SBJ), sit-ups (abdominal strength: SU) and the Functional Movement Screen for shoulder mobility (SM). Children divers were also evaluated for an elementary diving performance by three experienced coaches. All measurement were performed three times and the mean was considered as the final score of the subject for each item.

Results: No significant differences were found between D and C in the anthropometrical values (age 8.0 ± 1.4 years, height 128.6 ± 9.0 cm, body mass 29.7 ± 5.2 kg, BMI 17.8 ± 1.6), indicating that they were evenly matched. Significantly different values were found between D (SR 4.6 ± 11.8 cm, SM 9.0 ± 5.5 cm, SBJ 109.3 ± 20.8 cm, SU 18.1 ± 5.3 n) and C (SR -1.4 ± 10.0 cm, SM 23.1 ± 24.8 cm, SBJ 72.6 ± 32.7 cm, SU 14.9 ± 4.4 n) for all fitness variables, showing that D had better fitness level than C. For all tested item non-significant differences were found between sexes. A significant correlation of performance with SR was found ($r: 0.841$; $p < 0.05$).

Conclusions: Recreational diving could represent a structured activity able to improve health-related fitness in primary school children. It entails technical abilities that are already heavily trained at early ages, requiring a constant and meticulous evaluation of fitness level.² Among the fitness test battery used in the present work the sit-and-reach appeared as the most correlated one to divers' performance, while the other strength and mobility items could be indicative of the general fitness level of children.

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PP42B—The teaching methods of movement and sports activities in the university curricula of generalist and specialist teachers for physical and motor education in Italian primary school

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Purpose: In the Italian primary school the compulsory nature of the two additional hours of Motor Education (ME) held by specialist teachers, graduate in Exercise and sport master's degree, compared to curricular Physical Education (PE), is a highly educational reform. Finally, Italy adjusts its policies with the majority of EU Countries that provide PE taught by experts and this brings out the problem of double and different university teacher training on the same subject (PE and / or ME) limited to the congruence (quantity) and coherence (specific relevance) of the University Credits (CFU) on movement and sports disciplines (MEDF) established in the study plans. The objective is the comparison of the contents and possible aims of the CFU, divided into classes, between the master's degree courses in Primary Education Sciences (LM85bis) and the courses in the three master's degree classes of Exercise and Sport Sciences (LM 47/67/68).

Methods: Through the documentary approach, the analysis of the rules, declarations and tables of the degree classes LM85bis, LM 47/67/68 and single annual forms, the data useful to outline the congruence of the CFU, the consistency of the contents and the related specific learning aims are extrapolated.

Results: LM85bis courses have an homogeneous distribution with 9 CFU of MEDF classes and laboratories, while there is a widespread heterogeneity of MEDF CFU in the master's degrees in Exercise and Sport Sciences. As regards the contents and objectives of the MEDF classes in the LM85bis courses, the educational characterization of the MEDF training activities is evident, while in the master's courses of Exercise and Sport Sciences the potential coherence and congruence of educational factors are not fully expressed in all courses, while economic-legal imprints persist in the LM47 courses and biomedical ones in the LM67 courses, instead the LM68 courses preserve and disseminate knowledges and skills in the sport field.

Conclusions: The data show a huge difference in terms of congruence and consistency between LM 85 bis and LM47/67/68. Furthermore, even among the LM of Exercise and Sport Sciences there is a significant difference because they have as their main training objectives the construction of the professional profiles of the two types of kinesiologists and the sports manager and, therefore, the complex training purpose decreases the training specificity for teaching of PE and ME.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP42C—Practicing outdoor physical activity: is it really a good choice? A literature review on the association among physical activity, exposure to particulate matter and oxidative stress

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Purpose: Following the Covid-19 pandemic, more and more people choose to train outdoors to avoid contagion but not only infectious

diseases cause serious damage to health. Air pollution is the first environmental risk factor for mortality and fifth largest risk factor for all causes of death (Cohen, 2017). Oxidative stress (OS) appears to play a key role in the cardiovascular effects of many air pollutants (Kelly & Fussell, 2017; Miller, 2021). The practice of regular physical activity is strongly encouraged to achieve a healthy lifestyle. However, particularly during a physical exercise session, the volume of inhaled pollutants increases. The aim of this review is to evaluate the association between air pollution and biomarkers of oxidative stress on the basis of existing studies, trying to understand if it would be safer to stay physically inactive or if physical activity is able to create adaptations capable of counteracting the harmful effects of air pollution.

Methods: Based on PRISMA guidelines, it was performed a literature review on Web of Science and PubMed databases to summarize studies reporting the association between exposure to particulate matter (PM10, PM2,5) and biomarkers of oxidative stress. Subsequently, the physical activity variable was added to the search string. A total of 103 studies were selected for full text assessment, 21 met inclusion and exclusion criteria of research.

Results: Despite some contradictions, the current literature suggests that physical exercise in a polluted environment contributes to increasing OS but on the other hand it determines a greater resistance of tissues to morphological damage thanks to the antioxidant system upregulation. The effect changes according to the level of pollution, the time of exposure and the intensity of physical exercise. Vigorous physical activity is a protective factor for both high and low PM levels.

Conclusions: Although most of the published data supports a beneficial effect of physical exercise even at higher pollution levels, it is necessary for those who train outdoors to evaluate the external environmental conditions. The single person can only partially protect his health, local governments should provide information on the places, time slots and days on which activities are recommended. The change should be aimed at improving air quality by implementing stricter legislative guidelines on air pollution thresholds

PP43A—Health and well-being effects of physical exercise in primary school in the light of the compulsory 2 hours of physical education by exercise and sports science specialists

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Purpose: The compulsory 2 hours per week of motor education (ME) by master's degree students has highlighted the health value of ME because, on the basis of World Health Organisation (WHO) directive on daily physical exercise, it has been envisaged in National Recovery and Resilience Plan (PNRR) for reform in primary schools even though National Curriculum Requirements for primary school (NCRps) do not contain specific references to health and physical well-being. The aim of the study is to identify content, objectives and related competence targets on health and physical wellbeing for the 5–11-year-old age group in order to offer them to the bodies in charge for the purposes of IN integration.

Methods: Specific literature review was conducted by consulting Pubmed, Google Scholar and Scopus with relevant inclusion criteria and inherent to year of publication, number of citations. Search-specific word strings were used: Physical activity 5–11 years, physical

activity and well-being, effects of moderate to vigorous physical activity, exercise for childhood and pre-adolescence.

Results: Physical activity ensures adequate levels of physical well-being and health in the period under study, in which self-perception and relationship with one's body and environment should be consolidated, in the control of body composition to address overweight and obesity at an early stage, in the maintenance of cardiovascular function and balance skills to ensure optimal functional status, well-being and health in childhood. The intensity of physical activity is based on metabolic equivalents (METs) and the rate of perceived exertion (RPE). METs distinguish 4 levels of intensity: from sedentary (< 1.5 METs) to vigorous (> 6 METs). The RPE define 6 levels of intensity: from very light to maximum effort. The 3 levels of physical activity are highlighted: mild, moderate and vigorous in adherence to WHO recommendation of at least 60 min of moderate to vigorous physical activity per day in order to promote motor, cognitive and social development.

Conclusions: Limitations of the study, related to the narrowness of the scientific sources, do not allow the integration of NCRps but allows the request, by the scientific community of reference, to the Ministry of Education to implement, through discussion with the scientific community, the prescriptions of PNNR and thus initiate the application of WHO directive.

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PP43B—Stay connected, be active: a cross-sectional study on the relationships between active lifestyle, body image satisfaction and social media use among preadolescents

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Purpose: This cross-sectional study aimed to test a model of relationships between active lifestyle, body image satisfaction and the use of social media among preadolescents. It was hypothesised that an active lifestyle along with an attitude to be more physically active is positively associated with body satisfaction. It also represents a variable that could mediate the negative effect of the physical appearance alteration related to the massive use of social media. Preadolescents using image-centred social media may perceive other users to be more attractive than them with negative influence on their self-esteem. Sociocultural models emphasise the role of media internalisation in preadolescents' appearance dissatisfaction and several studies have documented the influence of idealised media models in shaping the perception of preadolescents (Eyal & Te'eni-Harari, 2013; Tatangelo & Ricciardelli, 2015).

Methods: A sample of 2378 Italian preadolescents aged 11–13 years (Mage = 12.02 years, SD = 0.82) was recruited. The data collection strategy was based on two anonymous and self-administered questionnaires aimed at investigating: social media use, including typology, intensity, image-based used, type of profiles (public/private); the representation of the bodies through the social media; the

relationship between the natural and the virtual bodies; the body image; the level of physical activity.

Results: The statistical analysis indicated an excellent model fit. The scaled chi-square was $\chi^2(31) = 233.57$ ($p < 0.001$, CFI = 0.92, SRMR = 0.06). Based on the obtained RMSEA point estimation (= 0.11) and the 90% confidence interval (= 0.10, 0.12) the model had an acceptable fit. Generally, the findings gave support for direct association between active lifestyle and body satisfaction.

Conclusions: The daily use of the body for walking, practising sport, etc. helps individuals to establish a positive link between the self and the body, in its tangible dimension. In this light, the promotion of physical activity as part of preadolescents' daily routine may be considered as a strategy to contrast the negative effects on body image related to the massive use of image-centred social media. The engagement of preadolescents in offline activities that promote a positive sociocultural model about the body lifestyle may increase their emotional health (Biddle & Asare, 2011) and their social skills, and reduce the negative effect of social media use.

PP43C—Atherosclerotic cardiovascular risk in paralympic athletes with a locomotor impairment: beneficial effects of practiced sport and high aerobic fitness

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Purpose: Individuals with a locomotor impairment (I-LI), in particular those with a spinal cord injury (SCI) display a high prevalence of the risk factors (RF) of the atherosclerotic cardiovascular disease (ACVD). Paralympic Athletes (PA) with a LI show a high prevalence of ACVD-RF in spite of their active lifestyle. We tested the hypotheses that the prevalence of ACVD-RF is influenced by the type of practiced sport (skill sport – SS; power sports – PS; intermittent sports – IS; endurance sports – ES) and is inversely related to oxygen uptake peak (VO₂peak).

Methods: Summer and winter male PA, 87 PA with either SCI or spina bifida (SB-SCI) and 74 PA with other health conditions (HC) determining a lower limb impairment (e.g., amputation, poliomyelitis, etc.), screened during the Health&Fitness evaluations preceding 8 Paralympic Games, underwent to anthropometric and blood pressure (BP) measurements and laboratory blood tests to estimate an ACVD-RF score. The latter was obtained summing 1 point for each RF: central obesity -OB (waist circumference ≥ 102 cm), hypertension – HT (rest systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg), dyslipidemia -DL (total Cholesterol—TC ≥ 200 mg/dl or LDL-C ≥ 130 mg/dl or HDL-C < 40 mg/dl), impaired fasting glucose -IG (fasting plasma glucose ≥ 100 mg/dl) and subtracting 1 point with high serum HDL-C (≥ 60 mg/dl). All PA were submitted to an incremental cardiopulmonary maximal exercise test to assess VO₂peak. Prevalence of ACVD-RF in different sport were compared with Chi-squared. The differences in VO₂peak between the two HC groups

within different ACVD-RF classes were evaluated using two-way analysis of variance (Bonferroni corrected). The relationship between VO₂peak and ACVD-RF was evaluated.

Results: Based on the ACVD-RF score, 3 groups (G) were formed: G1 (RF≤0), G2 (RF=1) and G3 (RF≥2). G1 (17 PA competing in ES, 15 in MS, 8 in PS and 10 in SS), G2 (10 PA in ES, 23 in MS, 13 in PS and 16 in SS) and G3 (3 PA in ES, 22 in MS, 5 in PS and 19 in SS) differed significantly for the prevalence of PA competing in different sports ($p < 0.01$) (ml/kg/min) of PA respectively for both SB-SCI and HC in G1 (34 ± 9.9 and 38 ± 9.4) was higher than those in G2 (29 ± 7.8 and 34 ± 6.1), which was higher than those in G3 (24 ± 6.7 and 31 ± 9). The following significant ($p < 0.001$) regression was found: $VO_2\text{peak} = 34.924 - 3.494 \text{ RF}$.

Conclusions: Competing in ES and having high levels of VO₂peak seems to provide a protective effect against the risk of developing ACVD

PP44A—Pilot study to improve physical activity and fitness at university of L'Aquila

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Purpose: Sedentary time is an huge issue when the people works in an office. Especially jobs that needs to spend many hours to study, to make a research seated at personal computer in university. Aim of the study, was to demonstrate that a culture of movement during day with a specific program, improve physical activity level and avoid the sedentarism.

Methods: 36 Professors at the University of L'Aquila (UNIVAQ) have been enrolled for this project for entire academic year. We were evaluated Work Ability Index (WAI) and Physical Self-Inventory (PSI). Functional Training was administered with a Training Lab Italia Protocol® (CTLIP) built as circuit training with a 2 session training/week and one session of Pilates training.

Results: Our data suggest that WAI and PSI was significant ($p < 0.05$) and the mobility and aerobic power was better at the end of the exercise intervention ($p < 0.05$) measured with Student's t-Test. We also speculated in self-efficacy data, related to exercise session and energy expenditure during work in university and we have found, positive trend measured with Self-Efficacy questionnaire.

Conclusions: Promote exercise session directly in the university should be the main vision of each university governance in Italy and in the world. In fact, the self efficacy during work and skills are influenced by exercise, physical activity level and well-being.

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PP44B—Prospective study on the probable future specialist teacher of motor education in primary school related to perceptions and awareness in the function of sports tutor for the project of the ministry of education "active school kids"

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Purpose: For 2021/2022, the Italian Ministry of Education and Sport & Salute, public company, promoted the national "Active school kids" project, which involves the sports tutor, such as specialist teacher, supporting the generalist teacher for one hour for week of physical education (PE) lesson in primary school. In view of the duty of 2 lesson hours for the next years, by the specialist teacher of motor education (ME) in primary school, it could be useful to investigate the perceptions of sports tutors, regarding the current contextual conditions to hypothesize, through support guidelines, the setting up of the reform.

Methods: The sample consisted of 24 sports tutors (26 ± 2.4 years old) from Salerno who participated in "Scuola Attiva Kids" project. A semi-structured questionnaire was prepared using Google Form with the aim of investigating the tutors' perceptions of their work and the current contextual conditions.

Results: The main difficulties perceived by the tutors concerned the class-group management (33.3%), lack of knowledge of the assigned sports (27.1%), use of inclusive strategies (14.6%) and increasing ability programming (8.3%). 45.8% of the schools do not have a gym or it is not accessible (16.7%), so activities are performed in the classroom (54.2%). Equipment is available in limited quantities (75%). According to 70% of the tutors, the preparation of the teachers is totally inadequate for conducting EM lessons. 70% believe that co-presence is useful for class management and teacher formation.

Conclusions: Despite the limitation of the territorial sample of convenience and the inaccuracy of the questionnaire, the results offer an overall idea of the context that presents obvious cultural difficulties to the full acceptance of the reform. The aim, therefore, has been achieved and the outcome will reflect on possible support and accompanying measures for the full implementation of the legislative novella.

Acknowledgments: (non obbligatorio).

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PP44C—Knowledge transfer at international mega sports events: a systematic literature review

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Purpose: Sport Mega-events are characterised by a high degree of organisational complexity. A plethora of multifaced ‘know-how’ is produced when a city hosts a major event. However, there is scarce evidence that the knowledge generated is transmitted between former and future host cities (Mair et al., 2021). This study was aimed at systematically reviewing the current literature about knowledge transfer at international mega sports events with the aim to shed light on the barriers and enablers of the knowledge transfer mechanism between previous and future hosts.

Methods: The paradigm of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) was employed in this study. Starting from an initial pool of 301 documents the application of the quality and eligibility criteria yielded a final corpus of 33 relevant scientific documents including 25 empirical studies and 8 official reports.

Results: Our systematic literature review revealed that most of the documents were: 1). In English, published in 2011–2013 and 2015–2017, from European and American scholars; 2) Applied qualitative research methods while 44% studies applied a mixed research method; 3) Situated within the fields of “Organisation Theory” and “Public Administration” and the main focus was around knowledge management, event management and business management. 4) Identified three major barriers for knowledge transfer at international mega sports events, those were the following: a) “Lack of Knowledge Resource & Expertise”, b) “Coordination & Communication issues”, and c) “Context, Culture and Organisational Learning Capacity”. On the other hand, the key elements that were identified as enablers were: a) “Learning from Failure and Success of Similar Events”, b) “Communication, Coordination & Networking”, and c) “Improving the Learning Culture and Capacities of the Receiver”.

Conclusions: Overall, our systematic literature review detected the scarcity of studies having collected primary data as well as applying mixed research method to investigate the topic. The controversies among different studies also revealed the possible bias and insufficient knowledge in relation to language, database, technology, geographic location and priority setting etc. Referring to the barriers and enablers of external knowledge transfer, we suggest further research focusing on specific cases between previous and future host hosts of Sport Mega Events.

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PP45A—Use of drugs and dietary supplements in physical activity and health students: results from a survey-based study

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Purpose: Dietary supplements are used to implement and balance the common dietary habits. The general belief is that natural substance reduce the risk of chronic diseases and amplify sports performance with no harmful side-effects. Since “Sport and Health Science” students will become the professionals of sport activities and may also have a role in suggesting the use of dietary supplements to athletes, aim of the study was to evaluate if physical activity influence the use of drugs and dietary supplements.

Methods: A modified version of the International Physical Activity Questionnaire—Short Form (IPAQSF) was administered to perform these evaluations. A total of 1452 students from the University of Messina completed the survey, of these 1075 (704 male and 371 female students) were active in doing moderate or high intensity training.

Results: Of those physically active, 709 (440 male and 269 female) were agonist athletes, identified on the basis of their answer to a specific question. Analyzing the results regarding the regular use of drugs 82 among 1452 students were current users (5.6%), of these 15 were doing agonist sport (1.0%); while the consumption of natural supplements was quite similar (14% vs 15%) between groups. The most used supplements were vitamins, including vitamin C, vitamin B complex, and multivitamin complex, followed by minerals and aminoacids or protein complex. The probability of using dietary supplements was mostly related to the male gender (OR 1.64; 95%CI: 1.17–2.30), to have a job (OR 1.45; 95%CI: 1.07–1.96) and most of all do physical activity (OR 3.53; 95%CI: 2.18–5.71). The only factor related to a higher use of drugs was female gender (OR 2.40; 95%CI: 1.52–3.79) and the most used class was antihistaminic, followed by FANS.

Conclusions: These results suggest that among the specific population of “Sport and Health Science” students, those performing physical activity are less prone to use drugs and have a healthier habit.

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References: (non obbligatorio).

P45B—Key competences, social and motor skills of team sports activities in primary school

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Purpose: The National Curriculum Guidelines (NCG) in primary school are structured by thematic nuclei, describing them with generic motor activities for an approach to teaching–learning that, through self-determined and self-designed experiences, can become an opportunity to learn and expand the motor, educational and social heritage. However, concerning the competence development goals (knowledge and skills to be applied in any context), there is no reference to the European Parliament’s requirement for key competences (2006, 2018). The latter, on the occasion of the compulsory two additional hours of movement education (ME) in classes IV and V of primary school by specialist teachers with a master’s degree in sports science, in addition to the ordinary hour of physical education (PE), provides for an update of the NCG also concerning the complex activity of team sports. This study aims to deepen the social skills identified in the list of 8 key competences, in order to finalise them into competences generated by cooperation, relationship and performance activities for the common goal of achieving the typical results of team sports.

Methods: An archive search of official and professional documents was conducted, extrapolating from the thematic nuclei of the NCG for primary school those methodological elements that contribute to the achievement of the specific educational objective, the improvement of motor skills related to team sports games and, finally, the social skills of key competences through scientific elaborations that take into account the most up-to-date evidence.

Results: It is necessary to move towards the choice of teaching methodologies using an ecological-dynamic approach with heuristic learning because it is interdisciplinary and transversal. Several team sports games particularly suitable for primary schools were identified in this review, including volleyball (Volley S3 and Spikeball), basketball (Easy Basket) and football (Giocalcando). Three key competences that can be developed through these sports games are multilingual, citizenship and cultural awareness competences.

Conclusions: In order to decline these three key competences in the NCG for the generalist part of PE, workshop teaching in a playful context could be promoted aimed at learning the basic concepts of discipline, skill awareness, process development and cooperative learning skills. For the specialist part of ME, on the other hand, it is necessary to consider above all the pupils' self-regulated exploration and research activities, using educational deliveries as a didactic tool through the development of educational practices and the alteration of the environment and rules of play. These proposals could bring out original and multivariate social and motor skills.

PP45C—Impact of personality traits and motivation on sport performance in young soccer players

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Purpose:

This exploratory study aims to investigate the impact of personality traits and motivation on the sport performance, specifically the competitive team sport, looking at somatic maturation, fitness test scores and sport-specific technical skills of young male soccer players.

Methods:

Two young soccer teams were enrolled: Under16 (U16, n = 13, age 15.5 ± 0.6yrs, weight 60.4 ± 5.7 kg, height 172.8 ± 6.0 cm) and Under19 (U19, n = 13, 17.6 ± 0.5 yrs, weight 72.9 ± 10.7 kg, height 175.4 ± 6.9 cm), having at least 2 years' experience. Body composition by bioimpedance analysis and somatic maturation were evaluated. Participants performed the standing long jump test (SBJ), the Yo-Yo IR1 test and a 3 min-circuit training to evaluate precision to score under a match-like stress. Personality traits at developmental age and motivation to practice team sport (intrinsic and extrinsic determinants) were evaluated by a specific questionnaire developed considering items and measures already validated.

Significance was set at p<0.05 (ANOVA test). Pearson correlation coefficients (r) ranged from weak (r<0.3), to moderate (0.3<r<0.7), to strong (r>0.7).

Results: U16 and U19 differed anthropometrically, in their body composition and maturity offset (p < 0.05). Such a starting point significantly affected their performance in SBJ (p < 0.05), Yo-Yo

IR1 tests (p < 0.05) as well as precision to score with the non-dominant limb under an endurance stress.

In U16, there was a moderate positive and negative correlation between age at peak height velocity (PHV) and VO2max and explosive leg power, respectively. Similarly, maturity offset showed a moderate positive and negative correlation with the precision to score with the dominant and non-dominant limb, respectively.

In U19 team, a moderate positive correlation was found between a) age at PHV and VO2max, explosive leg power and precision to score with the dominant limb and b) maturity offset in respect with explosive leg power and precision to score with the dominant limb. Moreover, a moderate positive correlation linked VO2max and precision to score with the non-dominant limb.

Then, a positive correlation between high extrinsic motivation, some personality traits (mainly extraversion and openness) and sport performance was observed.

Conclusions: This study highlights that somatic maturation improves performance, above all precision to score, and sport performance could be a good indicator of young soccer players' motivation/personality.

PP46A—The effect of an active breaks intervention on physical and cognitive performance: results from the quasi-experimental I-move study

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Purpose

Active Breaks (ABs) are short bouts of moderate to vigorous physical activity (MVPA) conducted by teachers and delivered during curricular lessons. The I-MOVE was a quasi-experimental study aimed to evaluate the effect of ABs intervention to promote healthy lifestyle and cognitive improvement in primary school children.

Methods

A final sample of 152 children were involved in the study: N = 110 children in Active Breaks experimental group performed the I-MOVE protocol three times a day (ABsG) and N = 42 children in control group (CG) continued with normal lessons. The cardiorespiratory performance was evaluated performing the 6-min Cooper test (6MCT), classroom behaviour was assessed with an ad hoc questionnaire and short-term working memory (WM) through the working memory test. Physical activity levels were calculated using Actigraph accelerometer and physical activity questionnaire for children (PAQ-C). The baseline assessment was conducted in October 2019 while in May 2021 the follow-up.

Results

The 6MCT was significantly different between-group with adjustment for baseline values (ABsG change: 1.77 ± 136.03 vs CG change: -156.42 ± 187.53; p < 0.05). WM performance increased significantly more ABsG (change: 1.30 ± 1.17) than in CG (0.96 ± 1.20), p < 0.05. Actigraph showed that the weekly time spent in MVPA

increased in both groups with no statistically significant difference between groups, only ABsG increased in light PA. The time spent in sedentary behaviour significantly increased both in ABsG and CG. Both groups significantly decreased their self-reported PA levels without significant differences between groups. Children reported improvements in their quality of school life including feeling better in class (75.40%) and in school (82.50%) when using ABs. There were also improvements in their time on task behaviours: children work easily in class, and can stay seated easily, listen more clearly, and learned better after ABs.

Conclusion

The I-MOVE study showed that the ABs was effective in improving cognitive health and classroom behaviour. Despite various difficulties associated with the pandemic, ABs, in particular the high intensity interval training exercises, proved to be sustainable and play a protective role with regard to physical fitness. In conclusion, ABs represent a cost-efficacy strategy to be implemented in the school setting in order to make the school a more dynamic environment for both physical and cognitive health.

PP46B—Trend in motor skills and abilities in school-aged children. Improvement or decline?

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Purpose: Regular physical activity has health benefits across the life span. In children and adolescents, physical activity benefits musculoskeletal and cardiometabolic health, cognitive development, motor skills, self-esteem, social integration, academic performance and general well-being (WHO, 2020). Physical activity guidelines, highlighting the critical role of physical activity as a driver factor of biopsychosocial health and well-being, recommend that children and adolescents engage in at least sixty minutes per day of moderate to intense physical activity.

This data unfortunately is not always satisfied by adolescents; according to the international study *Health Behavior in School-aged Children* only 25.0% of boys and 15.0% of girls report not practicing the amount of physical activity suggested by the WHO (2018). Despite the guidelines on the promotion of physical activity and the knowledge of all the beneficial effects, the participation in physical-sports activities continues to drop dramatically over the years.

Methods: This study aims to highlight the results emerging from some scientific studies that have investigated the levels of motor skills and abilities in young people; this in order to understand what are the trends recorded in the last years preceding the pandemic period. Relevant studies were identified by searching the Web of Science, Pubmed, Google Scholar and Science Direct databases, using the following keywords: trends, decline, physical activity, motor skills, children, young people. Selected studies and research published in the period 1989–2020 have been included in this study, focusing on the following aspects: physical activity and movement, level of obesity, development of motor skills, psychosocial development and other health indicators.

Results: The results of the study were summarized in table highlighting the names of the authors, year of publication, objectives, methodologies and results obtained.

Conclusions: According to literature analysis, it emerged that the problem of sedentary lifestyle is evolving dizzily and in the modern era, so much so that the continuous advancement of technological discoveries and the continuous mechanization and automation of our

daily life, suggests an increase in sedentary children and consequently a trend of involution of motor skills and abilities.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP46C—The influence of 8 weeks of sport-specific training on children's gross motor coordination: comparison between soccer and rugby players

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Purpose: The acquisition of appropriate levels of motor coordination (MC) in children is important for daily living activities and psychophysical well-being, thus continuous monitoring is essential in the developmental age. Recent studies reported that children who play sport showed higher levels of MC than sedentary children. However, little is known about the effects related to the type of sport practiced on MC. Therefore, the aim of this study was to investigate the influence of 8 weeks of sport-specific training on gross MC in children.

Methods: For this longitudinal study, thirty-one boys aged between 6 and 8 years were randomly enrolled. Participants were engaged in their first year in soccer (n = 17) and rugby (n = 14) and had not practiced other sports before. Each participant performed the Körperkoordinationstest für Kinder (KTK) before (T0) and after (T1) 8 weeks of sport-specific training. The KTK allows to measure MC expressed as motor quotient (MQ) and includes four subtests: 1) walking backward on a balance beam of decreasing widths; 2) two-legged jumping sideways from side to side over a beam for 15 s; 3) one-legged hopping for height over a foam obstacle of increasing height; 4) moving sideways on the floor in 20 s. The MQ was computed by adding the score of the four subtests.

Results: Our results showed that soccer players significantly increased MQ (p < 0.001) and all the four subtests' scores from T0 to T1 (p < 0.01 for the two-legged jumping sideways and p < 0.001 for all the other subtests). As concern rugby players, a significantly higher MQ was found at T1 (p < 0.05) and, although higher scores were obtained in all the four subtests, significant differences were found only in the two-legged jumping sideways (p < 0.05) and in the one-legged hopping for height (p < 0.05). **Conclusions:** Our results suggest that regardless of the type of sport practiced, children improve their gross MC. However, different levels can be achieved depending on the type of sport highlighting an early specialization and diversification. Further studies need to confirm this hypothesis.

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PP47A—Regional observatory of motor development and physical fitness in apulia region: a transversal comparison between lecce and foggia

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Purpose:

The Regional Observatory of Motor Development and Health Prevention in Apulia (Italy) is a regional project aiming at assessing health status and physical fitness in children and adolescents. Previous studies, based on the monitoring of healthy habits in Apulia Region (Southern Italy), showed the increase in the percentage of overweight and obese children (9–10 years) with a concurrent reduction of physical fitness (strength, speed and aerobic fitness). At the same time, international literature has showed that the development of physical fitness represents an important health indicator during the developmental age. This study aims to assess differences in physical fitness in children aged 9–10 years participating in SBAM—Health, Wellness, Nutrition, Movement At School—Project between two Apulia province (Lecce and Foggia). The purpose is to interpret the monitoring data and address specific Regional intervention policies aimed at promoting active lifestyles and the practice of motor activities.

Methods:

Six-hundred children were randomly selected from the SBAM monitoring in Lecce (N = 300) and Foggia (N = 300) provinces. According to Cole et al. (2000) participants were grouped by BMI: normal-weight (Nw), overweight (Ow) and obese (Ob) children. The total sample consisted of 50 males and 50 females Nw, 50 males and 50 females Ow, and 50 males and 50 females Ob from. In addition to stature and body mass, the standing long jump (SLJ), medicine ball throw 1 kg (MBT1Kg), 6-min walking test (6-MWt) and 10 × 4 shuttle run (10 × 4) test were performed.

Results: The preliminary results of physical fitness highlighted that: (a) female Ob group of Lecce showed better performance in SLJ than Foggia peers ($p < 0.01$); (b) both male and female Nw group of Foggia showed higher performances in MBT1Kg than Lecce Nw group ($p < 0.05$ and $p < 0.01$, respectively); (c) female Ob group of Lecce showed better results in 10 × 4 compared to female Ob group of Foggia ($p < 0.05$); (d) children of Foggia covered—on average—longer distance in 6MWt than children in Lecce regardless of gender and BMI ($p < 0.01$).

Conclusions: The assessment of physical fitness in children and adolescents allows the acquisition of transversal and longitudinal information on the development and evolution of motor skills as health indicators. Furthermore, it allows to acquire and periodically compare quanti-qualitative data on the evolution of physical fitness and motor abilities in different geographical areas, evaluating the effectiveness of school, institutional and sports interventions for health promotion.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP47B—The efficacy of the project motorfit: educational action through physical activity in schools

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Purpose Physical exercise is important for the healthy development of children [1]. It is often argued that the developmental age is a critical period for the expansion of an individual's motor competence, and it is sensitive for learning such skills [2]. Motor competence is described as the ability to perform a broad range of motor skills necessary for everyday activities, such as quality of movement, motor control, and fine and gross motor coordination [3]. Our project aimed to improve mental and physical Motorfit students and aims to assess the degree of motor pupils attending compulsory education. In addition, the school year in progress this project has been screened in the Puglia region where, unfortunately, where epidemiological investigations show a high rate of sedentary lifestyle between children.

Methods The Motorfit test used is an individual administration test, which evaluates gross motor functions [4]. It consists of several trials, for each of which exist four variants that evaluate different elements. One point is awarded for the full accomplishment of each task, otherwise no score is awarded. The total score is obtained from the sum of the variants of the test.

Results A nine-week training protocol was used on a cohort of 44 primary school children (9–11 years). The protocol aimed to develop coordination skills through the disciplines of volleyball and athletics. The Motorfit test was used to establish the initial and final coordination levels for each subject. The children underwent two weekly workouts, practicing volleyball and athletics every other week. At the end of the administered protocol, an increase in the coordinative mean of the sample equal to $13 \pm 0.5\%$ was recorded.

Conclusions The evidence of these data suggests how training coordination skills through several different sports can be an excellent strategy for children's motor development.

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PP47C—Body image perception, weight status and physical activity in children

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Purpose: The purpose of this study was to examine the perception of body image and the degree of dissatisfaction in children with particular regard to differences in relation to anthropometric characteristics and physical activity.

Methods: A sample of 233 schoolchildren aged 11–14 years were recruited for this study in northern Italy. Anthropometric traits were measured directly and Body Mass Index (BMI) was calculated. The nutritional status of children was attributed in according to international age and sex-specific Cole's cut-off points. Assessment of body image perception was performed using Body Silhouettes Charts for

preadolescent children and FID (Feel minus Ideal Discrepancy) index was used to assess the degree of body dissatisfaction, as feel silhouette minus ideal silhouette. The IPAQ A (International Physical Activity Questionnaire for Adolescents) was administered to determine the physical activity level.

Results: The main results of the study show that one-third of the sample examined were above the normal BMI range (prevalence of overweight: 28.8% girls; 24.8% boys). The 36,5% of participants in this study were not satisfied with their figure (FID = ± 1) and the 22,7% was very dissatisfied (FID $\geq \pm 2$). The dissatisfaction and satisfaction were similar in boys and girls and the percentage increased in overweight and obese children. Feel figure perception and BMI were significantly correlated in both sexes (boys: $r = 0.7119$ $p < 0.0000$; girls: $r = 0.7085$ $p < 0.0000$) this provides a measure of appropriateness of the children's body image perception. Among the subjects who practice sports or high levels of physical activity, there was a lower frequency of high dissatisfaction in relation to those who do not practice extracurricular sports or practice lower physical activity, especially in girls.

Conclusions: These results suggest that the association of body image perception, anthropometric evaluation and physical activity can provide important tools to prevent the onset of eating and body image disturbances in children. Moreover, the study shows the important role of sports and physical activity in increasing one's level of bodily satisfaction.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

Postural disorders in basketball players: relationship between lower limbs morphology and postural control

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Purpose

The postural “disorder” translates, first of all, into a condition of general and local stress and fatigue and, secondly, into wear and degenerative phenomena destined to configure pathological situations, especially in sport. The study focused on basketball, a sport with alternating aerobic-anaerobic commitment, that requires good coordination and flexibility skills. This study aimed to verify possible axial alterations in relation to height and weight and standing oscillations in basketball players (experimental group) compared to sedentary people (control group).

Methods

The present observational study was designed to perform a postural assessment on male athletes divided into two groups. The experimental group (EG - n: 40, age 18-25) who play basketball at least three times a week plus match, with a medium - high intensity training, compared to a control group (CG - N: 40, age 18-25) of young sedentary people. Postural analysis was conducted using two tools: Knee Rotation Measurer (KRM - Postural Service, Milano) and Podata stabilometric platform (Chinesport, Udine). Statistical analysis was performed using SPSS.18.

Results

Preliminary results obtained from the bipodal stabilometric platform showed that regarding the weight (mean total weight EG= 82.70 \pm 12.24 kg vs CG = 69.61 \pm 10 kg) and the distribution of the loads on the right and on the left, no differences emerged between the two groups ($p > 0.05$). Concerning KRM evaluation, statistically significant differences emerge between the two groups in knee flexum on the left (Δ 8.4 mm, p value < 0.033) and right (Δ 7.6 mm, p value < 0.036) in favour of the EG, as well as regarding knee varus (EG= 109.1 \pm 11.34 mm on the right; 106.88 \pm 13.86 mm on the left; CG= 99.93 \pm 16.74 mm on the right; 98.33 \pm 16.74 mm on the left, $p < 0.05$)

Conclusion

Preliminary findings confirm that posture is a multidisciplinary subject of growing interest. Although without statistical significant differences performing Pearson's correlation, results show a linearity between the anteriorized center of gravity and the knee flexum concerning sagittal plane as well as between the load on the fifth metatarsal and the knee varus as regard the frontal plane, in the EG compared to the CG. Postural assessment can be the starting point from which, to obtain precise observations, technology is useful and sometimes necessary.

PP48B—Physical education in the schools during the pandemic period: preliminary assessments coming from an Italian high-school “liceo scientifico—indirizzo sportivo”

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Purpose: In 2013, in Italy, a new educational school curriculum with a sporting character was established in Italian High schools: Scientific high school—section on sport and physical activity (SHS). This study aimed to assess the fitness levels of SHS students and compare them with traditional high school (THS) students that have suffered most of the restrictions due to the pandemic.

Methods: The design of this study is a case-control study; the members of the experimental group (EG-Sport) were part of a high school class with a special sports program (SHS), while the control group (CG) was made up of students attending Traditional High School (THS). Thirty subjects were enrolled for this study. Fifteen attended classes with a special physical education program, and fifteen attended classes with a traditional physical activity program. The study sample included students who met the following selection criteria: (1) no structured physical activity in sports clubs during the after-school hours; (2) during the pandemic period, they haven't done any physical activity with sports science professionals other than those authorized at school. The following tests were administered to assess the fitness levels: the Static Baropodometric Analyses, Counter Movement Jump (CMJ), and the Handgrip test. The unpaired t-test was used to evaluate the statistical differences between measurements. A p-value lower than 0.05 was considered useful. For each outcome, Cohen's d was then calculated. The Pearson correlation index was used to analyze the correlations between the variables. These analyses were conducted via Jamovi software (version 2.3.0.0).

Results: Pearson analysis of the results of the test showed significant high correlations between variables: Handgrip test Dx vs Handgrip test SX, Handgrip test DX vs CMJ, Handgrip test SX vs CMJ. Unpaired T-test analysis between EG-Sport (T0) vs CG (T0) showed the significative correlations: Handgrip DX and SX ($p < 0.001$ and

$p < 0.001$); Surface left and right ($p < 0.05$ and $p < 0.05$) and CMJ ($p < 0.001$).

Conclusions: Our results showed that the students of EG-sport have better strength performances both in the CMJ and the Handgrip test. Furthermore, from our analysis, we can be deduced that school physical activity programs can significantly affect the fitness levels of adolescents who do not engage in motor activity during extra-school time.

Results currently submitted on frontiers in public health

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PP48C—Evaluation a state of physical well-being between 5th grade student of primary school: are motor skills related to cognition?

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Purpose: A state of physical well-being is not just the absence of disease. It includes lifestyle behavior choices to ensure health, avoid preventable diseases and conditions, and live in a balanced state of body, mind, and spirit. Especially among the children, the purpose was to evaluate, in two time specific of the school period during School Active Kids project, the link between exercise practice and cognition system. Aim of the study was to investigate the efficacy of this project on improvement of motor skills.

Methods: 25 Students of 5th grade of primary school have been enrolled in this study. Subsample was called Active Group (AG) and Motor Skills were assessed by Eurofit test. Cognitive skills were assessed by "Test di valutazione delle competenze di lettura, ascolto e scrittura, per la scuola primaria" recognised by QCER. To improve physical activity intervention was School Active Kids project. We have also compared other 25 Students, Control Group, with same characteristics of Active Group to evaluate the differences between primary school classes.

Results: Data showed the positive improvements after school treatment period with the School Active Kids project intervention. Cognitive skills have been improved ($p < 0.05$) and Motor Skills showed a positive and significant enhancement ($p < 0.05$) as seen with Student's t-test.

Conclusions: Motor Skill and Cognitive skill are influenced by exercise and physical activity level of students. Even though at the beginning of the study, test showed that control group was better than the other, at the end of the study with a difference due to School Active Kids project. In fact, the active group respect to the control group seems to be better in Motor skills. In this pilot study data did not show improvements or relationships in cognitive skills even though we have found a positive trend. To understand if it has been

related to the exercise, we need to expand the samples and case studies.

Acknowledgments: (non obbligatorio).

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PP49A—The role of postural physical exercise in the prevention of muscle-joint pain and muscle stiffness in smart-working employees

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Purpose: The goal of our study was to analyze joint mobility, muscle stiffness and chronic pain perceived in smart working employees (SWE) and to evaluate how a postural physical exercise (PPE) program could reduce the negative effects of a sedentary lifestyle on the spine and joints.

Methods: 20 SWE, homogeneous for age, sex and sedentary time (> 7 h / day), were divided into two groups: 10 in the experimental group (EG) and 10 in the control group (CG). Initially (T0) all subjects underwent: Neck Disability Index (NDI), Modified Oswestry Low Back Pain Disability Questionnaire (MOLBPDQ), Shoulder Pain and Disability Index (SPADI), Back scratch test (BS), Sit and reach test (S&R), Prone spine extensibility (PSE), Shoulder Mobility test (right / left): External rotation, Internal rotation, Shoulder flexion. After 10 PPE lessons (T1) and follow-up at 2 months (T2) test were repeated. EG, in T0-T1, performed 10 supervised PPE lessons, while in T1-T2 independently practised a PPE protocol. The tests were conducted in person, the remote PPE online live. No PPE was performed by GC. Data were analyzed with Two Way Repeated Measures ANOVA.

Results: In EG relatively to NDI, MOLBPDQ and SPADI, we observe a clear significant improvement between T0 and T1 ($p = 0,025$), with the data stabilizing at T2. Furthermore, if we compare the values of the two groups in the individual trials, these significantly differ, with the EG improving compared to the CG ($p < 0.05$). In BS right and left and PSE there are significant improvements in T0-T1 with a tendency to stabilize in T2, but no significant changes when comparing EG and CG.

In the specific shoulder tests (external rotation, internal rotation and flexion) slight differences were found, in some cases not significant.

Conclusions:

The PPE adopted from the subjects was more effective in the general improvement of flexibility, rather than in the more specific movements of the shoulder joint.

EG's subjects, despite having maintained smart working over time with the typical sedentary lifestyle, perceived a significant reduction in chronic pain and therefore the effectiveness of the proposed program is evident.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP49B—Effects of an abduction brace after shoulder surgery on gait parameters and functional mobility

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Purpose: Even though the need of wearing a brace after shoulder surgery is still a matter of debate, an abduction brace is almost always used for 4 to 6 weeks after shoulder surgery and before starting a rehabilitation program. Due to its possible harmful effects, including stiffness and balance problems, the use of a shoulder abduction brace (SAB) needs to be carefully evaluated. However, it is still unclear whether the use of a brace after surgery might affect patients' functional outcomes, and whether these changes persist after rehabilitation. Therefore, this study aimed to analyse gait and functional mobility in patients undergoing shoulder arthroplasty and rotator cuff repair and wearing a 15° SAB.

Methods: Gait parameters and functional mobility evaluations were carried out on thirty-five participants (age: 53.3 ± 10.4 years) using a wearable inertial device for gait analysis (G-Walk System by BTS Bioengineering). Each participant performed the 10-m walk test (10MWT) at normal speed and the Timed Up and Go (TUG) test before surgery (T0), 24 h after surgery (T1), 1 week after surgery (T2) and after removal of the shoulder brace (T3).

Results: Regarding the 10MWT, time of execution was significantly lower at T0 than at T1 ($p < 0.01$) and significantly higher at T1 than at T3 ($p < 0.01$). Therefore, speed was significantly higher at T0 than at T1 ($p < 0.01$) and significantly lower at T1 than at T3 ($p < 0.05$). Cadence was significantly lower at T1 than at T3 ($p < 0.05$). No significant differences were found for right and left step lengths. Regarding the TUG test, the final turning phase was significantly higher at T2 than at T3 ($p < 0.01$). No significant differences were found for all the other variables.

Conclusions: The use of SAB negatively influenced walking speed and cadence during the 10MWT and the final turning phase before sitting during the TUG test. However, after SAB removal these variables returned to basal values (i.e., before surgery). We may hypothesise that patients wearing a SAB pay more attention when walking and before sitting due to the fear of falling. Exercise specialists, together with physiotherapists, should take into consideration these effects in order to define the optimal rehabilitation protocol.

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PP49C—Physical activity interventions for preschool children's fine motor coordination

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Purpose: The purpose of this study was to verify the effect of two different physical activity (PA) interventions, aiming to help the development of preschool children's fine motor coordination.

Methods: A total of 54 kindergarten children aged 5–6 years were randomly assigned either to an experimental ($n = 28$) or to a control ($n = 26$) PA program lasting 10 weeks. The control intervention consisted of one-hour session per week. The experimental intervention provided an additional 20 min of exercise for each physical activity lesson, mainly focused on exercises to develop manual dexterity, fine motor precision and fine motor integration skills. The BOT-2 Bruininks–Oseretsky Test of Motor Proficiency-Short Form (BOT-2 SF) assessed children's motor proficiency before and after intervention. Moreover, parents completed a questionnaire to evaluate physical activity level of their children.

Results: After the intervention period, fine motor precision (Folding paper test: 1.07 ± 1.64 scores vs 1.59 ± 1.82 scores, pre vs post), manual dexterity (Transferring pennies test: 10.28 ± 1.89 num vs 11.33 ± 1.67 num, pre vs post), bilateral coordination (Tapping feet and fingers test: 9.69 ± 0.87 num vs 9.94 ± 0.23 num, pre vs post), balance (Standing on one leg: 8.69 ± 2.08 num vs 9.52 ± 1.12 num, pre vs post), upper-limb coordination (Dropping and catching a ball test: 3.93 ± 0.89 num vs 4.46 ± 0.79 num, pre vs post; Dribbling a ball test: 3.15 ± 1.51 num vs 3.85 ± 2.30 num, pre vs post), muscular strength (Knee push-ups test: 15.00 ± 4.67 num vs 16.78 ± 4.04 num, pre vs post; Sit-ups test: 12.81 ± 5.21 num vs 15.22 ± 4.21 num, pre vs post), running speed and agility (One legged stationary hop test: 28.87 ± 8.17 num vs 37.02 ± 7.88 num, pre vs post) significantly improved in both groups.

Conclusions: The results showed that both experimental and control PA interventions were effective for the development of preschool children's motor proficiency and positively affected their fine motor skills development and thus their initial writing process.

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PP50A—Ankle instability: effects of training and taping on balance and posture

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Purpose: The Chronic Ankle Instability (CAI) is one of the most frequent injuries among sportspeople. CAI is associated with a lack of postural control and balance under static and dynamic conditions; deficits in sport tasks and in daily living activities (Hertel & Corbett, 2019; Webster & Gribble, 2010). An adequate training method to improve this condition has not yet been put in place and the role of ankle taping is not yet clear. The aim of this study was to evaluate the effects of training on balance and performance as well as to investigate the effects applying rigid ankle taping on CAI subjects.

Methods: 13 sports subjects (6F, 7 M) aged between 16 and 42 (26.69 ± 6.37) were recruited. Training involved plyometric, proprioceptive, strengthening and joint mobility exercises. The experimental group trained for 30 min, 3 times per week for 4 weeks. Y-balance test and static and dynamic stabilometry (OE, CE) were used for the assessment at T0-T1. X moyen, Y moyen, Surface, VarVit, IVV and Romberg were submitted to statistical analysis. The perception of the joint function was evaluated using Foot & Ankle Ability Measure–Sport (Goulart Neto et al., 2022).

Results: Significant statistics were achieved in dynamic stabilometry in EO condition (X moyen = 0.033), and in the Y-Balance Test scores (anterior = 0.004; posteromedial = 0.005; posterolateral = 0.022; composite score = 0.001).

Conclusions: According to the test results, training could improve dynamic balance and postural control, while taping seems to have no significant effects (Webster & Gribble, 2010).

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PP50B—Isometric neck strength in male rugby union players: backs vs. forwards

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Purpose: Concussion is a frequently reported injury in rugby union. Furthermore, the increases in body mass, strength, and power have resulted in larger magnitude impact forces in the contact phases during the game. Greater neck strength has been associated with decreased head acceleration during rugby contact events, and increasing neck strength is a potential means to reduce the incidence of concussion. This study analyzed isometric neck strength parameters in male rugby union players playing in different positions and the relationship with concussion events.

Methods: Twenty-one young (under 15) and thirty-three senior rugby union players participated in this study. Using a handheld dynamometer, three maximal isometric repetitions were performed in each direction (i.e., anterior, posterior, left, and right lateral flexion) in a neutral cervical spine position. Parametric statistics (i.e., Student t-test) were applied to evaluate the difference between backs and forwards according to age, experience, height, weight, BMI, neck and chest circumference, and isometric neck strength separately for senior and junior sub-group. A series of logistic regression models were applied to explore the relationship between the above independent variables and the occurrence of concussion.

Results: Senior forwards were higher ($p = 0.021$; ES = 0.8), heavier ($p = 0.003$; ES = 1.1), and neck ($p = 0.012$; ES = 0.9) and chest ($p = 0.010$; ES = 0.9) circumferences were higher than backs. No differences occurred for isometric neck strength ($p > 0.05$). The

probability of concussion events was related to experience ($B = 0.371$; SE = 0.143; $p = 0.009$; OR = 1.449). Junior forwards were higher ($p = 0.026$; ES = 1.1), heavier ($p < 0.001$; ES = 1.9), and neck ($p < 0.001$; ES = 1.7) and chest ($p < 0.001$; ES = 2.0) circumference, as well as anterior ($p = 0.026$; ES = 1.1), posterior ($p = 0.033$; ES = 1.0) and left lateral ($p = 0.041$; ES = 0.9) flexion were higher than backs. The probability of concussion events was unrelated to any independent variables.

Conclusions: Data suggested that the position-specific game demand does not influence the isometric strength of the neck in senior male rugby players. Differently, in the junior group, players tend to have specific physical profiles to match the demands of the game. The probability of concussion events was related to experience only in the senior group.

PP50C—Teacher’s attitude, perceptions, and organizational measures influence on the implementation of inclusion strategies during physical education and recess at school

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Purpose: Nowadays, the implementation of inclusive strategies is a priority for school and sport teams. While the use of inclusive strategies is very common in the class environment, no studies were conducted about the use of inclusive physical education games in school recess and free playtime. Therefore, the aim of the current contribution is to fill this gap, analysing attitudes, perceptions and organizational measures that influence the use of inclusive physical education games in the school class and during recess.

Methods: In this study, 1583 schoolteachers responded to an online survey comprising questions about school management measures, perception of being able to use inclusive strategies, attitude toward inclusion, and effective use of inclusive measures. Data were analyzed through Mplus (version 7). We hypothesize that the attitude towards inclusion positively correlates with perception of being able to use inclusive measure and support from the school organization, that in turn, positively correlate with the use of inclusive tools. Specifically, two Structural Equation Models (SEMs) comparing the same variables in the classroom and in school recess were built.

Results: The comparison between the two models revealed that the model referring to the inclusive games in the classroom showed a better fit than the one considering physical education games in school recess ($AIC_1 = 47,112.92$ and $AIC_2 = 47,862.28$), with a small positive influence of attitude towards inclusion on inclusive strategies through organizational measures ($r = 0.27$ and $r = 0.07$), and a small positive relationship between attitude towards inclusion and perceived ability to use inclusive strategies ($r = 0.25$) and a strong correlation between perceived ability and the actual use of inclusive strategies ($r = 0.60$).

Conclusions: The use of inclusive games in school recess is an innovative topic that might foster teachers’ attitudes and perceptions towards inclusion but needs to be further investigated.

PP51A—Evaluation of functional ankle stability in young athletes: a preliminary assessment

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Purpose: Lateral ankle sprain is an ankle ligament injury and is the most common and recurrent injury in sports. Recent studies have shown no significant differences in functional ankle stability (FAS) between the left and right legs. The aim of this study was to evaluate postural stability differences between the left and right legs and to investigate the role of the foot surface on FAS.

Methods: Twenty-four young athletes were enrolled in this study. The following tests were administered: 1) dorsal flexion (df), plantar flexion (pf), eversion (ev), and inversion (iv) of both feet were measured with an accelerometer and angular velocity, range of motion, and fluidity of movement were used for statistical analysis; 2) stabilometric analysis; 3) single-leg posturographic evaluation using a dynamic task. The Pearson's and the Spearman's correlation index were used to analyze the correlations between the variables. A paired t-test was used to evaluate postural stability differences between the left and right legs. The relationships between the results were analyzed with linear regressions. Statistical analyses were conducted with the Jamovi software.

Results: The parameters of the left leg showed significant correlations with the left foot surface: Y mean ($p < .05$, $r = 0.36$); ellipse ($p < .05$, $r = 0.33$); foot angle ($p < .001$, $r = 0.59$); angular velocity – df ($p < .05$, $r = 0.34$); range of motion – iv ($p < .01$, $r = -0.44$). The parameters of the right leg showed significant correlations with the right foot surface: ellipse ($p < .05$, $r = 0.33$); the fluidity of movement – ev ($p < .05$, $r = 0.34$). The paired t-test showed significant differences between left Y mean after a lateral jump vs right after a lateral jump, mm ($p < .05$), and left Y mean vs left Y mean after a lateral jump ($p < .001$). Multiple linear regression: dependent variable: left Y mean; independent variable: left foot surface, left motion range – df; left fluidity of movement – pf; left motion range – ev; left fluidity of movement – iv. Factors: Jump. Regression p value < 0.001 ; $R = 0.79$, Adjusted $R^2 = 0.55$.

Conclusions: Our results showed that the foot surface could affect FAS, especially for the left foot. The anterior/posterior COP oscillations are a reliable measure of dynamic postural stability in athletes during jump-landing. Ankle stability depends on the direction of body movement performed prior to landing. The right leg showed a better stability. Future studies are needed to confirm these hypotheses.

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PP51B—Assessment of anthropometric measures from a commercial scanning mobile application: a preliminary validation study

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Purpose: Digital imaging systems are increasingly being used in health care settings for quantifying body size and shape, as well as accurate classifications. The potential exists to provide similar anthropometric measure outside of professional settings using smartphone applications (apps). The aim of this study was to compare the waist-to-hip ratio (WHR) acquired by a downloadable application with that measured with a flexible tape at the same anatomic sites.

Methods: Sixty-two adults of both sexes (age 23.3 ± 3.6 years) were scanned with the SizeYou app. (SizeYou, I-DEAL S.r.l., Italy) and measured with manual anthropometry. All anthropometric measurements were performed by a level I- accredited anthropometrist (F.C.) according to the ISAK protocol. The mobile software was used to generate waist and hip circumference estimates and the derived WHR from device-acquired object files that were then compared with reference tape measurements. To assess the accuracy of the mobile application, validation parameters included the analysis of the coefficient of determination and the pure error. Additionally, the concordance correlation coefficient (CCC) using the Lin's approach was performed. Agreement between the digital-derived measures and the reference procedure was assessed using the Bland–Altman method, including the analysis of the correlation between the mean and the difference of the methods and an estimate of the limits of agreement.

Results: Regarding the regression analysis between the manual approach and the digital-derived WHR, the methods were highly correlated ($r^2 = 0.85$; $p < 0.01$; $SEE = 0.02$). The precision and accuracy of the methods were 0.91 and 0.95, respectively, with a CCC between the digital method and the reference procedure equal to 0.87. From the agreement analysis, we observed no trend ($r = 0.040$, $p = 0.750$) between the mean and the differences of the methods, with 95% limits of agreement considered acceptable (from -0.03 to 0.06).

Conclusions: The anthropometric estimates provided by the SizeYou application are precise and accurate, and allow to obtain a WHR index comparable to that obtained by manual anthropometry. This digital method offers a rapid alternative to manual measurements for assessing health-related anthropometric parameters.

PP51C—A cluster-randomized trial to improve pupils' attitudes toward inclusion of peers with physical disabilities through paralympic sports in primary school PE

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Purpose: Decreased involvement in physical education (PE) among children with disabilities can result from negative attitudes toward peers with impairment. School- based paralympic sports programs may improve students' views about people with disabilities (McKay et al., 2021). The present study aimed to determine whether paralympic sports in PE would have a favorable impact on primary school students' intentions toward including peers with physical disabilities in PE, while considering their familiarity with disability.

Methods: Participants included 105 fifth-grade pupils of a primary school (mean age 11 ± 0.2 yrs) who were randomly assigned to a control (33 boys, 29 girls) or an intervention (25 boys, 18 girls) group. The intervention consisted of 8 PE lessons developed during 8 consecutive weeks, and it was based on paralympic boccia and sitting volley (adapted to pupils). Moreover, the intervention included an education intervention comprising information, multimedia material,

and the simulation of physical impairments. Participants responded twice to a questionnaire investigating sociodemographic information, their attitudes, self-efficacy, and intention toward inclusion of peers with physical disability in PE, and the Children's Attitudes towards Integrated PE-Revised. A RM-MANOVA was conducted to investigate gender, group, and familiarity with disability main effects, and the time \times group \times familiarity interaction effect, on all the variables.

Results: Girls reported higher values across all measures in comparison to boys ($F = 3.5$; $p = 0.011$). Results revealed a time \times group effect ($F = 7.4$; $p < 0.001$) with the intervention group reporting significant improvements in all the measures. The intervention efficacy was enhanced by a significant effect of familiarity with disability (time \times group \times familiarity), with children used to interact with a peer with disability reporting greater improvements in the investigated variables ($F = 7.0$; $p < 0.001$).

Conclusions: These findings could support primary school PE teachers in implementing paralympic sports in PE. Further, paralympic sports could assist in educating students to develop and perform appropriate behaviors towards their peers with disability, to facilitate their mutual development and learning.

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PP52A—Pattern of coordination of torque production during time to exhaustion tests in competitive cyclists

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Purpose: Marginal changes in the pattern of coordination of torque production during cycling can represent a significant change for performance success. Such changes, however, are often evaluated in moderate and heavy exercise intensity domains. Thus, we aimed to investigate if and how coordination profile affects cycling performance at the maximal intensity (i.e., severe exercise intensity domain) from both kinetic and temporal coordination perspectives.

Method: After a preliminary session for determining maximal oxygen uptake (VO₂max) and maximal power output (MPO), 15 national-level cyclists performed a time-to-exhaustion (TTE) trial at their respective MPO on an electronically braked cycle ergometer (Lode Excalibur Sport with PFM, Groningen, the Netherlands). The phase coordination index, accuracy, and consistency were determined from the phase relationship between the torque peak timing of the left and right legs. The intraindividual variability was calculated as the average standard deviation of torque from each cycle. A one-way ANOVA with Bonferroni's post hoc test was used to compare the four sections of tests. Pearson's correlation tests were also applied to correlate the coordination parameters versus cycling performance reflected by the TTE trial. Statistical significance was set at $P < 0.05$ (R software package).

Results: TTE values ranged from 113 to 188 s (average: 138.8 ± 21.1 s). Average accuracy and consistency were respectively $0.49 \pm 0.22\%$ and $0.70 \pm 0.33\%$, resulting in an overall phase coordination index value of $1.19 \pm 0.55\%$. The average intraindividual variability during the trials resulted in $37.6 \pm 1.7\%$. No differences were observed in all coordination parameters across the sections of the trial ($P > 0.05$). No significant correlation has also been found between the phase coordination index and TTE ($r = 0.42$; $P = 0.112$). Conversely, intraindividual variability showed a large, positive correlation with TTE ($r = 0.068$; $P = 0.005$). Interestingly, a very large correlation was found between intraindividual variability in the last quarter of the trial and TTE ($r = 0.76$; $P = .001$).

Conclusion: The phase coordination index showed no correlation with cycling performance at maximal intensity. Further analyses at different intensities and conditions are needed to establish the role of bilateral coordination in cycling performance. Measures of kinetic coordination, however, showed to be largely related to cycling performance, particularly at the onset of exhaustion at maximal intensity, and showed good potential for being integrated into the assessment and monitoring of competitive cyclists.

PP52B—Fat mass estimation in athletes: bioimpedance or anthropometry?

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Purpose: Bioelectrical impedance analysis (BIA) and anthropometry are considered alternatives to well-established reference techniques for assessing body composition. In team sports, percentage of fat mass (FM%) is one of the most informative parameters and a wide range of predictive equations allow its estimation through both BIA and anthropometry. Although it is not clear which of these two techniques is more accurate for estimating FM, the choice of the predictive equation could be a determining factor. To date, several predictive equations are available for the general and athletic populations, as well as for specific sports. The present study aimed to examine the validity of BIA and anthropometry in estimating FM with different predictive equations, using Dual X-ray Absorptiometry (DXA) as reference, in a group of futsal players.

Methods: Sixty-seven high-level male futsal players (age 23.7 ± 5.4 years) underwent BIA, anthropometric measurements, and DXA scan during the in-season period. All anthropometric measurements were performed by a level I-accredited anthropometrist (F.C.) according to the ISAK protocol. Four generalized, four athletic, and two sport-specific predictive equations were used for estimating FM% from raw bioelectrical and anthropometric parameters. DXA-derived FM% was used as reference.

Results: BIA-based generalized equations overestimated FM% (ranging from 1.13 to 2.69%, $p < 0.05$), whereas anthropometry-based generalized equations underestimated FM% in the futsal players (ranging from -1.72 to -2.04%, $p < 0.05$). Compared to DXA, no mean bias ($p > 0.05$) was observed using the athletic and sport-specific equations. Sports-specific equations allowed for more accurate FM% estimations than athletic predictive equations, with no trend (ranging from $r = -0.217$ to 0.235, $p > 0.05$).

Conclusions: Regardless of the instrument, the choice of the equation determines the validity in FM% prediction. In conclusions, BIA and anthropometry can be used interchangeably allowing for valid FM% estimations provided that athletic and sports-specific equations are applied.

PP52C—The role of physical education on physical activity promotion on early adolescents during the lockdown: an action-research

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Purpose: The present observational study was carried out to investigate the impact of a physical education intervention on physical activity levels (PAL) during lockdown.

Methods: A convenience sample of 156 early adolescents (age range 11–14 years) attending a secondary school was recruited. PAL data were collected by means of the IPAQ-SF questionnaire administered pre and post a physical education intervention program aiming to promote active lifestyles during lockdown. Descriptive statistics were calculated for all the variables. Subsequently, as recommended from the IPAQ scoring protocol, students were classified as physically inactive (MET/week: < 700), sufficiently active (MET/week: 700–2519), and active (MET/week: > 2519). Students' t-test for paired samples were computed to investigate the difference in PAL pre and post intervention in relation to the school year.

Results: Paired data of 40 (1st year), 32 (2nd year) and 25 (3rd year) students were collected. Among the 1st year students pre intervention 6(15%) were inactive, 18(45%) sufficiently active and 16(40%) very active; post intervention 2(5%) were inactive, 12(30%) sufficiently active and 26(65%) very active. For 2nd year students it emerged that pre intervention 4(12.5%) were inactive, 9(28.1%) sufficiently active and 19(59.4%) very active; post intervention 2(6.3%) were inactive, 7(21.9%) sufficiently active and 23(71.9%) very active. Finally, among 3rd year students pre intervention 7(28%) were inactive, 8(32%) sufficiently active and 10(40%) very active; post intervention 3(12%) were inactive, 9(36%) sufficiently active and 13(52%) very active. From the Student's t-test it emerged that only for first year students the intervention was statistically significant ($p < 0.05$).

From a deeper analysis results revealed that among 1st year students 2(5%) and 3(7.5%) of inactive became sufficiently active and very active, respectively, and 11(27.5%) of sufficiently active became very active. Among 2nd year students 2(6.3%) inactive became sufficiently active and very active and 4(12.5%) of sufficiently active became very active. Finally, among 3rd year students 3(12%) of inactive became sufficiently active and very active and 5(20%) of sufficiently active became very active.

Conclusions: Physical education has the potential to contribute to the promotion of active lifestyles fundamental in helping youth coping with stressful situations and preventing detrimental effects of sedentary behaviors on preadolescents' emotional, social, and cognitive skills development.

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PP53A—Assessment of exercise impact on jugular venous pulse by an innovative cervical plethysmography

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Purpose: The jugular venous pulse (JVP) is a crucial parameter of efficient cardiovascular function [1]. The JVP waveform was obtained non-invasively by an ultrasonographic scan of the internal jugular vein in microgravity detecting both cardiac filling and cerebral venous return [2]. Recently has been demonstrated the reliability of JVP trace by a non-operator dependent wearable plethysmography in healthy subject [3]. The aim of the present work is to study the feasibility of a JVP plethysmography system to monitor exercise.

Methods: Twenty healthy subjects (mean age 25 ± 3 y.o., BMI: 21 ± 2) underwent to cervical strain-gauge plethysmography synchronously with electrocardiogram in supine, upright, during leg-press machine and aerobic exercise (2 km walking test). The focus was on a and x peaks of the JVP waveform since they represent the heart filling, and the on Δax which is the difference between the two. Furthermore, an analysis of the distribution of the Δax over the time was performed for all the activities, to observe if the amplitude of this Δax changes according to the exercise duration.

Results: Significant differences were found between the JVP waveform during supine, standing, leg press and walking, as follows: peak a: 0.5 ± 0.1 , 0.3 ± 0.1 , 1.3 ± 1.2 , 4.7 ± 2.8 ($p < 0.0001$); peak x: -0.6 ± 0.2 , -0.3 ± 0.1 , -1.6 ± 1.5 , -4.3 ± 2.3 ($p < 0.0001$); Δax : 1.1 ± 0.3 , 0.6 ± 0.2 , 2.9 ± 2.6 , 9.1 ± 5.1 ($p < 0.0001$) respectively. Moreover, the distribution of the Δax over the time during walking presents a linear correlation with the time of exercise exposure.

Conclusions: Our findings demonstrate that the plethysmograph sensor is workable both in static and dynamic condition. This could be of particular importance for exercise training monitoring, although further technological advancement is required for a widespread use of non-invasive JVP waveform.

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PP53B—Is physical performance affected by the sleep duration of the previous night? a cross-sectional study

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Purpose: Sleep is a key process for human homeostasis as it is able to regulate molecular mechanisms which are basic for life. From this, it follows that an excessive deviation of the amount of sleep from that recommended by the guidelines can generate chronic health

problems, as well as fatigue and difficulties in recovery processes. The literature agrees on the relationship between chronic sleep restriction / deprivation and reduced physical performance abilities⁽¹⁾; however, it seems that the quality and quantity of sleep only of the previous night of the performance have no effect. Nevertheless, the studies in the literature focus mainly on specific sports abilities or field tests and do not consider the moment of the day when the performance is requested. The purpose of this study was therefore to investigate in depth with objective methods and laboratory tests on the relationship between the Actual Sleep Time (AST) of the night before the test and performance capacity in the morning and in the afternoon.

Methods: 32 young adults (23 females, 9 males; age = 21.9 ± 3.6 ; BMI = 22.83 ± 2.86) were recruited. The participants underwent 3 tests able to objectively determine strength (Handgrip Strength Test), endurance (Åstrand Test) and balance (m-CTSIB, Modified Clinical Test of Sensory Interaction in Balance⁽²⁾). In particular, the latter allows to evaluate the static balance of a subject by means of a stabilometric platform, which determines an oscillation index. The 3 tests were performed once in the morning (9:00 a.m.) and once in the afternoon (5:00 p.m.). AST was objectively evaluated by actigraphy.

Results: Linear regression analyzes were performed. In accordance with the literature, no statistical significance emerged from the relationship between the AST and the results of the tests carried out in the morning. However, as far as the p.m. performances are concerned, the balance was significantly influenced by the amount of sleep of the night prior to the test ($p < 0.05$; $r = 0.36$). No statistically significant results emerged as regards endurance and strength capabilities.

Conclusions: Although this study presents some limiting factors, such as the sample size and its distribution in terms of sex, it can be assumed that the fatigue deriving from a short sleep duration is displayed more in the afternoon than in the morning, in coordinative but not in endurance and strength tasks.

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PP53C—Can a complex physical activity program impact children’s arithmetic problem solving and reasoning abilities?

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Purpose:

Research has shown that higher levels of physical activity are associated with better cognitive performance in children. However, the benefits of physical activity on academic achievement and specifically on mathematics performance need to be further explored. Therefore, this study aimed to investigate the effects of a Complex Physical Activity (CPA) intervention program, including cognitive involvement, on children’s mathematics performance.

Methods:

Participants were 128 children (aged 12–13 years) attending the third class of three middle schools. They were randomly allocated into a CPA intervention ($n = 64$) or a wait list control group ($n = 64$) to whom was given a regular and easy-to-perform activity program. At baseline and after the intervention, students’ physical fitness was measured using a battery of standardized motor tests (20-m shuttle run test, curl-up test, push-up test, and sit and reach test). In addition, the AC-MT 11–14 test was administered to allow a standardized and comprehensive assessment of arithmetic problem solving and arithmetic reasoning abilities.

Results:

In comparison to the control, the intervention group showed significant improvements in comprehension and production, arithmetic reasoning, and problem-solving, as well as in physical fitness ($p < 0.001$). No significant changes were found in the control group.

Conclusions: In conclusion, findings showed that a 12-week CPA intervention program improves Math performance in children of the third grade of middle school. CPA intervention may be an effective method to improve academic performance and avoid student failure.

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PP54A—Comparison of synthetic metrics assessing gait stability in parkinson’s disease

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Purpose: In this work, we defined synthetic indices as biomechanical indices, able to provide an overall assessment of dynamic stability during gait. These metrics are commonly applied in studying movement disorders, such as Parkinson’s disease (PD). However, the results of these studies are sometimes discrepant and are carried out regardless of the levodopa intake. Here, we wanted to compare the sensitivity of different synthetic indices in individuals affected by PD before and after the levodopa intake (OFF and ON conditions, respectively). Specifically, we calculated the values of the Harmonic Ratio (HR), the Jerk Ratio (JR), and the Golden Ratio (GR) which assess the harmony and the smoothness of gait. Furthermore, we also calculated the Trunk Displacement Index (TDI), a new gait parameter that we have recently implemented, which assesses the displacement of the trunk with respect to the Centre of Mass (COM). Lastly, in order to evaluate their clinical meaning, we tested whether there was a

relationship between the indices analysed and the Unified Parkinson's Disease Rating Scale-III (UPDRS-III) clinical scale scores.

Methods: Through a stereophotogrammetric system, we acquired the 3D- gait analysis data of 21 PD patients. The statistical analysis was carried out in MATLAB. We performed a two-sided Wilcoxon signed rank test to compare the values of the HR, JR, GR and the TDI of the PD patients in OFF and ON conditions. Moreover, we performed a Spearman's correlation analysis between the clinical improvement (i.e., the difference between the UPDRS-III scores in the OFF and the ON condition) and the kinematic improvement (i.e., the difference between the synthetic indices values in the OFF and ON conditions).

Results: Our results revealed that all metrics, except the Jerk Ratio, showed a significant difference before and after the levodopa intake. Interestingly, Spearman's correlation showed that only the TDI improvement positively correlated with the UPDRS-III improvement.

Conclusions: The TDI, GR and HR can be considered sensitive enough to detect motor changes induced by the levodopa intake. However, not all of them displayed a direct relationship with the motor improvement achieved with the pharmacological treatment. Here we showed that the TDI is the only synthetic measure able to show a direct correlation with PD clinical motor improvement.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP54B—Repeated-sprint ability training in ultimate frisbee players: comparison between two mesocycle periodization models

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Purpose: Repeated-sprint ability (RSA) can be improved in competitive ultimate frisbee players through frisbee-specific drills designed for physical training.^[1] To further elucidate the impact of general and sport-specific physical training on RSA in ultimate frisbee, this study aimed to analyze the effects of two 6-week training programs, both including traditional interval training and sport-specific conditioning drills, respectively based on a traditional vs. a block training periodization model.

Methods: Group A included 9 elite female ultimate frisbee players (age: 19.6 ± 3.0 years; height: 166.8 ± 6.8 cm; weight: 58.2 ± 6 kg) and 6 elite male players (age: 21.6 ± 3.2 years; height: 181.6 ± 6.0 cm; weight: 76.6 ± 9.5 kg), and they performed 6 weeks of traditional high-intensity interval training combined with sport-specific conditioning drills in the same session. Group B included 5 elite female players (age: 20.7 ± 3.2 years; height: 167.9 ± 6.1 cm; weight: 57.2 ± 3.9 kg) and 6 elite male players (age: 22.2 ± 2.5 years; height: 183.1 ± 3.7 cm; weight: 72.2 ± 9.5 kg), and they performed 3 weeks of traditional high-intensity interval training followed by 3 weeks of frisbee-specific drills. Training frequency (2 sessions/week) and volume were equal between the two groups. RSA was assessed before (T0) and after (T1) training, using a 6 × 20 + 20 m sprint protocol. Velocity of the fastest sprint (RSABEST), average velocity (RSAMEAN), and percentage decrement (RSADEC) across sprints were examined.

Results: Group A showed a small, though significant ($p < 0.05$), decrease in RSABEST (-0.39 km/h, -2.07%, ES = 0.26) and RSA-MEAN (-0.26 km/h, -1.40%, ES = 0.16), and a significant increase in RSADEC (+ 1.09%, ES = 0.79). Group B showed a significant increase in RSABEST (+ 0.29 km/h, + 1.53%, ES = 0.29) and

RSAMEAN (+ 0.23 km/h, + 1.29%, ES = 0.23), and a significant decrease in RSADEC (-0.83%, ES = 0.46). There were large, significant differences between groups regarding post vs. pre-training changes for all examined variables (RSABEST, ES = 1.24; RSA-MEAN, ES = 1.18; RSADEC, ES = 1.21).

Conclusions: The results suggest that performing general and sport-specific drills combined in the same session can allow to improve RSADEC in ultimate frisbee players, though involving slightly decreases in RSABEST and RSAMEAN. Conversely, performing a period of interval training followed by a period of sport-specific conditioning drills, with a block periodization approach, can elicit small improvements in RSABEST and RSAMEAN, but not in RSADEC. The present findings highlight how the structure of a mesocycle can induce different RSA responses in ultimate frisbee players, even with the same training volume, frequency, and exercises.

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PP54C—"Junior walking leader" a pilot project in Italian high school

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Purpose: The positive effects of walking at all ages are now known, especially in adulthood, and initiatives aimed at raising awareness of this practice are multiplying. The aim of the project is to raise awareness among students and train them so that they can in turn become promoters, in the community, of the good practice of walking. **Methods:** At the Alberto-Porro Institute of Higher Education in Pinerolo (Turin) in collaboration with the Regional School Office for Piedmont and with the "Health Promotion Structure" ASL TO3, the project called "Junior Walking Leader" was carried out on an experimental basis. The activity included a 4-h training program with theoretical and practical lessons including notions of anatomy and physiology, hygiene, walking technique. 28 students with an average age of 18 ± 1 years were involved, 86% females.

Results: At the end of the activity a questionnaire was administered whose answers were interesting. The activities carried out were adequate, of "simple" and "fun" execution (77.7%) and contributed to the enhancement of walking techniques, acquisition of good practices related to the activities and to improve sensitivity with respect to the practice of walking (96.3%). The interviewees declare that they consider walking groups an important and useful activity as a "stimulus to do activity" (44.4%) and to "feel better with themselves and with their body" (37%). Students were promoters in spreading the messages, purposes and contents learned with their families (70.4%) and also with their friends / classmates (37%). Students would advise everyone to take part in walking groups (40.7%), but in particular to an adult and / or elderly public (44.4%).

Conclusions: The results obtained in terms of satisfaction and effectiveness are undoubtedly encouraging. This leads us to think that the activity can be proposed to all educational institutions in the area, in particular to high schools with biomedical curvature, scientific high schools with a sporting focus and professional institutes with a socio-health orientation.

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PP55A—Effect of individualised whole-body vibration on the pistol shooter’s performance: a case study

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Purpose: Whole-body vibration (WBV) effects are well known in training and rehabilitation in terms of power, strength, balance and flexibility. This study aimed to investigate the acute residual effects on balance and muscle activation, by applying individualised WBV.

Methods: A female competitive shooter (age: 31 years; stature:178 cm; body mass:63 kg; body mass index:19.88 kg/m²) took part in the study The individual WBV magnitude was determined by recording the surface electromyographic activity (sEMG). WBV intervention was applied before the performance and the measurements were carried out on two different days, with (WBV)/without WBV (NO-WBV) during the performance. The postural control with synchronized sEMG (vastus lateralis, biceps femoris, tibialis anterior and lateral gastrocnemius) was assessed by measuring the body sway on the force platform. Shoot score was measured by integrating an optic sensor assembled to the pistol and an interactive target. The performance was analysed using a window of 1-s before that each shoot was triggered. The integrated variables (sEMG, body sway and score) were analysed during the entire period of performance (60 shoot in ~ 1 h). Different relationships were plotted between the variables measured (body sway, sEMG, score) over time.

Results: WBV tended to increase the score ($y=0.0015x+8.69$) in comparison to NO-WBV ($y=-0.0042x+9.3503$) over time. In addition, WBV decreased the forward-backward sway ($y=-0.12x+40.274$) whereas the NO WBV situation tends to increase the sway ($y=0.1607x+32.809$).

Conclusions: Individualised WBV increased the shooter’s performance over time after a single session of intervention. WBV intervention should take in account not only the intensity but also the optimal quantity of WBV intervention. Future studies should consider WBV as an alternative exercise in the training of the pistol shooter’s.

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PP55B—The effects of different warm-up strategies on jumping performance

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Purpose: It is widely recognized that the warm-up preceding high-intensity exercise is crucial to achieve optimal performance. The use of different warm-up strategies have been suggested to enhance muscle power performances through post-activation performance enhancement (PAPE). The aim of the present study was to compare different strategies of warming-up and their ability to maintain the jumping performance over time.

Methods: Twenty-four physically active healthy young adults were recruited (age 20.3 + 0.8 years; weight 71.1 + 10.1 kg; height 176.7 + 8.1 cm). Firstly, subjects underwent two tests: 1) a one-repetition maximum (1RM) test on a horizontal leg press and 2) a functional threshold power (FTP) test on a bike ergometer. After a period of familiarization with the execution of the counter movement jump (CMJ), subjects were randomly tested in 5 different conditions: 1) baseline, after pedaling 5 min at 50% of FTP; 2) high intensity (HI), after 5 min pedaling at 50% of FTP + 6 min at 110% of the FTP; 3) post activation performance (PAP), after 5 min pedaling at 50% of FTP + 5 sets of 3 repetitions at 75% of the 1RM; 4) medium intensity active recovery (MIAR), after 5 min pedaling at 50% of FTP + 20 min pedaling at 80% of the FTP; 5) control, after 12 min pedaling at 50% of FTP. After every warm-up subjects performed three CMJs at 5th, 15th, 30th and 45th minutes. The best of the three jumps was collected for further analysis. The flight height (FH, in m), the average rate of force development of the eccentric phase (RFD-eccAVG, in N/s), the peak power output (P-peak, in W) and the stiffness (in N/m) of the CMJs were compared between conditions and over time.

Results: All the warm-ups tested (PAP, MIAR and HI) showed significant higher values than control ($p < 0.05$), except for stiffness. FH and P-peak showed the best performance at the 5th minute and then decreased over time. RFD-eccAVG and stiffness remained constant over time. No significant differences were found between PAP, MIAR and HI warm-up conditions.

Conclusions: Despite the lack of specificity, the three different types of warm-up affected positively the performance parameters of the CMJs, indicating that some kind of warm-up is necessary to improve jumping performance. Moreover, performance decreased over time in the same way, suggesting that it is not advisable to sit still for too long after a warm up in order to maintain CMJ performance. Stiffness was not affected by warm-up strategies, likely because it strongly relies in musculo-articular properties rather than in warm-up strategies. Finally, the participants were not athletes, so athletes specifically trained for jumping may obtain different results.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP55C—From spontaneous-expressive body movement to improving motor skills at primary school: a preliminary study

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Purpose: The scientific literature on the expressive potential of the body in movement certifies its ability to foster the acquisition of a more effective self-awareness in relation to others and the environment. The spontaneous/exploratory motor activities that the child engages in if not hindered, allow for an integrated mind-body approach that pursues the pleasure of experiencing the own corporeality in relation to the world, space and objects (Gamelli, 2013). The study aimed to promote and observe, in the educational context of primary schools, dance movement workshops that, far from performance-oriented practices, promoted the implementation of body-motor and expressive movement activities, in a creative and spontaneous key. The aim was to understand whether the implementation of dance movement activities can foster the consolidation and development of old and new motor skills.

Methods: The pre-experimental investigation involved a convenience sample, 81 children aged 8 and 9 ($M = 27$; $F = 54$) divided into control and experimental group, the latter involved in a dance movement workshop. The investigation included the administration of the MOBAK 3–4 test, at entry and exit, which investigated the body in movement, in relation to space and objects.

Results: The results of the pre- and post-test were computerised and organised in the SPSS environment. A descriptive statistic and an ANOVA with comparison between the groups was elaborated. From the analysed data, a general improvement of the mean values emerged from the comparison between the experimental group and the control group for all areas of competence, with a greater significance for the area of 'moving' (p -value 0.05).

Conclusions: The scientific literature supporting the centrality of the body, in the promotion of integral personality development, is contributing to significantly influence the national regulatory choices on the figure of the specialised primary school teacher (D.M. 90/2022). In this scenario, it is important for research to promote and study the outcomes of educational practices that enhance the role of the body, starting from a renewed conception of physical education at school. The preliminary study aimed to investigate the potential of a different way of understanding movement at school, moving away from performance practices in favour of spontaneous activities oriented towards creative-motor performance. The results, although not significant, provide encouraging data that suggest extending the experimentation to a larger sample and over a longer period of time, so as to increase the workshop proposals.

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PP56A—Gait variability index at different running speeds

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Purpose: Gait variability (GV) is usually defined as a measure of inconsistency of muscular activities or body segmental movements during repeated tasks. Hence, GV might serve as a relevant and sensitive measure to quantify adjustments of running control. Anyway, has not yet been clarified if the GV is related to the speed to exploit effective running performance.

Methods: To this aim, 16 runners (age 35 ± 6 years, body mass 70 ± 6 kg, body height 1.75 ± 0.06 m) participated in this study. Each participant after three days of a simulated 10-km (average speed, TT) on asphalt was assessed randomly on three intensities running speed for 15' at $-10\% = / + 10\%$ of TT with 5' of passive recovery in-between. For each running condition, heart rate (HR) was monitored beat-to-beat (Garmin) while the RPE (CR-10) after each trial. Conversely, kinematic analysis was assessed with two foot-pods (RunScribe) about Contact Time (CT), Flight Time (FT), Step Length (SL), Step Frequency (SF) and Gait Variability (GV) as Phase Coordination Index was determined, while heart rate was normalized as HR%max. To assess differences for each variable on the three running conditions (as factor) a Univariate ANOVA was used. Rejection level was set at $\alpha < 0.05$.

Results: The TT was 14.16 ± 1.65 km·h⁻¹ with a RPE of 8.94 ± 0.36 a.u. and HR $95.25 \pm 5.83\%$ HRmax. RPE and HR increased at the speed increased (RPE $5.30 \pm 0.67/8.15 \pm 0.34/9.20 \pm 0.26$ a.u., HR $82.27 \pm 4.72/89.65 \pm 3.84/94.67 \pm 4.78$ %HRmax, with $F_{1,14}=192.066$, and $\eta^2= 40.725$ with $P=0.0001/ F_{1,14}=19.491$, and $\eta^2 = 388.840$ with $P = 0.0001$; respectively). CT decreased at the speed increased ($265 \pm 19.44/249 \pm 16.86/241 \pm 16.97$ ms, $F_{1,14} = 4.960$, and $\eta^2 = 1571.134$ with $P=0.015$). FT, SL and SF increased at the speed increased ($95.24 \pm 19.64/105.36 \pm 18.99/118.65 \pm 16.07$ ms, $1.29 \pm 0.08/1.37 \pm 0.07/1.44 \pm 0.11$ m, $2.79 \pm 0.08/2.84 \pm 0.08/2.92 \pm 0.07$ Hz, $F_{1,14} = 4.114$ and $\eta^2 = 1378.231$ with $P = 0.028$, $F_{1,14} = 6.532$ and $\eta^2 = 0.052$ with $P = 0.005$, $F_{1,14} = 8.118$ and $\eta^2 = 0.49$ with $P = 0.002$; respectively). Conversely, GV was 2.37 ± 0.52 % (worse) at 12.37 ± 1.13 km·h⁻¹, $2.10 \pm 0.46\%$ (best) at 14.16 ± 1.65 km·h⁻¹, $2.72 \pm 0.61\%$ (worse) at 15.11 ± 1.38 km·h⁻¹ ($F_{1,14} = 8.320$ and $\eta^2 = 34.372$ with $P = 0.002$).

Conclusions: While the bioenergetic variables changing linearly when the speed increased, the better GV was at the same speed on 10 km running race. Whereas the GV gets worse at the increased external/internal loads, trainer and sport scientist can use this tool as monitoring of the training load adaptations.

PP56B—Can resistance training influence flexibility? A systematic review

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Purpose: Strength and flexibility are widely recognized as key components of physical fitness (U.S. Department of Health and Human Services, 2018), and they are both important predictors of health-related quality of life (Moratalla-Cecilia et al., 2016; Musalek & Kirchengast, 2017; Uemura & Machida, 2003). But what is the effect of resistance training on flexibility? Eccentric strengthening training can increase the fascicle length of the muscles and the ROM of the joints involved (Potier et al., 2009), while concurrently increasing strength. On the other hand, the effect of concentric and isotonic resistance training on joint flexibility is still debated.

Methods: A systematic search was conducted on 10 databases and search engines, including PubMed, Scopus and SPORTDiscus. Inclusion criteria were: (1) Age \geq 18; (2) Healthy participants; (3) Resistance training as intervention for at least 4 weeks; (4) Any measure of ROM or flexibility as outcome. The restricted maximum likelihood method was used to estimate the ES of interest, hypothesizing a three level model, with the single ES nested at the study level. Moderator analysis was conducted by testing the significance of one variable at a time against the intercept-only model (using the likelihood ratio test). All analyses were conducted in the statistical environment R.

Results: 27 studies were included. The point estimate of ES of the intercept only model was 0.6922 (95%CI: 0.4274–0.9570). The total amount of heterogeneity (I²) was 60.34%, with a sampling error variance of 0.277 and a between-study (I²level 3) heterogeneity of 38.27%. The final reduced model included only 14 studies and estimates an overall mean ES = 0.6865 for trunk flexibility, and ES = -0.0118 for upper limb flexibility, increased by 0.064 for each additional second of rest time between sets.

Conclusions: The positive overall ES estimated from the 27 studies included supports the hypothesis of an effect of Resistance Training on joint flexibility in the studied population. Contrary to our initial hypotheses, there seems to be no effect for age ($p = 0.8645$) or activity level ($p = 0.1439$). The incomplete reporting of some covariates (e.g., exercise intensity) in many studies carried a loss of information and lead to an increased width of the confidence intervals. It is therefore possible to improve flexibility, especially trunk flexibility, with resistance training, with important implications for activities of daily life and exercise protocols prescriptions.

PP56C—A study on the implication of motor practices in teaching: a proposal for a motor laboratory for the improvement of graphomotor skills in developmental age

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Purpose: The objective of the study is to evaluate graphomotor abilities in the developmental age through the use of the BHK scale (Di Brina & Rossini, 2021). In particular, this study aims to study the effects of a treatment programme involving the introduction of motor laboratories to improve graphomotor skills and for the achievement of greater body awareness to promote the use of the whole body in the motor act of writing and to optimize the motor skills. In order to satisfy the hypothesis that this type of methodical application has had the expected results, the final phase has seen the realization of a comparison carried out before and after the experimentation, making use of an experimental group and a control group.

Methods: The qualitative-quantitative study was conducted on the field, subjecting children to a plan of games and motor practices developed according to the Jeannot method (Jeannot, 1976), following a precise and progressive time scan. The method allows the subjects in the developmental age to learn playing and moving using the whole body and to write with it, retracing the movements and the preparatory directions that characterize writing in italics in a correct and fluid way, finding in those movements accurate and finalized also some of the basic motor schemes. The population under investigation consists of 74 primary school children aged between 8 and 9 ($M = 38$; $F = 36$), divided into control and experimental groups, the latter involved in the motor laboratory. The survey included the administration of the BHK scale.

Results: The results were computerised and organized in an Excel environment and then analysed in an SPSS environment. The thirteen parameters of the BHK were analysed by ANOVA analysis and compared by gender and class. Although P-Value is not gender-significant, the results are significantly higher by class for the write speed factor.

Conclusions: The results obtained show how proposing motor practices in teaching can potentially improve and facilitate both motor and writing learning, with particular attention to motricity in order to give it its pivotal and proactive role in the diacritic practices (Sibilio, 2011), since any type of skill can be consolidated only with continuous exercise, stimulation and repetition in order to become a functional skill (Pratelli, 2019). Finally, by means of systematic evaluations and planning of this type, the possibility of diagnosing developmental disorders such as dyspraxia and dysgraphia in a late manner is much more limited.

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PP57A—Statistical methods in sports science and exercise: a theoretical study

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Purpose: The increasing amount of research in the field of sports science and exercise emphasised the use of increasingly heuristic statistical methods appropriate to the aim in terms of qualitative, quantitative and qualitative-quantitative data. Often, a lack of knowledge of statistical tools and their appropriateness for data analysis, especially between the use of parametric and non-parametric statistical techniques, is encountered by researchers. This requires the indispensable use of statistical experts, who, for the comprehensive understanding of the research design, need the use of human and economic resources that could probably be used differently and more efficiently. The aim of this study was to provide a list of the most commonly used statistical methods in the sports science and exercise, focusing on the distinction between parametric and non-parametric statistical processing for both quantitative and qualitative research.

Methods: The method was the literature review with argumentative elaborations concerning the validity of the use of the statistical tool. Synoptic tables schematised the characteristics of the included studies with their statistical tools.

Results: For each statistical tool (parametric and non-parametric), a number of scientific articles relating to sports science and exercise concerning the individual research topics are shown.

Conclusions: These data allow the predisposition of potential guidelines for the better definition of research projects for the systemic use of statistical processing in the complete hypothesis of the study.

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PP57B—Gross motor coordination in Italian children and early adolescents

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Purpose

Although the complexity in the definition and assessment of coordination, its importance in learning motor skills, physical development, social integration, and health promotion is attested by extensive literature. Little is known about motor coordination in Italian children and adolescents, therefore we studied the characteristics of gross motor coordination (GMC) of the Italian youth population (6–13 years) assessed with the Körperkoordinations Test für Kinder (KTK) (Kiphard, 1974) and related to age, anthropometric characteristics and living setting.

Methods

GMC, BMI, physical activity (PA), and the characteristics of living setting (geographical area, population density and neighbourhood walkability) were analysed in 2,206 subjects (girls: $n = 1.050$) between 6 and 13 years old, recruited in 49 Italian schools in the northeast, Lazio, and Sicily.

Results

KTK's standardized values (MQ) tended to decrease with age ($r = -0.148$; $p < 0.001$) and showed differences by gender ($p < 0.001$), age ($p < 0.001$), and an interaction gender \times age ($p < 0.05$). Our MQ data were 13.36% lower than 1974's original standardized values. MQ level was reduced ($p < 0.001$) in:

(1) overweight/obese versus underweight /normal weight ($F = 37.66$); (2) older versus younger ones ($F = 25.25$); (3) girls than boys ($F = 67.22$).

KTK's overall raw score (RS) increased with the age of the subjects ($p < 0.001$), progressively reducing, however, the entity. RS showed differences by gender ($p = 0.015$) and age ($p < 0.001$) without interaction gender \times age. In the four KTK sub-tests, girls performed better than boys in "Walking Back" ($p < 0.001$), while the opposite occurred in the other three ones ($p < 0.001$).

Results revealed that Lazio children had higher BMI than Northern and Southern children ($\eta^2 = 0.01$). Moreover, Northern children showed the highest motor quotient ($\eta^2 = 0.148$) and PA level ($\eta^2 = 0.02$). Lower MQ, lower PA level and living in a rural setting and a car-dependent neighbourhood seemed associated with a higher relative risk for obesity.

Conclusions

These findings can be a guidance tool to help physical education teachers and coaches plan individualized interventions for developing motor skills across childhood. They also inform policymakers on the evolution of one of the least studied motor capacities, fundamental for development and health. Future research perspectives include verifying the applicability of KTK in a population aged 14–18 and its discrimination capacity in various sports.

PP57C—Teaching net gameplay skills to elementary school children

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Purpose: Assessing the effect of different teaching approaches on the development of gameplay skills related to net games in elementary school children.

Methods: A quasi-experimental design, with a nonequivalent control group and longitudinal assessments, was used. The study was six months long and involved 67 children (34 girls, mean age: 9.35 y). To support the ecological validity of the study, the experimental group (EXP) was composed of the children of two intact classes ($n = 36$); these children followed a physical education (PE) process developed according to the Tactical Games Model. The control group (CON) was composed of the other intact classes of the same school year; the PE process delivered to this group was mainly focused on the development of ballistic skills and on the practice of net games. Both groups followed ten lessons.

Assessments were performed before the study began (Pre), at the end of the lessons (Post), and twenty days after the Post (RePost). Gameplay skills were assessed by means of the GPAI tool. Specifically, game involvement (GI) and game performance (GP) were computed and examined as a proxy of the overall effect of the teaching approaches on gameplay skills. RM-ANOVA was used to assess overall within-students differences per group and Bonferroni-Holm tests were eventually performed to identify changes between assessments. Effect size (ES) and its 95% Confidence Interval (CI) were estimated for each significant difference.

Results: Significant results were identified for GI and GP for the EXP. In detail, GI improved throughout the study, with moderate improvements between Pre and RePost (ES: 0.62, CI=[0.12, 1.12]). GP showed a large improvement due to the lessons (ES=1.14, CI=[0.49, 1.79]) and an overall medium improvement from the start (Pre) to the end of the study (RePost) (ES=0.62, CI=[0.03, 1.20]). For what concern the CON, no significant effects resulted from the tests. However, PE lessons positively affected both indicators, but GI showed the greatest improvements.

Conclusions: The use of a model-based approach guarantees more improvements in gameplay skills than unstructured teaching. GI seems the indicator with the most regular increase under both approaches, but the GP scores of children enrolled in TGM lessons increased in the biggest way. The end of the teaching-learning process had not the same effect on both indicators and groups, and it confirms how the learning related to PE process follows a non-linear pathway.

PP58A—The role of emotional states and mental techniques in dancesport: a systematic review

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Purpose: Psychological parameters are relevant in dancesport practice. The emotions perceived by athletes during competition can significantly influence the outcome of sport performance, as they can support the sport action or block it. Therefore, the analysis of emotions is essential to understand how emotions can support sport performance. This systematic review aimed to summarize the studies examining the influence of emotional states on dancesport

performance and the use of mental techniques to improve psychological preparation to face the competition.

Methods: We used Web of Science, Scholar, Scopus and Pubmed databases for searching studies. The screening of the articles was performed following three phases: reading the title, the abstract and the full text. Screening processes were summarized within the flowchart PRISMA 2020. Only articles met our eligibility criteria were included in the review.

Results: Only 9 articles met our inclusion criteria. The results demonstrated that anxiety was the most common pre-competition emotional state of high-level dancesport athletes, followed by stress, arousal, concentration and self-confidence. The mental techniques founded for psychological preparation in dancesport were mental contrasting, self-talk, neurofeedback, the nine step connection model and Cantón's Giraffe model.

Conclusions: Considering the athlete's psychological state can affect performance in dancesport, it is important to monitor these factors in order to improve one's performance. Several mental techniques can be tested to improve the psychological aspects of the athlete. Further research is needed to better understand the effects of these parameters on dancesport performance, especially in mid-low-level athletes.

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PP58B—Speed profile analysis in speed climbing performance

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Purpose: Speed climbing involves optimization of the velocity of the ascent and the trajectory path during the performance. The ability to maintain the highest speed in each step is essential not only for the final time but also to avoid technical errors that can lead to the athlete's fall.

Methods: To examine this, 10 elite speed climbing athletes (5 male and 5 female, age: 25 ± 2 and 18 ± 3 years for male and female, respectively) of the Italian national team performed 4 maximal trials on a standard 15 m speed climbing wall. A motorized unassisted towing device (1080 Motion, Lidingö, Sweden) was tied behind the harness. During the ascents, speed and acceleration profiles were recorded. Sprinting mechanics were also analyzed using a high-speed video camera (Panasonic Lumix DC-TZ, Italia, Milano) through the following technical aspects: the number of hand moves (overall and alternately), the number of leg moves (overall, using holds and using friction), as well as the differences in climbing technique for men and women.

Results: Mean ascent time was 6.02 ± 0.19 s and 7.83 ± 0.60 s for males and females, respectively. In male climbers, after the start and a turn to the left, we observe a first acceleration followed by a dyno, a second acceleration followed by a second dyno, and the final. The speed peaks are reached during the two acceleration phases (mean values of 3.43 ± 0.07 m/s and 3.53 ± 0.28 m/s), while speed decreases very strongly concurrently with the two dyno moves. In female climbers, less clear speed peaks (mean values of 2.76 ± 0.25 m/s) are observed, and greater slowdown after the dyno. Concerning the

technical aspects, the climbing mechanics show a high standardization within the group of male climbers (hands moves: 5 right hand, 6 left hand, 3 both hands; foot moves: 12 using holds, 4 using friction). In the group of females, greater variations in the ascent technique were observed among the athletes (hands moves: 5 ± 1 right hand, 5 ± 1 left hand, 5 both hands; foot moves: 15 ± 2 using holds, 5 using friction).

Conclusions: The speed profile analysis in speed climbing may help to highlight potential deviations from an optimal climbing path and shows the moves where the ascent stalls, providing coaches and climbers with helpful feedback on trial. The conservation of the speed on the various phases of the track, indeed, is recognized to be one of the key factors for performance.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

PP58C—Relationships between motor creativity, healthy weight, music specialization in primary and secondary school students

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Purpose: Children with a high level of motor competence are more likely to have an active lifestyle which positively influences their psychophysical wellness. The highest manifestation of motor competence is motor creativity. In a vision of a transdisciplinary school, musical teaching could represent a valuable tool for developing creativity and motor competence. The aim of the present cross-sectional study is to investigate whether a music specialization in primary and secondary school can enhance motor competence and motor creativity with a special emphasis on age, gender and BMI.

Methods: In the present research, 163 primary (n = 96) and secondary (n = 67) school students were recruited (students with music specialization = 58, students without music specialization = 105, girls = 83, boys = 80). Körperkoordinationstest Für Kinder test (KTK) and the Divergent Movement Ability test (DMA) were used to assess respectively coordination and motor creativity, while differences in rhythmic ability due to music specialization were investigated by the Mira Stambak test (MS). Each participant familiarized with each test and repeated it on two different days to assess reliability.

Results: All tests demonstrated good reliability. Interactions with music specialization was found for age (DMA Locomotor task: $p = 0.020$; DMA Stability task: $p = 0.001$). Furthermore, although no interaction was observed, main effect for BMI was detected in DMA (Locomotor task: $p < 0.001$; Stability task: $p = 0.005$, Manipulative task: $p = 0.033$) and in KTK (walking backward: $p = 0.015$, hopping for height: $p < 0.001$, jumping from side to side: $p < 0.001$, moving sideways $p = 0.034$, normalized MQ: $p = 0.019$), while main effect for music specialization was also found in MS ($p < 0.001$).

Conclusions: Students who attended the music specialization were more creative than peers and also presented a higher perceptive rhythmic ability due to the longer time spent in music classes. Moreover, these results are mostly influenced by age. Indeed, motor creativity presents higher levels in secondary school students with music specialization, probably due to more years of music practice. However, overweight and obese students had a lower level of

coordination and motor creativity regardless of music specialization. In conclusion, the music practice could represent an excellent example of school transdisciplinary to enhance motor creativity.

PP59A—Using field tests to verify the possible equivalence among different tests for complementary functionality: a pilot study on yo-yo endurance test, capanna-sassi test and cooper test

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Purpose: The monitoring of the improvement of physical qualities during training period is based on specific tests that reproduce also the sport skills, performance models and physiological demands. Therefore, it is essential to know which tests to use and their differences, as well as the possible equivalence for interchangeable function. The problem arises from these differences, namely understanding even if using all the tests, in different periods of the year, it is possible to indirectly obtain an equivalent measure from the other tests. The aim is to verify whether it is possible to find an equivalence between the three tests administered to then indirectly derive the value of the other two, so as to reduce monitoring times and thus optimize training programming.

Methods: Three field tests (yo-yo endurance test, Capanna-Sassi test and Cooper test) were administered to fifteen-years-old amateur male soccer players.

Results: From the analysis of the data obtained, a significant and positive correlation emerged between the Cooper test and the yo-yo endurance test ($r = 0.78$; $p < 0.01$) and a significant but negative correlation between the Cooper test and the Capanna-Sassi test ($r = -0.54$; $p < 0.05$). On the other hand, a no significant and negative correlation was found between the yo-yo test and the Capanna-Sassi test ($r = -0.42$; $p > 0.05$).

Conclusions: The conclusion suggests the possibility of a limited use of this three tests during the training period of the monitoring phase. Consequently, it could be possible to obtain an indirect value by using a hypothetical mathematical function that puts in quantitative relation the different three measurements.

Acknowledgments: (non obbligatorio).

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PP59B—Salivary hormonal concentration on two distinct strength training VBT baseD

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Purpose: Different resistance exercise can stimulate different hormonal response. Hormonal response is associated with the intensity of exercise, volume of exercise and recovery. DHT increases in response to acute exercise. Testosterone and Cortisol response is specific to the resistance exercise protocol used. The aim of this study is to compare the effect of two different strength exercise VBT based on salivary DHT, Testosterone and Cortisol.

Methods: Ten resistance trained men from different sport or fitness activity were recruited to this study. All participants had a minimum strength training history of 2 years with back squat exercise. They were randomly assigned into 2 groups: 10%- Velocity Loss (VL) or Failure Training (FT). After ten minutes of incremental full squat warm up, both training groups completed one intervention using the back squat exercise. The 10%-VL group executed maximum number of repetitions for five sets of back squat at 75% of 1 RM. Every set ended when the barbell losses 10% of velocity recorded with linear encoder in the first repetition of the set. All subjects were constantly stimulated to move the barbell at maximum velocity as possible. The FT group executed maximum number of repetitions for five sets of back squat at 75% of 1 RM. Every set ended when the subject failed the last repetition. All subjects were constantly stimulated to complete the maximum number of repetitions as possible. After each set RPE were collected and session RPE were calculated. Saliva samples were collected before warm up (T0), at the end of training (T1), 15 min (T2) and 30 min after the end of training (T3). Salivary hormones concentrations were measured by ELISA Assay Kit.

Results: Salivary DHT, Testosterone and Cortisol concentration were not significantly different in the FT than for 10%-VL. Anyway, we can observe not significant differences in the mean concentrations of all hormones at different sample times related with the training protocol. In particular a tendency of cortisol increase from T0 to T4 and it was higher in FT protocol, whereas testosterone seems to decrease from T0 to T4 and was higher in FT protocol. The mean concentration of DHT was higher in FT protocol.

Conclusions: We can only speculate that these variations can be related to training protocols. Due to the small number of participants, statistical analysis was poor then this trend of hormones variations could be confirmed with a higher number of participants.

Acknowledgments:

References:

PP59C—Coordination, physical activity at vigorous intensity and inhibitory control. A control study on adolescents

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Purpose:

Physical activity plays a crucial role on the correct psycho-physical developments of subjects in evolutive phase. Researchers in the last few years focused on brain adaption achieved through interaction of physical activity and executive functions. Less than 20% of students aged from 13 and 15 years old reach the indications recommend by WHO. The aim of this study was to evaluate the impact of a chronic intervention focused on coordination activities followed by vigorous-intensity exercise on inhibitory control in a group of adolescents.

Methods:

A group of students aged between 15 and 16 years old ($n = 27$) took parts in this intervention. Students were evaluated with the Stroop-task on a computer at the beginning (T1, March 2022) and the end (T2, May 2022) of the intervention. The sample was divided in

Experimental Group (EG, $n = 7$) who practiced coordinative and aerobic activities in Open Skills modality at vigorous intensity and in active Control Group (CG, $n = 20$) which carried out a non-specific physical education class according to the academic curriculum. The whole sample was trained with practical and theoretical lessons on the RPE scale in the two weeks prior to T1. On a day of week 6 and 8 the EG filled the PACES-It questionnaire to evaluate the enjoyment during the activities.

Results:

The Stroop-task's results showed to which extent the EG has improved by physical interventions on the median reaction time ($p = 0.033$). The analysis on the PACES-It questionnaire showed higher average general preference in carrying out sport-specific activity over functional exercises in girls compared to boys.

Conclusions:

A physical education intervention has positive repercussions on executive functions, specifically on inhibitory control, with possible implications on academic performance. The nature of such an intervention seems to be a way to better comply with the physical activity guidelines indicated by WHO. More emphasis should be granted on the role of the enjoyment of performing any activity in an academic context.

PP60A—Differences in muscle quality between male and female elite field hockey players are more evident in the lower than in the upper body muscles

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Purpose: The present study was conducted to compare muscle morphology and performance between male and female elite Field Hockey players and to investigate the relationships between morphological characteristics of the muscles and performance.

Methods: Twenty-one male (M: 24.3 ± 3.6 years; 75.1 ± 8.5 kg; 176.8 ± 6.4 cm) and nineteen female players (F: 27.4 ± 3.9 years; 61.2 ± 7.4 kg; 164.4 ± 4.9 cm) were tested for muscle morphology of trapezius (TRAP) and vastus lateralis (VL) muscles. Muscle thickness (MT) and echo intensity (EI) were measured in both muscles. In addition, players were assessed for peak power at the bench press and sprint ability (30 m dash). All assessments were performed before the beginning of the European Cup.

Results: A significantly lower muscle thickness was detected in F compared to M players on VL (-20.3% ; $p = 0.004$) and TRAP (-19.9% ; $p = 0.001$). A significantly lower EI was detected in VL (-26.2% ; $p = 0.001$) in M compared to F, while no differences on this parameter were detected between the two groups in TRAP ($p > 0.05$). M were significantly faster than F in 30 m sprint ($p < 0.001$; 4.19 s and 4.81 s in M and F, respectively), and significantly more powerful at the bench press (476.2 W and 216.5 W in M and F, respectively). When the two groups were combined, significant correlations were detected between TRAP MT and bench press power ($r = 0.60$; $p < 0.001$), and between VL EI and 30 m sprint ($r = 0.74$; $p < 0.01$).

Conclusions: Results indicate that no differences exist between M and F on EI of upper body muscles, while differences are present in the lower body muscles. Thus, the performance gap registered in F compared to M players may be mainly related to muscle size in the upper body and to both muscle size and quality in the lower body muscles. Echo intensity of lower body muscles may represent an important parameter for sprint performance in elite Field Hockey Players.

Acknowledgments: The authors would like to thank the players of the Italian Field Hockey National Teams for their participation in the present investigation.

PP60B—A comparison between high and low cuff pressures on the recovery phase following blood flow restriction resistance exercise

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Purpose: The aim of the study was to compare the recovery response and muscle oxygenation of a blood flow restriction resistance exercise (BFR) session with high [HP: 80% of the arterial occlusion pressure (AOP)] and low cuff pressure (LP: 40% of AOP). Both exercise sessions included 4 sets to failure at 30% of 1RM with 30 s of rest between sets at the barbell preacher curl exercise.

Methods: Twelve resistance trained men (27.4 ± 5.0 years; 83.5 ± 11.6 kg; 176.6 ± 7.0 cm) with 8.3 ± 6.7 years of resistance training experience performed each protocol in a counterbalanced, randomized order. Maximal isometric force, muscle morphology and muscle soreness of the biceps brachii muscles were assessed at baseline (BL), 15-min (15P), 60-min (60P) and 24-h (24hP) post-exercise for each testing session. In addition, muscle oxygen saturation (SmO₂) was assessed during each training session.

Results: A significantly lower number of repetitions ($p = 0.013$) was detected in the 4 sets of HP protocol compared to LP. A significantly lower SmO₂ ($p < 0.001$) was detected in the recovery time between the sets in HP (mean: 47.6%) compared to LP (mean: 68.9%). No significant differences ($p > 0.05$) were detected between HP and LP for the minimum SmO₂ at the end of each set. In addition, no significant differences between the two trials ($p > 0.05$) were noted for isometric force, muscle morphology and muscle soreness at any timepoint. Following both trials however, a significant reduction in maximal isometric force ($p < 0.01$) and a significant increase in muscle thickness ($p < 0.01$) were registered at 15P and 60P.

Conclusions: Results indicate that, despite a high cuff pressure may allow a lower number of repetitions and induce a more ischemic condition compared to a lower cuff pressure, similar recovery responses may be registered following BFR protocols with different cuff pressures in trained men.

PP60C—Motor competence outcomes of the Canadian agility and movement skill assessment in sporting and non-sporting children: a preliminary study

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Purpose: Being motor competent is a fundamental step for an individual to become physically literate. It is worth noticing that engaging or not with sport activities routinely determines a different acquisition of complex movements that has to be monitored within a dynamic

environment (perhaps reflecting the childhood play). However, most of the current assessments focus on skills that are performed in isolation and surrounded by a static environment (Longmuir et al., 2017). In this wake, the Canadian Agility and Movement Skill Assessment (CAMSA) may represent an emerging assessment tool for verifying motor competence across complex movements and dynamic environment. The aim of this study is to examine the difference in motor competence (by CAMSA) between young individuals who are practicing (sporting) and those who are not practicing (non-sporting) sports regularly.

Methods: Fifty-four participants took part in the study. Among them, nineteen (11 males and 8 females) and seventeen (9 males and 8 females) regularly engaged in deliberate gymnastics artistic (G, 10.6 ± 2.7 h per week) and football (F, 6.8 ± 1.0 h per week) practice, respectively. Whereas the remaining eighteen participants (9 males and 9 females) performed little or no sport activity (N, 1.5 ± 1.1 h per week). Maturity offset (MO) was derived by the Mirwald's somatic equation. The CAMSA was employed to assess the actual motor competence of each participant. Completion time and skill score were then registered to compute the total raw score of the CAMSA.

Results: The skill score of G and F was similar and higher than N. After covariation for MO, the analysis showed a statistical difference in the total raw score among groups (G vs. F vs. N; $p < 0.001$, $\omega^2 > 0.14$). Specifically, post-hoc analysis revealed that G group performed significantly ($p < 0.01$, $d > 0.7$) better than F and N groups. No significant ($p > 0.05$, $d = 0.6$) difference was observed between F and C.

Conclusions: Bilateral, inter-limb and hand–eye coordination, and rhythmic movement are commonly found in gymnastics rather than football, which is asymmetric with prevalent foot-eye coordinative stimuli. However, although the dynamic environment is embraced by CAMSA assessment, total score based on time- constraints would add variability, consequently limiting the interpretation of an actual motor competence. This would also explain the non-significant difference between F and N against a different skill score.

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PP61A—Jump performance relates to maximal cycling workload in young alpine skiers

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Purpose: Both aerobic fitness and muscular power have been reported as crucial for elite alpine ski racing¹. To date, aerobic fitness has been mainly investigated in skiers using incremental cycling step test, while muscular power by the mean of jump testing such as countermovement jump (CMJ)¹. However, no research investigated the relationship between these two fundamental systems. Thus, our purpose was to study the relationship between the maximal cycling workload (MCW) and CMJ- derived metrics.

Methods: Sixteen young alpine skiers (gender: 7 F / 9 M; age: 16.7 ± 1.3 years; BMI: 22.8 ± 1.9 kgm⁻²) performed 2 CMJ trials using an Optojump system². First, the jump height (CMJH) was computed from the highest trial, as well as the jump peak mechanical power (CMJP) using the Johnson & Bahamonde formula³, including CMJH and participants' height and weight. Then MCW was determined through an incremental maximal cycling test performed at 80 rpm. After a 3-min warm-up (at 50 W for females and 75 W for males), the workload increased every minute with 15 W steps for females and 25 W for males until exhaustion. MCW was registered as the workload of the last step completed before exhaustion.

A stepwise regression model tested the relationship between MCW and CMJ-derived metrics. CMJH and CMJP were entered as continuous predictors, with a threshold to enter and remove terms equal to 0.15. The significance level was set to $\alpha = 0.05$.

Results: Both CMJH (36.2 ± 9.1 cm) and CMJP (2929 ± 1006 W) were included in the model ($R^2 = 84.9\%$) and resulted significantly positively correlated with MCW (282 ± 81 W) ($F = 5.9$, $p = 0.030$; and $F = 36.5$, $p < 0.001$ respectively). Follow-up individual linear regression models confirmed the relationships (CMJH: $R^2 = 45.5\%$, $F = 10.4$, $p = 0.006$; CMJP: $R^2 = 78.1\%$, $F = 49.6$, $p < 0.001$).

Conclusions: The presented results demonstrated that both CMJ metrics were positively correlated with MCW, with a strengthened relationship for CMJP, thus adjusting CMJ performance using participants' anthropometrics. Therefore, these findings further support the interdependency of aerobic fitness and muscular power in the alpine skiers' performance profile and the importance of training and evaluating both systems.

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PP61B—Yoyo IRTL1 ecological validity with match total distance and high-speed running

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Purpose:

The purpose of this study was to examine the association with relevant match activities (ecological validity) and field test for intermittent high-intensity endurance known as Yo-Yo intermittent recovery level 1 (YYIR1C) in elite female soccer player.

Methods:

Twelve elite female soccer players (age 25 ± 3 , height 168 ± 8 , body weight) were tested using YYIR1C.

A descriptive correlative design aiming at investigating the association between YYIR1, the Total Distance (TD) and the high-speed running (HSR) during official matches, recorded by the means of GPS devices, was used in this study.

Results:

The YYIR1C performance does not show a significant correlation with the match HSR ($r = 0.016$; $p = 0.961$) and with the TD ($r = -0.008$; $p = 0.981$).

Conclusions:

The results of this study showed that YYIR1C may not be considered a valid and reliable field test for assessing intermittent high-intensity endurance in elite female soccer players.

Castagna C., Krustup P., D'Ottavio S., Pollastro C., Bernardini A., Araújo Póvoas S. *Ecological validity and reliability an age-adapted endurance field test in young male soccer players*

PP61C—Balance is affected by lean and fat mass in its vestibular and somatosensory components: a cross-sectional study

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Purpose: It is widely proven that many motor skills, such as strength and endurance, are strictly connected with body composition. However, balance is a complex ability composed of three integrated components (visual, vestibular and somatosensory), and studying deeply its peculiarities is rather difficult. The literature is still uncertain in establishing whether body composition can influence this capacity, in terms of percentage of lean mass (% LM) and fat mass (% FM). Furthermore, studies that

show an effective correlation between these two factors have never investigated whether all components of balance are affected or only some of them⁽¹⁾. The goal of this study was to assess whether %LM and %FM and balance, or at least some of its components, are related.

Methods: 32 young adults (23 females, 9 males; age = 21.9 ± 3.6; BMI = 22.83 ± 2.86) were recruited. Their balance skills were assessed by a test (m-CTSIB, Modified Clinical Test of Sensory Interaction in Balance⁽²⁾) able to discriminate the three components of this ability through 4 different subtests: 1. eyes open on a rigid surface; 2. eyes closed on a rigid surface; 3. eyes open on a soft surface; 4. eyes closed on a soft surface. An oscillation index was then derived in each of the tests. The participants' body composition was assessed by plicometry (7-site method⁽³⁾).

Results: Linear correlation analyzes were then performed. As expected, statistical significance emerged in the correlation between both % FM and % LM, and the general oscillation index ($p < 0.05$; $r = 0.54$), indicating that the integration of the three components of balance is related to body composition. However, by examining which components were actually correlated, only the vestibular ($p < 0.05$; $r = 0.41$) and somatosensory ($p < 0.05$; $r = 0.53$) were statistically significant, while in the visual component no correlation was shown.

Conclusions: Although this study presents some limiting factors, such as the analysis of the body composition carried out by plicometry and the sex distribution of the sample, it allows to analyze more in depth the relationship between body composition and balance, highlighting the critical components to act on in order to prevent possible adverse events.

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PP62A—The acute effects of unpredictable slope surface variations in well trained runners

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Purpose: To compare cardiopulmonary, neuromuscular and psychological parameters across three running aerobic speeds in two conditions different for treadmill's movement: flat condition (FC) and with unpredictable roll variations (URV).

Methods: Twenty well-trained male runners (age 33±8 years, body mass

70.3±6.4 kg, body height 1.77±0.06 m, V'O₂max 63.8 ± 7.2 ml kg⁻¹ min⁻¹) voluntarily participated in the study. Laboratory sessions consisted in a cardiopulmonary incremental ramp test (IRT) and two experimental protocols. Metabolic parameters, plasma lactate, electromyography activation (EMG) of eight muscles in the right lower limb, cadence, ground contact time (GT), affect grid score (AF), and RPE values were assessed.

Results: Cardiopulmonary parameters not significantly different between conditions (V'O₂: $p = 0.104$; BLA⁻: $p = 0.214$; HR: $p = 0.788$). Worsening of the individual mental state during the URV protocol was visible, even if not significantly different to FC (average of -4.9% ± 1.7% for pre, (F(2,36) = 0.444, $p = 0.645$) and—4.9% ± 2.2% for post, (F(2,36) = 0.782, $p = 0.465$). The variability of EMG estimates were significantly affected by conditions as CoV_peaks_height (F (1,19) = 11.448, $p = 0.003$) and CoV_peaks_width (F(1,19) = 19.188, $p < 0.001$) were higher in URV than in FC. However, muscle group data never emerged in a statistically significant interaction with conditions or speed.

Conclusions: The URV was not able to induce significant differences in measured parameters in well-trained runners. However, the variability of muscle activations was affected, underlying the need of further investigation with higher roll variability and untrained runners.

PP62B—Tapering and peaking periodization in middle-distance and long-distance running: from theory to strategies

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Purpose: To analyze the current knowledge about tapering in middle-distance and long-distance running. The purposes of this dissertation are (1) to give an overview of the bases of tapering and (2) to see the applications on the field

Methods: A systematic review has been conducted using two electronic databases (SPORTDiscus and PubMed) for original research articles. The main words of research were “tapering”, “periodization”, “middle- distance running” and “long-distance running”. Most of the studies considered have been conducted on trained runners. In absence of papers on runners, studies from other sports athletes were taken.

Results: Tapering is a complex phase of training periodization. It depends strictly on the athlete physiology and the workload he or she has undergone. Tapering length is influenced by race distance and previous training. Despite the fact that the literature recommends a volume decrease of 40–60% in the last 2–3 weeks before the race most of the runners undertake a smaller decrease in the last 7–10 days prior to competition. A successful taper can enhance performance in well- trained athletes by ~ 1–3%.

Conclusions: Knowledge about tapering has reached a good point, however some aspects remain shady. Future articles should investigate clearer the relationship between tapering and VO₂ max and running economy. More research is also needed to define the use of cardiac autonomic function measures to assess the progress of tapering phase.

PP62C—Balance control in young alpine skiers with different levels of expertise

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Purpose: Few studies analyzed subjects’ balance performance to discriminate the expertise level among highly skilled athletes of a specific discipline; however, results among sport-specificity of balance remain controversial. This study examined the balance performance of two groups of young elite skiers ranked at different levels. The aim was to evaluate static and dynamic balance control to understand whether performance in simple and sport-oriented balance tasks could depend on the skiers’ expertise.

Methods: The seventeen recruited skiers (F = 7; M = 10; age: 15.8 ± 1.82 yrs; height: 1.68 ± 0.74 m; weight: 58.8 ± 10.12 kg) were divided into two groups considering the International Ski Federation ranking: high-ranked (i.e., ranked < 50; n = 7) and low-ranked (i.e., ranked > 50; n = 10). Each group underwent three experimental balance conditions: static, dynamic unspecific (US), and dynamic sport-specific (SS). During US task, the barefooted subjects stood on an unstable board positioned over a force platform (AMTI, USA). During the SS task, subjects wore ski boots, grasped ski poles, and stood on two unstable boards, positioned over two force plates (Kistler, Germany) to collect data of the left and right adjustments. Unstable boards allowed only anterior–posterior oscillations. Each trials lasted 30 s. The displacement (Area95) and the mean velocity (Unit path) of the center of pressure were considered as outputs of balance efficiency. Moreover, during US and SS tasks, the unstable boards’ angular displacement was recorded by a 12-camera optoelectronic system (Qualisys, Sweden). The markers applied to the boards allowed calculating three kinematic parameters as outputs of balance performance: overall full balance (FB), fine (FiB) and gross (GB) balance.

Results: Mann–Whitney test revealed a significantly higher balance control in high- ranked than low-ranked skiers only in the static and SS task (p < 0.05), for both Area95 and Unit Path. Conversely, no significant differences were detected in US task. Overall, kinematic parameters (i.e., FB, FiB, and GB) did not show any significant

differences between balance performance of the two groups in US and SS tasks.

Conclusions: Results underlined that postural balance control was more representative of skiers’ expertise when the task was sport specific. Moreover, despite high- and low-ranked skiers had the same balance performance in the dynamic tasks (i.e., US and SS), the high-ranked skiers showed a greater balance efficiency.

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PP63A—Mental fatigue impairs second serve accuracy in tennis players

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Purpose: Tennis is one of the most popular sports worldwide. Is an individual sport that requires short explosive bursts of energy repeated several times per match. Tennis is very unpredictability because point length, shot selection, strategy, match duration, weather and opponents can influence all the physiological and psychological aspects of a tennis match. This characteristics leads athletes to experience different situation of mental fatigue (MF). To date no study of the effects of MF in tennis is available. Therefore, to better understand the impact of MF in tennis players the aim of this crossover study was to investigate the effect of acute MF on tennis serve performance and accuracy in male tennis players.

Methods: Ten male tennis players (age: 18 ± 4 years; height: 1.80 ± 0.08 m; body mass: 71 ± 13 kg) were recruited in a 2-week randomized, counterbalance and crossover study. Players were randomized to either the MF group (N = 5) that underwent to an acute MF protocol or to a control (CON) group (N = 5). The MF condition consisted in a 30-min modified Stroop color-word task performed before on-court serve speed test. A visual analogue scale (VAS) was used to assess the perceptions of MF and motivation toward the upcoming technical tests.

Results: Reduction over baseline score of Stroop test was noted in accuracy (P < 0.001), but not in reaction time (P = 0.968) in the MF group. Increment in perceived workload were detected (P < 0.001) in MF group compared to CON. No differences for first and second serve speed from deuce and advantage side were observed. Increment of percentage of failed second serves from the deuce side (P = 0.043) in MF were detected.

Conclusions: An acute MF protocol reduced tennis serve accuracy from deuce side in male tennis players. The findings of this study are important for players, coaches, and professionals for understand the role of MF during a tennis match particularly during tennis serve. To this regard, players should avoid cognitive efforts before training sessions and matches to prevent negative effects of their technical performance, as such condition is easily visible in daily and real life.

Acknowledgments: (non obbligatorio).

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PP63B—Functional movement screen™: a comparison between the motor qualities of athletes of different combat sports, through a functional evaluation system

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Purpose:

With this research work we intend to investigate, through the functional evaluation carried out with the FMS™ test, the differences between the qualities of the movements in athletes practicing combat sports disciplines and different combat sports, Grappling sports (Bjj, Judo e Wrestling) and striking sports (Kick Boxing, Karate e Boxe).

Methods:

90 athletes (58 male and 32 female) took part in the research, 15 for each discipline. The total sample is composed as follows: age: 25.9 ± 6.9 , years of practice: 11.2 ± 6.11 , weekly frequency: 4.9 ± 0.8 , height (cm): 172.03 ± 8.13 , weight (kg): 66.87 ± 10.31 , BMI: 22.46 ± 1.98 , sitting height (cm): 87.29 ± 3.64 , skeletal index (%): 50.91 ± 1.93 . They were different selection parameters used: at least 5 years of practice, one frequency of weekly training of at least 3 days, a minimum of 16 years of age. JASP software was used for the statistical analysis of the data.

Results:

The analysis of the data obtained showed that there was no significant difference between the averages of the FMS™ scores of the two types of disciplines (Grappling and Striking). A significant difference emerged in the comparison made between the averages of the scores obtained by the individual disciplines examined. The total average of the FMS™ score obtained on the entire sample is 15.3 ± 1.79 . A comparison of the FMS™ score was made between the two types of sports, ie between grappling sports (Bjj, Judo and Wrestling) 15.53 ± 1.70 and striking sports (Kick Boxing, Karate and Boxing) 15.07 ± 1.90 . From the analysis made through ANOVA, it appears that there is no significant difference between the groups of disciplines, in the FMS™ score, since a p-value of 0.223 (significance for $p < 0.05$) was found. The highest average score obtained on the individual tests was 2.51 ± 0.58 in the Trunk Stability Push Up (TSPU), while the lowest was the Deep Squat (DS) 1.96 ± 0.58 . The maximum score was obtained by Wrestling (16.53 ± 1.35) and the minimum score by Boxing (13.40 ± 1.35).

Conclusions:

During this study it was shown that the practice of some combat sports, more than others, is correlated with a better score in the FMS™ test. The best performance in the grappling disciplines, although not significant, would confirm a higher completeness of these activities.

Acknowledgments: (non obbligatorio).

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PP63C—Evaluation of the back of healthy individuals with thermography and rasterstereography

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Purpose: Musculoskeletal disorders of the back are increasing among the healthy population due to postural alterations during daily activities. Non-invasive methods are spreading to overcome the need to screen many individuals without harmful effects. These methods can identify a specific alteration before the individual experiences discomfort or pain. Rasterstereography and Infrared Thermography (IRT) are two non-invasive methods that use 3D cameras to analyze the body's alterations. The first provides information about the posture alterations of the back; the second investigates the thermal response of the body to different stimuli. In this study, we propose a combined infrared method of rasterstereography and thermography to assess the back alterations and provide normative data about these methods.

Methods: This cross-sectional study involved 175 healthy individuals (85 males and 90 females) aged 29.25 ± 5.95 , weight 62.66 ± 7.4 kg, height 170.18 ± 7.20 cm. The Spine 3D evaluated the morpho-structural aspects of the back; the FLIR E54 camera measured the IR emission of the back. The Student t-test determined any significant differences between the males and females for rasterstereography and IRT imaging. Cohen's effect size identified significant differences between the groups.

Results: On the sagittal plane cervical depth (males= 43.67 ± 9.99 mm vs. females= 31.74 ± 7.76 mm, $d = 1.33$), and in the lumbar lordosis angle (males = $36.39 \pm 8.70^\circ$ vs. females = $47.56 \pm 8.47^\circ$, $d = -1.30$) present a large Cohen's d. On the coronal plane shoulders obliquity (males = -7.23 ± 10.16 mm vs females = -2.91 ± 9.93 , $d = -0.43$) and vertebral deviation RMS (males = 3.01 ± 1.61 vs females = 2.57 ± 1.48 , $d = 0.28$) present a small effect size. On the transversal plane shoulders torsion present a small effect size (males = $-0.25 \pm 2.41^\circ$ vs females = $-1.02 \pm 2.43^\circ$, $d = 0.32$). The back temperature present gender differences in the cervical area (males = 33.84 ± 0.63 vs. females = 34.29 ± 0.86 , $d = -0.58$) and dorsal area (males = 33.14 ± 0.70 vs. females = 33.64 ± 0.95 , $d = -0.60$). Furthermore, males showed a moderate correlation for vertebral surface rotation RMS with cervical ($r = -0.42$), dorsal ($r = -0.57$) and lumbar ($r = -0.48$) areas. Females present a moderate correlation for lumbar temperature with lumbar lordosis angle ($r = -0.43$) and dorsal temperature with shoulder torsion ($r = 0.43$).

Conclusions: Combined infrared method represents an interesting method to analyze the back of healthy individuals. Further investigation may elucidate the mechanism of spine alterations and thermal asymmetry.

PP64A—The metabolic advantage of using lighter SKI boots in SKI mountaineering competitions

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Purpose: Competitive ski mountaineering is considered one of the most demanding endurance sports mainly due to the large amount of height gain to overcome and the relatively heavy equipment. This study aims to evaluate the effect of ski boots' additional weight (SBAW) on metabolic parameters at race velocities and to estimate its impact on the performance of a race.

Methods: Thirteen competitive high-level male ski-mountaineers (28.1 ± 9.4 y., 174.5 ± 3.3 cm, 67.5 ± 4.4 kg), volunteered to participate in the study. The protocol included two tests with ski mountaineering equipment on a treadmill at a gradient of 25%: a maximal exercise test with velocity increments to measure $\text{VO}_{2\text{max}}$, and four 5-min submaximal bouts (+ 0 gr; + 200 gr; + 400 gr; + 600gr on each boot, in random order), at 80% of $\text{VO}_{2\text{max}}$ velocity. A one-way ANOVA was used to determine the effects of the independent variable (SBAW) on the following dependent variables: oxygen consumption (VO_2), ventilation (VE), blood lactate concentration [La-], heart rate (HR), vertical energy cost (ECv)). When a significant main effect was observed, a Tukey's post hoc test was performed. Pearson's r correlation was used to estimate the relationship between SBAW and VO_2 variation.

Results: The mean $\text{VO}_{2\text{max}}$ of skiers was 67.1 ± 5.2 ml min^{-1} kg^{-1} . The mean velocity for submaximal tests was 5.2 ± 0.2 km h^{-1} . There was a significant effect of SBAW for all physiological variables (VO_2 , VE, [La-], ECv) except for HR. Post hoc tests revealed significant differences between 0 and 200 gr in VO_2 and ECv, and between 0 and 400 gr in VO_2 , ECv, and VE. By adding 600 gr, significant differences were found for all parameters (VO_2 , VE, [La-], ECv). The effect size (ES) of changes in VO_2 due to the SBAW was 0.83 (+ 200 gr), 1.77 (+ 400 gr), and 2.37 (+ 600 gr). A statistically significant positive Pearson correlation between SBAW and VO_2 variation was found ($r^2 = 0.52$, $n = 52$, $p < 0.0001$).

Conclusions: VO_2 and ECv show higher values even with very low additional weights (+ 200 gr) with a large ES. Based on these results it is possible to estimate that the lightness of the boots of elite athletes compared to the standard race boots' weight leads to an advantage of 1 min and 40 s in a vertical race time of about 33 min.

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PP64B—Relationship between crossfit workout performance and power output variables of 30-second wingate test in crossfit athletes

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Purpose: Recent studies showed significant correlations between physiological variables and CrossFit (CF) workout performance. However, the results are conflicting and depending on the benchmark workout, CF experience years and training volume. The aim of this study was to examine whether a typical CF workout performance was associated with power output variables obtained with a laboratory-based test.

Methods: Twenty-one athletes (12 men and 9 women) were recruited from a local CF gym. They were 38.2 ± 8.18 years old, with 72.0 ± 12.5 kg body weight, 172.0 ± 9.16 cm height, 24.2 ± 2.28 kg/m^2 BMI, $15.4 \pm 5.82\%$ fat mass, at least 1 year of Regular CF

training experience and a minimum of 3 training sessions per week. Power output variables including peak power (PP), time at PP (tPP), maximal speed (Vmax), power at Vmax (p-Vmax), time at V-max (t V-max), average power (AP) and minimum power (MP), power drop (PD) and power decline (Pdec, calculated as PP – power at the end of the test) were assessed with the Wingate 30-s test. CF performance was obtained by measuring the execution time of a benchmark Workout of the Day (WOD), known as Fran. Pearson's r correlations were used to determine the association between CF performance data and the power output variables. The strength of correlation was rated as per Hopkins: small (0–0.30), moderate (0.31–0.49), large (0.50–0.69), very large (0.70–0.89), and almost perfect (0.90–1). The alpha level was set a priori at 0.05.

Results: Negative correlations were found between Fran performance and all the examined power output variables. However, these were significant and large with PP, AP, PD, Vmax, p-Vmax and Pdec. Moreover, when PP and PD were related to body weight were also significantly associated with CF performance.

Conclusions: These results can be useful for coaches to monitor crucial physiologic determinants in CF performance, avoid time-consuming laboratory-based tests and design custom workout protocols.

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PP64C—Posture evaluation of healthy individuals with a digital and smart method: normative reference data

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Purpose: Healthy posture is essential for good function of the whole body during daily activities. Postural assessment plays a central role in different areas: clinical practice for diagnosing musculoskeletal disorders, sports for performance improvement, and ergonomics to solve problems caused by the maintenance of incorrect postures by sedentary workers. Manual postural evaluation is a low-cost but operator-dependent method. Nowadays, several devices are used for postural assessment through markerless devices such as rasterstereography or stereophotogrammetry, but their limitations are mainly due to the high cost. Modern methods such as digital applications aim to provide manageable and low-cost ways in clinical practice for the early diagnosis of musculoskeletal disorders. The study aims to provide standardized digital postural analysis data on healthy subjects using the APECS mobile application.

Methods: The sample comprised 100 healthy young adults, 50 males, and 50 females, mean age of 22.51 ± 3.12 , weight of 67.24 ± 13.26 kg, and height of 170.1 ± 8.33 cm. The postural assessment was performed in the frontal, posterior and sagittal planes using the APECS mobile application. A specialist placed adhesive markers over the anatomical landmarks throughout the body, and then a photo was taken for each plane. Through the APECS app, digital landmarks have

been placed over the adhesive markers previously allocated on the skin.

Results: We considered 24 postural components divided between sagittal, frontal, and posterior planes. Of those, only 7 provided a statistical difference according to gender; the rest did not differ between males and females. On the sagittal plane, the forward shift of the tibia differs between males (4.26 ± 2.29) and females (7.12 ± 3.57) with a large effect size ($d = -0.95$); The angle between lateral malleolus and the fifth toe differs between males (33.76 ± 5.17) and females (26.2 ± 4.24) with a large effect size ($d = 1.6$). On the frontal plane, the height of the right knee and the left knee differ between males (4.84 ± 2.98) and females (7.57 ± 3.16) with a large effect size ($d = -0.89$). No gender differences are present in the posterior plane.

Conclusions: These results provide a set of normative data concerning the digital examination of the posture of healthy individuals. This approach represents a reproducible, easy and low-cost method of posture assessment.

PP65A—The value of experience in relation to the sum of the degree of difficulty in the 3 m and 10 m diving

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Purpose: Athletic performance increases from birth to youth reaching a peak level in early adulthood and declines thereafter, furthermore, the competitive performance may change between athletes in different sports and events. As a general trend for both sexes, the disciplines concerning very specific technical skills involve the youngest athletes, such as for the gymnastics and aquatic disciplines. Thus, the aim of the study was to investigate the value of experiences in terms of ages and the influence of this on both sexes competitive performance in 3 m and 10 m diving.

Methods: Diving competition results from Sydney 2000 to Tokyo 2020 were collected from the FINA official web site. For the female (F) and male (M) medalists (Olympic (OL): F = 18, M = 18; World Championship (WCH): F = 30, M = 30; World Cup (WC): F = 33, M = 33) of each event the sum of the Degrees of Difficulty (DDs) and first the year of competition (3 m: F = 14.9 ± 2.2 yrs, M = 15.3 ± 1.8 ; 10 m: F = 14.2 ± 2.1 , M = 15.4 ± 1.8) were analyzed using the slope of the regression line of the results over time (y).

Results: Observing the trend over time of the first year of competition, it seems that in the 3 m men are older than women especially in bronze medalist (M: $y = -0.1959$; F: $y = 0.0573$). Instead, silver medalist women seem to be older than men (F: $y = 0.157$; M: $y = 0.0254$). In 10 m all medalists' women are younger than men (F: $1^{\circ}y = 0.0266$; $2^{\circ}y = 0.0469$; $3^{\circ}y = 0.0147$; M: $1^{\circ}y = -0.1144$; $2^{\circ}y = -0.0084$; $3^{\circ}y = -0.0829$). From the analysis of DDs: in 3 m women DDs continuously increased in all medalists ($1^{\circ}y = 0.0107$; $2^{\circ}y = 0.0478$; $3^{\circ}y = 0.0368$), the same trend is observed in men's DDs especially for gold medalists ($y = 0.0316$), while in silver and bronze there aren't a significant increase (Silver $y = 0.0017$; Bronze $y = 0.0046$). In 10 m women's DDs values decrease with the increasing of the years for all medalists ($1^{\circ}y = -0.1879$; $2^{\circ}y = -0.1727$; $3^{\circ}y = -0.0497$); in men especially for gold and silver medalist DDs values increase ($1^{\circ}y = 0.4599$; $2^{\circ}y = 0.6401$) while in bronze DDs decrease over the time ($y = -0.225$).

Conclusions: The results suggest that age is a fundamental parameter that may influence performance results in both competitions.

Furthermore, the experience, due to years of competitions, seems to have a great influence on DD and consequently affects the preparation phase for the competitions. A good knowledge of athletes' career and abilities could provide coaches a guidance on choosing athletes' routine and progression towards their performance goals.

PP65B—Validity of the nfl combine battery of physical performance tests

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Purpose: The purpose of this study was to assess the validity of the NFL combine battery of physical performance tests by assessing their ability to differentiate between different levels of performances in American football (AF) (known-groups technique).

Methods: Comparisons were made between three groups (36 subjects each) varying in AF performance: 1) Drafted and 2) Non-Drafted US college AF players, and 3) players from an Italian 1st division AF team. Players in these three groups were matched according to position (skill players, big skill players and linemen) (Sierer et al., 2008), stature and body mass (Robbins, 2008). Italian players were tested by one of the researchers using standard NFL combine procedures. The data of the US players were extracted from a publicly available database (pro-football-reference.com). Differences were tested statistically using Group x Position ANOVAs ($p < 0.05$) on each of the following variables: 40-yard dash, 20-yard shuttle, 3-cone drill, broad jump, vertical jump, bench press.

Results: In all the six physical tests the Italian players performed significantly worse than both drafted and non-drafted US players. Drafted US players performed better than Non-Drafted US players in 40-yard dash, 20-yard shuttle, broad jump, and vertical jump. On the contrary, Non-Drafted US players performed better than Drafted ones in the bench press tests, and no significant differences between these two groups were found in 3-cone drill test in any position.

Conclusions: In agreement with previous research (Vitale et al., 2016), all the six physical performance tests included in the NFL combine battery are able to discriminate between very large differences in AF performances. However, only 40-yard dash, 20-yard shuttle, broad jump, and vertical jump seems to be valid with respect to their main purpose: help with the selection of professional NFL players. Further research is required to develop and validate better tests of upper body strength and agility to be included in the NFL combine battery of physical performance tests.

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PP65C—Acute effect of the use of “fluiwalks” on key stride parameters

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Purpose: Walking is an important activity that can be used for the promotion of a healthy lifestyle. However, it can sometimes show alterations in its pattern due to postural defects or various pathologies of the musculoskeletal system. The aim of this preliminary study is to investigate the acute effect of the use of 20 cm diameter, partially water-filled, hand-held discs (Fluiwalk) on the main gait parameters, in order to use them to induce a change in gait pattern during walking.

Methods: 15 male subjects without any musculoskeletal pathology were selected (age: 30aa ± 5aa; weight: 70 kg ± 9 kg; height: 178 cm ± 6 cm). The protocol involved 3 walking steps on a treadmill with 5' breaks after each step. At each step, 5' of walking at 3.5 km/h and 5' of walking at 4.5 km/h with a fixed gradient of 0% were performed. The first step was carried out without the use of discs in order to study the subjects' natural walking (STEP_PRE_FW); the second step was carried out with two 800 g discs each in one hand (STEP_FW); the third step was carried out again without discs to monitor any residual effects of the previous step (STEP_POST_FW). The stride length and cadence were measured by the Optojump system and are analysed in relation to the last minute of each phase. The results were reported as mean and standard deviation and were compared by ANOVA with a post-hoc comparison using Tukey's test with accepted significance of $p < 0.05$.

Results: The results in the comparison between “STEP_PRE_FW vs STEP_FW” and between “STEP_PRE_FW vs STEP_POST_FW” in the trials conducted at 4.5 km/h show a statistically significant variation in gait parameters with an increase in stride length and a consequent decrease in stride cadence. The variations of stride length are as follows: STEP_PRE_FW vs STEP_FW: + 3,1%; STEP_PRE_FW vs STEP_POST_FW: + 1,4%. The variations of stride cadence are as follows: (STEP_PRE_FW vs STEP_FW): -2,9%; STEP_PRE_FW vs STEP_POST_FW: -1,1%.

Conclusions: The “Fluiwalks” show an impact on the acute modification of the gait parameters investigated, showing, moreover, even after use for only five minutes, the permanence of the effect even in subsequent trials conducted without discs, indicating a possible lasting effect of the changes recorded. Although further studies are needed, Fluiwalks could represent an easy-to-use tool for effectively conditioning certain gait parameters during walking.

Acknowledgments: (non obbligatorio).

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PP66A—Individual predictors of a sport-specific fitness test in elite judo athletes

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Purpose: The Special Judo Fitness Test (SJFT) is a specific sport test developed by Sterkowicz and described by Franchini. From the number of throws performed and HR values, a judoka fitness index is calculated. The aim of the present study was to verify if any predictors could be individuated for SJFT among anthropometric, fitness and cognitive variables in elite judo athletes.

Methods: Twentyseven subjects (14 males and 13 females) (age = 19.5 ± 2.0 years) participated in the study. The subjects were divided by sex. The following variables were considered: weight, height and body mass index (BMI) for anthropometric characteristics; fat free mass (FFM), total body water (TBW) and phase angle (phA) for body composition; SJFT, counter movement jump (CMJ), isometric and dynamic chin up test (IC and DC), handgrip test (HG) and muscular quality index (MQI) for muscular characteristics. Then Flanker (FT) and Digit span test (DST) were administered for cognitive functioning.

Results: SJFT index was significantly ($p = 0.025$) different between males (11.75 ± 1.08) and females (12.66 ± 0.80). Stepwise regression analysis showed a different equation between males and females. For males DC and Rate of Correct Score Digit span (RCS) significantly predicted SJFT (adapted $R^2 = 0.45$, standard error of estimate = 0.80). For females, age, HG, DC and RCS significantly predicted SJFT (adapted $R^2 = 0.73$, standard error of estimate = 0.41). The prediction equations to estimate SJFT are: for males $SJFT = 11.24 - 0.07 DC + 0.43 RCS$ and for females $SJFT = 26.74 - 0.14 HG - 0.81 RCS - 0.29 age - 0.1 DC$.

Conclusions: The results showed that muscular strength and cognitive variables can predict SJFT index better in female than male elite judo athletes. These outcomes might be regularly used by coaches during training monitoring process especially in female elite athletes. **Acknowledgments:** To the owners, coaches and athletes of Banzai Cortina of Rome, a special thanks for their willingness and kindness. **References:** 1) Franchini, E., Nakamura, F. Y., Takito, M. Y., Kiss, M. A. P., & Sterkowicz, S. (1998). Specific fitness test developed in Brazilian judoists. *Biology of sport*, 15(3), 165–170. 2) Koch, P., & Krenn, B. (2021). Executive functions in elite athletes—Comparing open-skill and closed-skill sports and considering the role of athletes' past involvement in both sport categories. *Psychology of Sport and Exercise*, 55, 101925

PP66B—Anthropometrics, fitness, and hormonal changes in male young football players during competitive season

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Purpose: Considerable individual differences in pubertal development can be described in terms of “how the individual maturation is compared to their same-sex and age peers (timing)” and “how quickly or slowly individuals progress to achieve complete sexual maturity (tempo)” (Malina et al. 2004). Considering that maturation bias between same age children and adolescents can account for three years in maturation difference for the same age category (Jackowski et al. 2011), this study aimed to investigate the seasonal variations in

anthropometrics, fitness, and hormonal measures and their changes according to biological maturity status within a chronological age.

Methods: 29 young male football players participated in the study according to their age category (Age: 13 yrs, $n = 18$, Age: 14 yrs, $n = 11$). Anthropometric, physiological (salivary testosterone sT, and cortisol sC), pubertal development (Self-Administered Rating Scale for pubertal development questionnaire, PDS) and physical (countermovement jump, CMJ; sprint 10 m) measurements were performed at the beginning and in the middle of the competitive season. Two MANOVA for repeated measures were conducted to test pre-post differences in the 4 measured parameters (CMJ, 10 m sprint, sT and sC), with PDS category as between factor (beginning vs mid-pubertal vs advanced), considering the two age categories (13 and 14 yrs) separately.

Results: Considering the whole sample, results showed changes that depend on puberty. Significant differences between age categories (13 vs 14 yrs) in the pre-post measurements were found: for CMJ ($F(1,27) = 4.44$), 10 m sprint ($F(1,27) = 4.66$). 14yrs players showing worse performance in the post-test respect to the baseline and for sT ($F(1,27) = 40.87$; $p < 0.001$) and sC ($F(1,27) = 40.82$; $p < 0.001$). For the category 13 yrs, a significant variation in pre-post was found only for 10 m sprint ($-3.9 \pm 4.1\%$; $F(1,15) = 10.54$), while significant differences were found in 14 yrs for CMJ (-6.7% ; $F(1,8) = 11.59$), sT ($F(1,15) = 29.11$; $p < 0.001$) and sC ($F(1,15) = 29.94$; $p < 0.001$). In both age categories, no significant interaction effects (time \times PDS-stage) were reported.

Conclusions: To create conditioning programs based on the stage of puberty development compared to chronological age can increase performance and minimize the risk of an excessive workload.

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PP66C—Active drag estimates based on full and semi-tethered swimming tests

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Purpose: In this study we explore the possibility to calculate/estimate active drag (Fd) based on full tethered and semi-tethered swimming tests (an adaptation of the “residual thrust method”). During full tethered swimming, propulsive force (Fp) is entirely utilized to exert force on the tether (Fp = Ft) while during semi-tethered swimming, Fp can be made useful to one of two ends: exerting force on the tether (Fst) or (actively) overcoming drag (FdST): Fp = Fst + FdST. As calculated, active drag (FdST) is expected to be larger than passive drag (FdP) but similar to the active drag values (FdPL) that can be calculated by means of other methods (e.g. the “planimetric method” [1]).

Methods: Fourteen male front crawl sprinters (age 23.1 ± 2.0 years, $93 \pm 3\%$ of WR) were recruited for the study. They were asked to complete one all-out full tethered test (to determine Ft) followed by five all-out semi-tethered swimming trials (to determine Fst) at

imposed loads from 35 to 85% of the individual Ft. The participants were also asked to swim a maximal trial at 0% load (free-swimming). Active drag (FdST) was calculated (at paired speeds) as: Fp – Fst (and Fp was set equal to Ft). Passive drag (FdP) was measured during five passive towing trials at speeds ranging from 1.0 to 2.2 m s⁻¹. According to the planimetric method (1), active drag (FdPL) was estimated as FdP · 1.5.

Results: During semi-tethered swimming, the increases in external load (FST, from 0 to 85%) were accompanied by decreases in swimming speed (from 2.2 to 1.0 m s⁻¹) and in active drag (FdST, from 186.8 to 26.8 N). At paired swimming speed, active drag calculated by means of the planimetric method (FdPL) changed in a similar manner (from 189.9 to 39.7 N). No significant differences were observed between FdST and FdPL, and both active drag estimates (FdST and FdPL) were significantly larger than FdP.

Conclusions: Since these two approaches (planimetric and residual thrust method) lead to similar results, they likely measure the same quantity (e.g. active drag). In addition, these results strongly support the consideration that active drag must be larger than passive drag (2, 3). From a practical perspective, full and semi-tethered swimming tests can be conducted in an ecological setting, require easy-to-use tools.

PP67A—VO₂max, sleep behaviour, and self-perceived fatigue influences in a sample of german active young subjects

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Purpose: Sleep is acknowledged as an important factor in influencing physical performance. Indeed, sleep deficiency linked to fatigue could negatively affect endurance performance. The present study aims to shed light on the relationship between VO₂max, sleep, and self-perceived fatigue in a sample of active German young subjects.

Methods: 96 German university students (males 54.2%; 21.5 ± 2.9 yrs) completed an incremental exercise test on a bicycle ergometer and filled in the Pittsburgh Sleep Quality Index (PSQI) and two visual analogue scales (VAS) to assess sleep behaviour, self-perceived fatigue and motivation, respectively. The male and female samples were analysed separately. VO₂max, self-perceived fatigue and motivation were compared between good and bad sleepers (PSQI score $< / > 5$, respectively) and longer and shorter sleepers (sleep duration $> / < 7.5$ h, respectively), while the predictors of VO₂max were defined with regression analysis.

Results: In the male sample, even without statistical significance, VO₂max was higher in good than bad sleepers (53.9 ± 8.4 vs 49.0 ± 14.1 ml·kg⁻¹·min⁻¹; $p = 0.1$), and in longer than shorter sleepers (54.2 ± 10.9 vs 50.0 ± 8.4 ml·kg⁻¹·min⁻¹; $p = 0.4$); self-perceived motivation was better in good and longer sleepers (7.1 ± 1.6 vs 6.3 ± 2.1 a.u., $p = 0.2$; 7.2 ± 1.5 vs 6.4 ± 2.1 a.u., $p = 0.1$). Self-perceived fatigue was significantly lower in good sleepers (2.3 ± 2.1 a.u.) compared to bad sleepers (3.6 ± 1.7 a.u.; $p = 0.04$). The regression analysis indicated sleep ($\beta = -0.3$, $p = 0.02$) as a significant predictor of VO₂max. In the female sample, good vs bad sleepers and longer vs shorter sleepers showed no significant differences. In contrast with the male sample, the regression analysis

indicated self-perceived fatigue ($\beta = -0.4$, $p = 0.03$), and not sleep, as a significant predictor of VO_2max .

Conclusions: Males seemed to be more negatively influenced by sleep behaviour and quality, whereas females by self-perceived fatigue. Indeed, sleep accounted for 20% of the VO_2max variance in males, indicating a relevant factor for cardiovascular performance. In females, physical performance seemed more affected by fatigue. Probably, considering the phase of the menstrual cycle might have highlighted a different role of sleep on VO_2max in females.

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PP67B—Attentional focus effects on neuromuscular characteristics during lower limb tasks in athletes: a systematic review

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Purpose: This study aimed to identify and synthesize information about the nature and quality of studies about attentional focus effects on neuromuscular characteristics during lower-limb exercise tasks in athletes.

Methods: Prisma PERSIST guidelines was used to search Scopus, Web of Science and EBSCO databases using keywords related to focus of attention, force production processes and athletes. Inclusion criteria required an age ≥ 16 years and to be a healthy competitive athlete. Exclusion criteria applied for research about technical skills, postural control and asymmetry comparisons. Based on literature definition, athletic populations were categorized in four tiers or a ‘mixed group’: World class (tier 5); Elite (tier 4); Highly trained (tier 3); Trained /Developmental (tier 2); and mixed (different levels). Information used from each eligible study were the aims and design, participants characteristics, neuromuscular task, attentional focus conditions, outcome measures, findings, a risk of bias calculation and assessment of certainty against several established methodological issues identified within the literature.

Results: 296 studies were initially found, but only 15 met the inclusion criteria. Study aims addressed focus of attention on performance ($n = 6$), between skill level ($n = 2$), for learning ($n = 5$), as a preference on performance ($n = 1$) and one study did not state the aim. Studies used either a cross-over within-subjects ($n = 9$) or RCT ($n = 6$) design. Participants were mainly male ($n = 440$ vs. $n = 96$ females) consisting of one elite, four highly-trained, eight developmental and two mixed group samples.

Studies mainly used single tasks: jump ($n = 8$), running acceleration ($n = 3$), isokinetic knee extension ($n = 1$) and lift ($n = 1$), performed with slow ($n = 3$), fast ($n = 5$) or combined ($n = 2$) stretch–shortening cycle, isometric ($n = 1$) and isokinetic ($n = 1$) muscle contraction. Outcome measured were kinetics ($n = 13$) or combined with EMG ($n = 2$). Most studies reported an advantage for external focus of attention ($n = 8$) with an average risk of bias score of Excellent.

However, findings suffered in the assessment of certainty when reviewed against key criteria identified authors in the field.

Conclusions: Despite the low risk of bias, research does not address the needs of elite level athletes and there is currently limited evidence on each type of muscle contraction. There is also a need to incorporate methodological steps to ensure fair comparisons between attentional foci conditions. Research should focus on contextualised information within professional practice to be able to offer stronger translational implications for athletes and coaches.

PP67C—An on-field evaluation of race walking gait variability during a conconi test through a video analysis with a new markerless pose estimation system: a pilot study

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Purpose: The literature presents numerous accurate laboratory analysis, but the “everyday field” conditions have not been sufficiently assess. Indeed there are no studies carried out on approved tracks with a sufficient number of steps. In addition, the analysis involve the use of expensive instruments that are often not transportable outside the laboratories or wearable tools that could affect the gait kinematics. Therefore, it is essential to find an economical and reliable on-field method that allows an evaluation that is as close as possible to the reality of training and competition.

The aim of this study is to assess the race walking gait variability in athletes with different ages, through a video analysis with a markerless pose estimation based on transfer learning with deep neural networks named DeepLabCut.

Methods: 4 athletes (2 males) of different categories perform a Conconi test in an official athletics field. The last 20 m of each lap of the 400-m track were recorded by two Go Pro Hero 5 cameras. Then, all the records have been analyzed by the software of DeepLabCut, allowing an evaluation of over 1000 frames per video. We evaluated the parameter of length, frequency, speed and time of every step. Moreover, we calculated contact time to investigate eventually suspension phases.

Results: During the progression of the test, as the speed increased, length and frequency of step augmented. Furthermore, body parts tracked with DeepLabCut has achieved excellent results, by reaching human accuracy.

Conclusions: In agreement with previous literature with the increasing of speed correspond a higher length and frequency of the step. In addition, DeepLabCut turned out to be a very useful and efficient tool for the study of gait kinematics. The next step will foresee a 3D kinematic analysis, through the use of both video cameras. The comparisons of this system with a consolidate gold-standard will be necessary to understand the strengths and weaknesses this new emerging technology.

PP68A—Relationship between water sports performance and anaerobic capacity assessed by inertial sensors kinematic analysis

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Purpose: The previous study demonstrated that the anaerobic qualities of highly trained swimmers might be inferred by analysing changes in swimming velocities and stroke kinematics and may be suggestive of sprint performance results. Mean velocities measured by a body-worn inertial sensor (IMU) resulted highly correlated with the mean power measured in the Wingate cycle ergometer test and with the best times of the 50 m and 100 m short course competitions. The present study aimed to assess if the analysis of inertial sensor data may provide an effective tool to discriminate anaerobic and performance capacity in swimmers of different levels and water polo players.

Methods: twenty-four athletes (8 elite swimmers -ES, eight collegiate swimmers—CS- and eight national water polo players -WP) performed a 75 m maximal swimming test in a short course pool, with an IMU positioned at the pelvis. Changes in speed, stroke parameters and Fatigue Index were assessed, and differences between the three groups were analysed.

Results: Mean speed, maximum speed, and minimal speed variables were significantly higher in ES than in the other two groups ($p < 0.05$). CS and WP presented similar speed values. While for the Fatigue Index, no differences were found between groups ($p < 0.05$). Stroke variables (stroke rate, stroke length, number of strokes and stroke efficient index) were investigated, and differences in stroke rate, stroke length and stroke efficient index were found between all groups ($p < 0.05$). Also, a significant decrease in stroke rate and swimming speed and a significant increase in stroke length was observed between the first and the third lap in ES ($p < 0.05$). The present in-water free swimming test with an inertial sensor provided insight into specific physiological/mechanical aspects of different water athletes. The difference between groups reflects the possibility of utilising this procedure to analyse the biomechanical skills and anaerobic qualities of an athlete's in-water performances.

Conclusions: The wearable inertial sensor could represent a feasible solution to evaluate stroke parameters, allowing a timely follow-up of variations in swimming biomechanics during the training season and identifying differences in biomechanical strategy and anaerobic capacity between swimmers. This analysis is of great interest for swimmers and coaches to characterise swimmer technique weakness and strength and plan individual race pacing strategies.

Acknowledgments: (non obbligatorio).

References: (non obbligatorio).

Purpose: Performing warm-up (WU) before any physical activity is universally accepted¹. According to literature², the best WU protocol should last 15 min including high intensity repetitions to improve short time trial performance, but any WU protocol appears to be ineffective on activity longer than 20 minutes³. Despite triathlon races last >50 minutes, athletes are forced to start swimming very fast for optimal positioning⁴. Thus, there is great interest in defining the best WU strategy for triathletes. Previous studies reported contrasting results about time duration (≤ 10 min⁵ or 25–55 min⁶), intensity (low-moderate⁵ or including also high intensity⁶), and sequence adopted (only run and/or swim⁵ or cycle-run-swim⁶) of WU adopted by triathletes. Therefore, the present study aimed to collect information about the WU protocol adopted by triathletes before a race, comparing results with WU prescribed by their coaches.

Methods: Two online surveys, one for triathletes and one for coaches, were created (PsyToolkit v.3.4.0)^{7,8} and the relative links were shared on social media. The survey was divided into two sections: i) general information and competitive level; ii) details (time, intensity, sequence) about the WU protocol adopted/prescribed. Only data from triathletes ranked in the first 50 positions at the national ranking (Tier 3⁹) or from coaches supervising Tier 3 triathletes were analysed. Wilcoxon and crosstabs chi-square tests were performed to identify, respectively, differences and associations between variables.

Results: 34 triathletes and 32 coaches completed the survey. According to triathletes, the cycle-run-swim sequence was the most adopted (49%) with a total WU time of 90 ± 23 min, divided among cycling ($50 \pm 13.9\%$), running ($24 \pm 12\%$) and swimming ($31 \pm 10\%$). Cycling was mainly performed at low intensity, while run and swim included high intensity bouts. General conditioning exercises were performed before swimming by 50% of triathletes, primarily including dynamic stretching and elastic band exercises. Coaches declared to prescribe mainly the cycle-run-swim sequence (55%) but with a total time of 60 ± 43 min and composed of cycling ($36 \pm 8\%$), running ($22 \pm 15\%$) and swimming ($33 \pm 12\%$). 71% of coaches included dynamic stretching and elastic band exercises in their WU protocol.

Conclusions: Triathletes practice a WU protocol different from both literature recommendations and suggestions of their coaches. Other studies to clarify the most effective WU for triathletes are needed.

Acknowledgments: (non obbligatorio).

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PP68B—The fancy of warm-up: differences between suggestions and real adopted protocol practices. The case of triathlon

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PP68C—Data-driven estimation of EMG muscular activity and fatigue through infrared thermal imaging

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Purpose: Superficial electromyography (sEMG) is the recording, from the surface of the body, of the electrical signal associated to muscle activation. Usually, sEMG is assessed through electrodes with electrolytic gel often causing skin irritation. To overcome this issue, capacitive contactless electrodes have been developed. However, contactless EMG sensors are still quite sensitive to motion artifacts and could be not comfortable for long monitoring. In this study, a non-invasive contactless method to assess muscular activity through infrared thermal imaging (IRI) is presented.

Methods: 10 healthy participants (age: 21.8 ± 2.9 years) were enrolled in the study. The participants underwent to 5 series of bodyweight squat exercise until exhaustion separated by 1 min of rest. The vastus medialis activity was assessed through EMG system Encephalan Mini AP-10. Concurrently, the temperature of the same muscle was measured through thermal camera FLIR A655. Regarding the EMG, the Average Rectified Value (ARV) and the median frequency of the Power Spectral Density (MDF) were evaluated for each series. Specifically, ARV is indicative of muscular activity and MDF of the muscular fatigue. Concerning the IRI, the average and the standard deviation of the temperature in a temporal window of 10 s after each series, and the thermal spatial gradient of the considered region were computed. Several Machine Learning regressors were tested employing the IRI features as input and, separately, the ARV and MDF as output. The data were normalized (z-score) and the leave-one-subject-out cross validation was used to test the generalization performance of the models.

Results: Concerning the ARV, the Gaussian Process Regression delivered the best performance, with a correlation coefficient $r = 0.75$ ($p < 0.001$) and root mean square error (RMSE) of 0.02 mV. Regarding the MDF, the Support Vector Machine with a radial basis function kernel allowed to obtain the best regression ($r = 0.66$, $p < 0.001$; RMSE=0.67 Hz).

Conclusion: The proposed method estimated the EMG parameters indicative of muscular activity and fatigue. These results indicate that the muscular activity influences skin temperature, suggesting a modification of the superficial blood circulation linked to the muscular need of oxygen during exercising. These results could pave the way to the employment of contactless methods to monitor the muscular activity and evaluate fatigue in a non-invasive and comfortable manner in sports and clinical applications.

PP69A—Postactivation potentiation effects on squat performance and muscle synergies in resistance trained men

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Purpose:

Postactivation potentiation (PAP) is a practical strategy to improve acute performance. PAP consists of performing two consecutive exercises, an exercise of maximal or submaximal contraction, called conditioning activity (CA), followed by a similar movement pattern that requires a rapid expression of force. There is a lack of literature

concerning the differences in muscle activation and muscle synergies during a resistance training exercise in resistance trained men in relation to PAP. Our study wants to investigate whether a relationship between PAP and NO-PAP effect exists, assessed by the tonnage beared. In addition, we want to analyze how the muscle activation and muscle synergy can affect the performance.

Methods:

8 resistance trained men were selected. Following an initial evaluation of their one repetition maximum (1RM) of squat (with at least 1.5 of their body mass), each participant was randomly assigned to a PAP or NO-PAP group, where subjects used or didn't use the CA before the resistance training protocol. After 72 h, the participants assigned at the PAP group were instructed to perform a protocol with CA, which involved performing 1 set of 2 repetitions at 90% of 1RM. After 7 min of rest 3 sets at 70% of 1RM were carried out until concentric exhaustion with 2 min rest between sets. The EMG was recorded on the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF), gluteus maximus (GM) and long head of biceps femoris (BF). The muscle activation was recorded by electromyography (EMG), instead the muscle synergies were evaluated by non-negative matrix factorization (NNMF) algorithm.

Results:

Despite the study is currently in the development stage, preliminary data show that PAP induces higher neuromuscular activity in BF and GM during the resistance training protocol. Instead, RF, VL and VM revealed a decrease in muscle activation. Tonnage is higher in PAP group than in NO-PAP group. The analysis of muscle synergies will provide in the future, but it's possible speculate on it.

Conclusions:

In the future, these data provide evidences of the necessity to assess the neuromuscular activity and muscle synergies in order to advance in understanding the PAP effect. Based on previous studies, we can hypothesize a more variable pattern in the PAP group than in the NO-PAP due to an individualized motor strategy by the PAP group through increased neuromuscular activation.

PP69B—Resistance training with and without feedback on perception of velocity accuracy

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Purpose: Perception of barbell velocity (PV) is a subjective parameter shown to be valid in estimating repetition velocity during resistance exercises (1,2) and useful when training without specific electronic devices. The aim of the study was twofold: to verify the improvement in PV accuracy through training with velocity feedback and to verify if the effects persist after 6 months of training without feedback.

Methods: Thirteen resistance trained participants completed two 1-RM tests (bench press (BP) and back squat (SQ)). Thereafter, their PV was assessed with 5 blinded loads in random order in three different moments: i) before (Pre), ii) after (Post) 5-wk of specific training with velocity feedback and iii) at least 6 months of training without velocity feedback (Re-test). For each load subjects were asked to perform 2 repetitions and report their PV using a validated velocity scale (Vp) (3). During the 5-wk of training they received visual and auditory feedback while performing different loads and viewed the scale at the end of each set. Mean propulsive velocity (Vr) of the barbell was recorded by a linear position transducer (Vitruve). Delta score (ds) represents accuracy of the PV and is calculated as the difference between Vp and Vr. Spearman's rho correlation

coefficients (rs) were used to determine interrelationships between variables. A simple linear regression analysis was performed using Vr as the criterion variable and Vp as the predictor variable. Friedman test and Wilcoxon signed-rank tests were used to identify any differences in ds between conditions.

Results: Very high correlations found in Pre (SQ: rs = 0.80, $p < 0.01$, BP: rs = 0.86, $p < 0.01$) increased in Post (SQ: rs = 0.91, $p < 0.01$, BP: rs = 0.89, $p < 0.01$). However, there was a decrease in the Re-test (SQ: rs = 0.86, $p < 0.01$, BP: rs = 0.80, $p < 0.01$) compared to Post but correlations coefficients are still higher than Pre condition. Similarly, coefficient of determination (R^2) values between Vp and Vr were: 0.63 (SQ) and 0.70 (BP) in Pre, 0.81 (SQ) and 0.76 (BP) in Post and 0.71 (SQ) and 0.57 (BP) in Re-test condition. Wilcoxon tests showed significant differences ($p < 0.05$) between dsBP(Pre) and dsBP(Post) and between dsBP(Pre) and dsBP(Re-test).

Conclusions: This study showed that PV accuracy can be improved through longer period of combined use of the device and PV scale. Furthermore, the improvements persist over time but tend to decrease gradually. Therefore, the combined use is recommended occasionally as a booster for PV.

Acknowledgments: (non obbligatorio).

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PP69C—Differences in peak muscle activation of core and lower limb muscles when performing three common functional tasks

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Purpose: Functional tasks are often used to evaluate movement related to injury but may present important differences between tasks. Previous studies have indicated that there are significant kinematic differences between functional tasks (Rabello et al. 2022). Muscle activation (measured with electromyography [EMG]) can show how superficial muscles are acting in order to control the movement, giving insight into the reasons why kinematics may be altered. Therefore, the aim of this study was to compare the activation of core and lower limb muscles when performing three different functional tasks.

Methods: Physically active women (N = 18, BMI = 21.1 ± 1.9 kg/m², 25.2 ± 3.6 years) performed the single-leg squat (SQ), anterior step-down (ANT) and lateral step-down (LAT) in five seconds while muscle activation was recorded from the following muscles: Abdominal oblique (counter [OB_CL] and ipsilateral [OB_IL]), Gluteus medius (GMED), Biceps femoris (BF), Vastus medialis (VM), Tibialis anterior (TA) and Fibularis longus (FL). The average of the three peak values of each trial (five trials) during the eccentric phase were calculated and adopted as the EMGpeak. For each muscle, a repeated-measures ANOVA was conducted to compare the EMGpeak between the three tasks.

Results: ANOVAs were significant for OB_IL, GMED, BF, VM and TA. Pairwise comparisons showed that LAT had lower activation than ANT and SQ for BF and VM and SQ had greater activation than

ANT and LAT for TA. No pairwise comparison reached significance for OB_IL and GMED.

Conclusions: The results of this study show that different functional tasks required different muscle activation patterns of five out of seven muscles evaluated. Both knee joint muscles had lower activation during the LAT task, indicating that this task required less contribution of the knee joint. TA had greater activation during the SQ, suggesting that it needed to play a bigger role in stabilizing the ankle joint in order to maintain balance. Although the pairwise comparisons did not reach significance, the comparison of the mean values showed that the greatest differences were between SQ and LAT, further indicating that these two tasks are rather different. Overall, muscle activation seems to be an important contributor to the differences between functional tasks and should be considered when seeking to understand the reasons for undesirable kinematics

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PP70A—Enduro mountain bike performance characteristic

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Purpose: Enduro mountain biking (END) is a relatively young off-road cycling discipline, not thoroughly studied as Downhill (DH) or cross country (XC)¹. This work aims at better understanding the performance determinants of END discipline, by considering both athletes' laboratory physiological profile and performance data collected on the field.

Methods: 13 male subjects (age 27 ± 3) with 5 ± 1.6 years of experience in END competitions were enrolled. Each participant performed a maximal cycle ergometry cardiopulmonary exercise test (CPET) and a 30-s Wingate (WIN). Subjects' neuromuscular characteristics were evaluated by means of maximal squat jumps (SJ) and counter movement jumps (CMJ) and maximal isometric strength of lower (squat at 130° knee angle) and upper (forearm handgrip-HG) limbs. All the participants took part in a simulated END race, consisting of active transfers (10 km with 615 m d +) and two special stages downhill (1.9 km 459 m d; 1.6 km 459 m d-) blocks. HR was continuously monitored, whilst perception of effort (RPE) and blood lactate concentration [La] were measured at the end of transfers and downhill blocks. Fixed cameras were positioned along the downhill sections to evaluate the riding technique and technical skills of the athletes. A technical score (TS) was assigned through a validated score sheet² filled in by two END experts and the auto-evaluation of each rider based on the same criteria.

Results: Simple correlation analysis showed that higher TS, VO2max and HG were related to best performance time ($r = -0.9$, $p < 0.01$; $r = -0.65$, $p = 0.04$, $r = -0.64$, $p = 0.03$ respectively). No other correlation between performance and physiological or neuromuscular parameters was found. Mean HR (178 ± 9.4) during the downhill was comparable with that associated with the second ventilatory threshold (VT2, 172 ± 6.2 bpm), whilst [La] at the end of the downhill sections was 7.4 ± 2.2 mmol/L. Finally, multiple linear regression analysis showed that 81% of variation in END performance is explained by TS ($p < 0.01$).

Conclusions: According to our results, high technical skills seem to be fundamental for improving performance in END cycling, but also

maximal aerobic power and upper limb strength could contribute to END performance. Comparisons between the current study and previous research in DH and XC also highlight some differences in sport-specific athletes' characteristics, thus further studies on this topic are required.

Acknowledgments: (non obbligatorio).

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PP70B—Are match-related exercises linked to players' intensity profile during matches? A data-driven approach

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Purpose:

Players' performance is characterized by metabolic and neuromuscular factors that should be considered by coaches during the training schedule process in order to maximize its effect. To this aim, this study provides a framework of data analytics that permits profiling players' performance to assess if the match-related exercises reflect competition intensity profile in different playing positions.

Methods:

28 semi-professional soccer players (age: 25 ± 6 yrs., height: 183 ± 6 cm, weight: 75.2 ± 7 kg), competing in the fourth Italian division, were recruited during the 2019- 2020 season. Data was collected through a GPS device (Qstarz BT-Q1000EX). A data driven approach was used to profile players in accordance with external load features during matches. In particular, a non-supervised machine learning model (k-means) was fitted to partition n observations into k clusters in which each observation belonged to the cluster with the nearest mean. A silhouette analysis was conducted to detect the best number of clusters. Finally, we assessed how the physical activity profiles detected in matches are distributed in small-sided games (SSG) and match-based exercises (MBE).

Results:

K-means analysis allowed to distinguish among 5 match profiles—from very-low to very high intensity (silhouette score = 0.34). These profiles are not fully related to playing positions during matches, but it changes within and between matches in accordance with specific tactical demands and players characteristics. Players' intensity profiles distribution during SSGs is not similar to matches one, showing that the intensity is strictly related to the field dimension and the task rules. Differently, MBE seems to better reflect the matches' profiles since rules and playing position are more like matches.

Conclusions:

Acknowledgments: (non obbligatorio).

Soccer players' playing position showed specific intensity profiles based on training task targets and on both neuromuscular and metabolic components during training and competitions. This framework of data analytics permits the evaluation of the soccer tasks' intensity allowing a deep and fast investigation of a players' physical performance. In this way, coaches could estimate the type of stimulus performed by a player in a specific training task to assess if they reflect the matches characteristics of their specific playing position.

References: (non obbligatorio).

PP70C—Correlation between muscular strength and power performed on bench lift exercises and 200 m kayak sprint performance in young paddlers

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Purpose: The current literature shows that, in elite athletes, the improvement of kayak performance is related to the high level of maximum power (Pmax) performed on prone bench pull (PBP) [1] more than the Pmax developed on the bench press (BP) [2]. The goal of this study is to investigate if these findings show the same trend in young sub-elite paddlers during 200m flatwater kayak sprint.

Methods: 10 young paddlers (national-level) participated in the present study. The test session was organized into three different days with an optimal recovery period between days of 24 h. To determine the Force-Velocity (F-V) and Power-Velocity (P-V) relationships, the paddlers performed an incremental test [2] at PBP and BP machines, increasing the load by 10 kg for each trial (from 40 to 110 kg), measuring the kinematic and dynamic parameters with a linear encoder. The kayak sprint test consisted of two trials of 200 m, with an optimal recovery time of 5 min, to cover the distance at maximum velocity. The kinematic parameters were acquired at 100 Hz from the E-kayak system placed directly on the boat [3].

Results: The linear regression between Pmax at PBP, BP, and the mean velocity on 200 m showed respectively a good correlation $r = 0.79$ and $p < 0.05$ for PBP while a poor correlation was found for BP $r = 0.59$ ($p > 0.05$). Considering the mean velocity measured at every 25 m, a correlation with the Pmax at PBP and 1RM at PBP and BP was found. The 1RM (BP-PBP) is correlated with velocity from 0 to 100 m ($0.05 < p > 0.001$) while only the PBP Pmax is correlated with velocity from 100 to 200 m ($p < 0.05$). The Pmax at BP showed no significant correlation with all kinematic parameters ($p > 0.05$).

Conclusions: The results of this study showed that the PBP Pmax is more correlated with the mean kayak velocity of 200 m sprint than the BP Pmax. In detail, differently from the elite paddlers [1], only a correlation between 1RM of PBP and BP with the mean kayak velocity was found in the first 100 m. On the contrary, in the second 100 m, according to current literature [2], a similar correlation between PBP Pmax and mean kayak velocity was found. In any case, from a forecasting point of view, even for young athletes, it would be appropriate to gradually move towards power-based training on PBP exercise.

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PP71A—Acute effects of trampoline training session on leg stiffness

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Purpose: SuperJump® workout is an innovative training modality that allows aerobic work by making the most of the potential of a jump training. Unlike jumping on the floor, it minimizes the stress on the joints, thus lowering the risk of microtraumas and injuries. Although SuperJump® is thought to stimulate higher muscle activations than traditional floor jumping exercises, only limited information is available on its acute effects on lower limbs stiffness performance. Therefore, this study aimed to evaluate the acute effects of a SuperJump® workout on lower limb stiffness, also in relation to sex.

Methods: 20 participants (11 females, age: 24.4 ± 1.0 yrs; 9 males, age: 27.3 ± 2.9 yrs) were administered continuous jump repetitions (CJs) before (PRE) and after (POST) a 30-min SuperJump® session including a warm-up with breathing and mobility exercises, a central phase with jumping exercises alternating movements of the upper and lower limbs and a cool-down phase. The CJs testing session consisted of 3 trials (5 CJs at preferred jumping Hz) with a 1-min recovery in between. They were asked to jump upwards without bending the knees with the arms on the hips and were instructed to jump as high as possible and as fast as possible. For each of the 3 trial the means of the 5 CJs was taken into consideration. Data were collected by a Quattro Jump force plate connected with a data acquisition system by means of a charge amplifier that allows the detection of force, power, and flight time. Vertical stiffness was evaluated by dividing the peak change in vertical force by the change in vertical displacement during contact. Multilevel regression models were performed to examine the effects of a SuperJump® training session on the subject's stiffness in relation to sex. After Bonferroni correction statistical significance was set at $p < 0.008$.

Results: No sex differences emerged. For both sexes, lower limb stiffness slightly decreased after SuperJump® training, however no significant differences were found from PRE to POST values. Women reported lower stiffness values than men both PRE (females: 23.94 ± 4.21 kN/m, males: 38.77 ± 9.41 kN/m) and POST (female: 23.83 ± 2.71 kN/m, males: 38.09 ± 9.53 kN/m).

Conclusions: Findings indicate that SuperJump® as a form of exercise is useful to maintain and improve leg stiffness performances. However, it would also be necessary to record neurophysiological parameters to evaluate the possible mechanism underlying the observed stiffness variations.

PP71B—Relationships between balance, hip strength, single leg vertical jump and complex motor task

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Purpose: The use of a complex motor task such as the Y Balance Test (YBT) is widespread among professionals as functional and motor evaluation procedure. At the same time, the specific goal of this test is not clear at all, indeed several researches found contrasting correlation between this test and other motor and physical evaluations^{1,2,3}. The aim of this study is to expand the knowledge about the relationships between YBT and other functional assessments.

Methods: Fifteen healthy and fitness volunteer (28.1 ± 6.7 yrs; 169.3 ± 5.1 cm; 65.5 ± 11.0 kg;) were tested for single leg stability using a pressure platform (FreeMed, Sensor Medica, Guidonia-RM, Italy); for gluteus medius (Gm), gluteus maximum (GM) and quadriceps (Q) strength with manual muscle test using an hand held dynamometer (FGP, Verona, Italy); for single leg CMJ height using an inertial sensor (Beyond, Motustech, Guidonia-RM, Italy); and for complex motor task skills using YBT. Data were analyzed with Pearson correlation in order to find out significant relationships. Significant level was set for $P < 0.05$.

Results: No significant relationships were found both for dominant and not dominant lower limb between YBT and static single leg stability. No significant relationships were found between not dominant limb and hip strength or CMJ. Significant relationships were found only for dominant limb between YBT anterior performance and Gm strength ($R -0.55$); YBT postero-medial, postero-lateral and composite score performance and single leg CMJ ($R 0.52, 0.61, 0.54$ respectively).

Conclusions: Our results are consistent with previous literature regarding the absence of relationships between YBT and hip strength assessed with manual muscle tests, except for the dominant leg were the strength of the Gm seems to limit the YBT anterior performance. The novelty of our investigation is the use of single leg CMJ. This choice led us to find a moderate but significant relationship between YBT performance and CMJ height observed only for dominant leg. Previous research did not investigate this aspect. These results allow us to repeat the study with other different kind of samples such as sportsmen or inactive people, in order to understand better this behavior.

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PP71C—The distribution of pressure on the saddle in young off-road cyclists: a pilot survey in both sexes

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Purpose: While pedaling cyclists distribute their body weight on the pedals, handlebars, and saddle. It would appear that the pressure on the saddle can compress specific neurovascular tissues of the perineum leading to acute and chronic genital pathologies. This study aimed to investigate the distribution of pressure on the saddle in order to prevent acute and chronic genital pathologies in young off-road

cyclists of both genders. Moreover, based on pelvic anatomical differences between males and females, a further aim of the study was to investigate any differences in pressure according to gender in order to establish the most suitable saddle.

Methods: Sixteen young off-road cyclists (10 m, 6f) between the ages of 10 and 12 years old (Italian youth categories: G4, G5, G6) were recruited. Participants were evaluated on their bikes installed in a specific bike roller (MagneticDays). Firstly, in order to standardize protocol measurements among participants, each participant was administered a bike fitting to optimize joints' function. Next, participants were asked to warm up for 10 min at a self-selected cadence and intensity. The pressure distribution was then measured using a device equipped with sensors to acquire pressure on the fixed saddle (W-Saddle Pro). The pressure distribution on the saddle of each participant was measured at three different intensities (100 W, 140 W, 180 W) with a pedaling cadence of 90 rpm. The male cyclists performed the three trials using a neutral saddle while the female cyclists repeated the three trials also using a lady saddle.

Results: A significant difference was found in the ischial distance between males and females ($p = 0.01$). As pedaling intensity pressure was higher in the pubic region in males ($p = 0.007$). In contrast, females showed higher pressure in the posterior regions with increased pedaling intensity ($p = 0.04$). Moreover, females showed higher pressure in the posterior regions with lady saddle compared to neutral saddle at an intensity of 100 W ($p = 0.04$).

Conclusions: Our results suggest that in male off-road cyclists the pressure in the pubic region is higher when intensity increases. Hence, in order to prevent acute and chronic genital pathologies it would be advisable to tilt the saddle with the tip pointing downwards. As for female off-road cyclists, it would appear that there is no difference in pressure between neutral and lady saddles except at low intensities. Further studies are needed.

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PP72A—Effects of a visual occlusion training program on the passing ability of under-14 football players

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Purpose: Visual occlusion seems to directly affect the players' field of vision during competition. It is important to identify how visual occlusion affects vision and whether it improves performance. This study aims to test whether a visual occlusion training program can improve the passing ability of young football players.

Methods: Thirty under-14 football players were divided into two groups. The visual occlusion group (OCC; $n = 15$) performed extraordinary visual occlusion training sessions using the reduced field of view glasses that prevented the participants' entire lower body view; they also performed the ordinary training program. The control group (CON; $n = 15$) performed only the ordinary training program. The study consisted of a pre-test, 3 months of differentiated improvement intervention for the 2 groups, and a post-test. The test used was the Loughborough Soccer Passing Test. Independent samples t-test was used to assess differences between the groups in pre-

and post-intervention. A two-way repeated measures ANOVA was used to test for differences in passing ability from training in the so-called "Trial," "Penalty Time," and "Global Performance" variables.

Results: Both the OCC group ($p = 0.21$) and the CON group ($p = 0.43$) did not change performance in the "Trial" variable. In addition, the OCC group experienced small to moderate improvements in the "Penalty time" ($p = 0.005$) and "Global Performance" ($p = 0.002$) variables; [d (95%CI) = 0.51 (0.10; 0.70) and 0.44 (0.05; 0.66); respectively]. In contrast, the CON group showed no significant changes in "Penalty time" ($p = 0.61$) and "Global Performance" ($p = 0.89$) variables. A significant interaction between time and group was found in "Penalty time" ($p = 0.016$) and "Global Performance" ($p = 0.011$) variables; [d (95%CI) = 0.19 (0.03; 0.48) and 0.21 (0.01; 0.45), respectively].

Conclusions: The OCC group significantly improved passing accuracy while simultaneously reducing execution errors. These results suggest that integrating visual occlusion into a training program for youth football players can have a positive impact on their passing ability. Further investigation is needed to address the study's limitations, consisting of the originality of the application of visual occlusion to youth football and the narrowness of the sample.

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PP72B—The use of the parachute as a resistive method for sprint training in recreational sprinters: a pilot study

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Purpose: Improving sprint running speed is one of the key goals of athletes and coaches in various sports. Sprinting speed is directly correlated with horizontal force production (1–2). Several resisted sprint training (RSS) methods, using relatively heavy loads, have been proposed in recent years in order to optimize horizontal force production and sprint performance (3). The aim of this study is to explore the effects of parachute-resisted sprinting on sprint and strength performance in a small group of sprinters.

Methods: 7 female recreational sprinters (age: 19.5 ± 3.7 years) were recruited for the study. The training protocol consisted in including one session of parachute-resisted sprinting during their training for six weeks. During the parachute-resisted sprinting, the athletes sprinted over distances of 30, 40, 60, and 80 m. The total training volume was increased between the second three weeks and the first three weeks. To test the RSS efficacy. Before (T0) and after (T1) the training protocol, the sprinters performed a battery of performance tests: 30 m linear sprint (30 m LS), 60 m linear sprint (60 m LS), and horizontal jump (HJ). Wilcoxon matched Pairs test was used to compare each

performance test between time, and Cohen's *d* with a confidence interval of 95% was used to estimate effect size.

Results: Statistically significant results emerged between T0 and T1 on the 60m LS ($z = 2.37$, $p < 0.05$) and HJ ($z = 2.20$, $p < 0.05$). No significant improvements emerged in the 30m LS performance. The effect-size was moderate for all 3 tests (30 m LS $d = -0.52$, -0.93 to -0.12 ; 60 m LS $d = -0.70$, -1.10 to -0.29 ; HJ $d = 0.50$, 0.09 to 0.90).

Conclusions: The results that emerged are promising and they seem to suggest that the use of the parachute as an RSS method improves sprint performance during the launched phase of running but not during the acceleration phase. Possibly, further studies with more subjects and a control group could confirm these findings.

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PP72C—Teamgym: application of video analysis to the study of double somersault in a tucked position on mini-trampoline

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Purpose: Teamgym is a sport discipline, similar to artistic gymnastics, practiced since the 1970s in Northern Europe and for the last twenty years in Italy. While the performance of artistic gymnastics has been widely studied, studies about Teamgym are scarce. Since performance in an acrobatic sport depends on multiple factors, including anthropometric and biomechanical ones, the present study aimed to identify the factors that influence the double somersault in a tucked position on a mini-trampoline.

Methods: Eight gymnasts aged between 10 and 14 participated in the study. The stature and weight of each athlete were measured according to a standardized procedure. A mobile laboratory was set up with 2 video cameras suitably positioned to film the jumps in such a way as to film the run-up phase with the first, the take-off phase, the acrobatic evolution, and the finishing phase of the jump with the second. Each gymnast performed 13 jumps and two judges scored independently the execution of each jump according to the Teamgym Code of Points and the average of the two assessments was recorded. The jumps considered valid were video-analyzed using Tracker software. We calibrated the images, chose the reference origin, and positioned the marker points, then we measured the following kinematic variables: maximum run-up speed, take-off length, maximum jump height, jump length, rotation speed, the average diameter of the first and second rotation, the horizontal and vertical distance between the two rotations. Correlations and multiple regression were performed.

Results: 81 jumps out of 104 were considered valid. The judges' ratings were significantly and negatively correlated with stature and with jump length, the horizontal and vertical distance between the two rotations, and positively correlated with maximum run-up speed,

take-off length, maximum jump height, the average diameter of the second rotation, and Team gym practice. The multiple regression showed as predictors of the evaluation given by the judges the kinematic variables: average diameter of the second rotation and maximum height of the jump. In addition, stature, among the anthropometric variables, resulted negatively correlated to score, while the years of practice in Teamgym positively influenced performance.

Conclusions: Knowing the factors that determine performance in Teamgym skills allows us to provide coaches with pointers to plan their training schedules and thus improve the performance of their athletes.

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References: (non obbligatorio).

PP73A—The metronome to evaluate the swimmer's performance during a season

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Purpose: The metronome (MET) is increasingly used in cyclical sports as, for instance, in swimming. This is because it allows coaches and athletes to find the right balance between stroke frequency and length during training sessions to learn and customize the best race strategy. The aim of this study was to evaluate the athlete's performance during the training period by means of an innovative methodology based on MET.

Methods: Fourteen competitive swimmers performed three 50 m freestyle time trials during pre-season (PRE) and after 2 months, during the in-season period (IN). The outcome parameters used to evaluate the performance in the three conditions were: the mean ISI value (s), the stroke length (SL), the total time of 50 m (TT), and the average velocity (AV). During the first trial participants were asked to swim at their maximum intensity (NO-metronome condition). Then, the intra-stroke-interval (ISI) was computed for each participant as the time between the strokes. The mean value of ISI of each subject was used as individual reference value. During PRE (PRE- ISI100), after the first trial the swimmers were asked to swim the second 50 m freestyle time trial in synchronous with the audio feedback provided by a waterproof MET positioned under the swimming cap and set at own ISI value measured in the first trial (ISI100 condition). During the third trial (PRE-ISI95), the MET was set at 95% of the ISI measured without MET, i.e., the 5% shorter than ISI100 condition (ISI95 condition). During IN, the swimmers repeated the same experimental conditions performed in PRE keeping the same ISI value (IN-ISI100, IN-ISI95).

Results: In NO-metronome condition the t-test showed a significant improvement of TT respect to PRE season ($p < 0.05$). The results didn't show a significant improvement of ISI ($p > 0.19$) and SL ($p > 0.37$). ANOVA on SL highlighted a significant main effect of PERIOD ($p < 0.05$), with SL significantly larger in IN (0.99 ± 0.02 m) than in PRE (0.97 ± 0.02 m). A significant main effect of ISI ($p < 0.01$), was also found, and indicated a lower SL value in ISI95 (0.97 ± 0.02 m) with respect to ISI100 (1.00 ± 0.02 m).

Conclusions: The results of this study showed that the use of the metronome is able to highlight how SL influences the improvement of

performance while maintaining a constant ISI. This allows coaches and athletes to know how to train for better performance.

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References: (non obbligatorio).

PP73B—Integrative neuromuscular and balance training to decrease inter-limb asymmetry values in young soccer players

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Purpose: The lower limbs functional asymmetries are determined by strength deficits between the two limbs (Read et al., 2021). This asymmetry seems to significantly affect performance but above all it seems to represent an injury risk factor (Filter et al., 2021; Helme et al., 2021). The purpose of the study is to analyse and understand the lower limb asymmetry values in the young soccer players. The study also verify whether neuromuscular training on unstable and small surfaces provides an effective plan able to reduce functional asymmetries and allows the strength performance increase.

Methods: 32 young male soccer players (14.22 ± 0.61 years, 47.66 ± 4.89 kg; 162.3 ± 7.7 cm, age training: 8.3 ± 1.1 years) have been randomly divided into Experimental Group, EG ($n = 15$) and Control Group, CG ($n = 17$). The EG completed a total of 16 training sessions directed at balance and neuromuscular training on unstable or small surfaces: two 30-min sessions/week over a 8-week period. The CG followed an identical training schedule, but training sessions consisted of soccer-specific drills only. The performances were assessed in the One-Leg Hop test and Side-Hop test, to quantify percent asymmetries in lower-limb strength before (T0) and following (T1) training.

Results: The data analysis returns the highlights significant inter-group results (T0vsT1): the One-Leg Hop test left limb ($p = 0.05$, $d = -2.67$), the One-Leg Hop asymmetry score (%), ($p = 0.0005$, $d = 10.77$), the Side-Hop asymmetry score (%), ($p = 0.0005$, $d = 4.25$).

Conclusions: The neuromuscular and balance training on small and unstable surfaces seem to respond effectively to two needs of the young soccer player: the injury prevention, by reducing the strength asymmetry values, and increasing the lower limb explosive strength values.

Acknowledgments: Thanks to Prof. Rosa Anna Rosa for the support in the statistical analysis.

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PP73C—Three-dimensional reconstruction of lower limb kinematics during acl injury in professional basketball players

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Purpose: Anterior Cruciate Ligament (ACL) injury is one of the most debilitating injuries in professional basketball [1]. Video analyses based on television footage offer a unique perspective on the real situational and biomechanical pattern of the injury mechanism [2]. In that, the model-based image-matching is a promising, yet scarcely adopted in basketball [3], technique to characterize the injury mechanics. This study aims at comprehensively characterize ACL injuries kinematics in professional basketball players.

Methods: The situational pattern [2] and injury mechanism of 14 non-contact and indirect-contact ACL injuries (3 females) occurred from 2016 to 2022 in the main competitions (NBA, WNBA, Euro-League) were analyzed. When an injury was identified, (i) multi-view non-coaxial television images were inspected to exclude direct-contact injuries and to identify the “initial contact” (IC) preceding the “injury frame” (IF); (ii) for each injury, camera views were taken every 100 ms from 500 ms before IC to 300 ms after IF; (iii) a size-matched pitch was modelled within Blender (v. 2.90, Blender Foundation, NL) and was used to calibrate the cameras by matching reference items in the images (e.g. pitch lines); (iv) a 3D body model was adjusted to fit the player’s pose in each frame/view; (v) poses were interpolated (Bezier spline), and (vi) Euler’s joint angles of the injured limb were extracted and compared among mechanical patterns using a Statistic Parametric Mapping 1-way ANOVA.

Results: Six injuries occurred through a non-contact, while eight with an indirect contact mechanism, primarily on the upper body. Three main biomechanical patterns emerged from the kinematic time series: landing, sidestepping, stopping. When landing, the knee and the hip were 40°-50° more extended before the impact with the ground; the hip was internally rotated at injury while sidestepping, neutral while landing and internally rotated while stopping.

Conclusions:

ACL injury mechanism in elite basketball is not unique. Rather, it is dependent on the situational and environmental pattern. Mechanical perturbations (contrasts, opponents’ actions), and the concurrent game requirements produce diverse conditions which can trigger an ACL injury: for instance, an excessively abducted hip appeared during sidestepping, but not during landing, where the ankle was pronated. Preventive neuromuscular training should be targeted towards safely dealing with game-specific actions and perturbations.

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PP74A—The influence of sleep quality on jumping performance and postural control in young tennis players

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Purpose: The relationship between sleep quality and postural control is increasingly of research interest. Although several studies showed the influence of sleep quality on sport performance, very few studies have explored the relationship with postural control. Hence, the aim of this study was to investigate whether sleep quality could influence jumping performance and postural control in young tennis players.

Methods: Fourteen young tennis players (7 f, 7 m; 12.71±2.52 years; 45.21±10.05 kg; 159±13.72 cm) were recruited from a Sicilian tennis club. Each participant was evaluated at the beginning (T0) and at the end (T1) of the competitive season. At T0 and T1 each participant filled out a questionnaire to evaluate sleep quality of the 7-day pre-test, based on the Pittsburgh Sleep Quality Index and the Mini Sleep Questionnaire. Moreover, measurements included: (a) 3 trials of Squat Jump (SJ) test using an optical detection system (OptoJump Next, Microgate) to measure jumping performance; (b) a stabilometric test in two conditions [i.e., open eyes (OE) and closed eyes (CE)] using a posturography system (FreeMed, Sensor Medica) to assess postural control.

Results: The sample was divided into two groups based on the improvement or worsening of sleep quality between T0 and T1: worsened sleep group (WSG) including 6 participants and improved sleep group (ISG) including 8 participants. For both groups a paired t-test was carried out to compare jumping performance and postural control between T0 and T1. As for the stabilometric test, results showed a significant increase in sway path length ($p < 0.05$) and sway mean velocity ($p < 0.05$) parameter in OE condition as well as in CE condition ($p < 0.01$ and $p < 0.05$, respectively) in the WSG. No significant differences were found for the ISG. As for the SJ test, although not statistically significant, the ISG showed a trend of improvement ($p = 0.07$) at T1.

Conclusions: Based on our findings, a poor sleep quality can affect negatively postural control in young tennis players. Whereas, a good sleep quality seems to have a positive influence on jumping performance. Future studies should investigate this topic with large sample size and involving young athletes of different sports.

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PP74B—Does stretching exercise order acutely influence outcomes of range of movement?

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Purpose: Exercise order has been shown to affect outcomes of strength with the first exercises performed having the greatest effects on strength, while for cardiovascular health the last exercises seem to be those which mostly affect endothelial function. It is still unknown if exercise order of stretching exercises may have an effect on outcomes pertaining to range of motion (ROM). Therefore, the aim of this investigation was to evaluate the acute effects of stretching exercises performed in different orders on ROM.

Methods: Thirty-two participants, 17 men and 15 women (22.7 ± 3.25 yrs; 68.5 ± 12.1 kg; 170 ± 10.2 cm) were recruited at the University of Palermo. For each subject, the type and amount of physical activity (IPAQ questionnaire), range of motion (ROM) for hip flexion and extension (through an inertial device) were measured. Participants were divided into five groups, each of them was evaluated before (T0), immediately after (T1) and 15 min after (T2) the delivery of the intervention. Intervention protocols were administered only to the right leg and included the administration of static stretching 1) only to the quadriceps muscle (agonist, AG), 2) only to the hamstrings muscle (antagonist, AN), 3) first to the AG and later to the AN muscles (AG/AN group) or 4) first to the AN and then to the AG muscles (AN/AG group). No protocol was administered to the control group. ANOVA was used for comparisons.

Results: A significant increase was observed for all intervention groups (except for control) in the right limb only for both flexion ($p < 0.0014$) and extension ($p < 0.04$) measures. No significant group interaction was observed, with ROM resulting significantly increased for all groups from baseline to T1. No differences between T1 and T2 were present in any group.

Conclusions: The preliminary results of this investigation highlight that ROM is not acutely influenced by stretching exercise order. Therefore, the subject's preferred order can be incorporated into stretching routines.

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PP74C—The effect of a swimming training program on swim-to-cycle transition during a triathlon simulation

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Purpose: Swimming interpretation can have an impact on the swim-to-cycle transition (T1) and influence the entire triathlon performance. Therefore, the purpose of this study was to evaluate the effect of an 8-week swimming training program adopting different swimming kick frequencies on biomechanical and physiological responses during a T1 simulation.

Methods: Fifteen triathletes were randomly allocated to a 6 kicks per stroke (K6), 4 kicks per stroke (K4), and control group (CG). Before and after the program, a T1 simulation (400-m swimming and 10-min

cycling segment) was conducted with the concomitant evaluation of biomechanical parameters (stroke frequency, stroke length, swim velocity, kick frequency, kick length, stroke, and kick index, cycling power output and cadence), and physiological parameters (heart rate, blood lactate, O₂ uptake kinetics $\dot{V}O_2$, energy expenditure). The values of the last 100-m swimming and the first 45-sec

cycling segment were analysed with a mixed ANOVA with post hoc comparisons.

Results: A time \times group interaction ($p < 0.05$) emerged in the swimming segment for stroke frequency, stroke length, stroke index, and average energy expenditure. Post hoc analysis confirmed a lower stroke frequency ($p = 0.004$, $d = 1.91$) and a higher stroke length ($p = 0.002$, $d = 2$) for K6 group compared to CG at post-training. A time \times group interaction ($p < 0.05$) was found in the cycling segment for minimum cadence, average heart rate, average $\dot{V}O_2$, average and maximum energy expenditure. Post hoc analysis confirmed a reduction in the K6 group between pre- and post-training for average heart rate ($p = 0.005$, $d = 3.30$), $\dot{V}O_2$ ($p = 0.014$, $d = 2.95$) and energy expenditure ($p = 0.008$, $d = 2.72$). Nominal differences ($p < 0.05$) showed an increase in minimum cadence and a decrease in maximum energy expenditure for the K6 group after training program.

Conclusions: The stroke length increment and stroke frequency reduction in the K6 group could be explained as an improvement of swimming technique. The reduction in physiological parameters for the K6 group after the training program observed in the initial part of the cycling segment could demonstrate an improvement in the cycling economy. This might be also related to the ability to maintain a higher minimum cadence coupled with a lower energy expenditure. Finally, although the training program did not directly influence kick frequency, an improvement in the cycling activity was found for the K6 group.

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References: (non obbligatorio).

PP75A—Effects of a short-term speed, agility and quickness training programme on cognitive and physical performance in young soccer players

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Purpose:

The importance of cognition for soccer can be found in the concept of agility, defined as “skills and abilities needed to change direction, velocity or mode in response to a *stimulus*” (Young et al., 2015). Moreover, there is evidence that athletes with high-performance level show high cognitive function in general cognitive tasks compared with their low-level peers (Huijgen et al., 2015). Elucidating the effect of specific training methodologies on physical and cognitive domain of agility might be helpful for coaches to stimulate qualities related to performance. The aim of the present study was to

investigate the effect of a short-term (4 weeks) non-soccer-specific training programme based on speed, agility and quickness (SAQ) on cognitive and physical performance in young soccer players.

Methods:

Twenty-one participants were randomly assigned either to non-sport specific training group based on SAQ drills ($n = 11$, 9.7 ± 0.4 yrs, 1.34 ± 0.07 m, 32.3 ± 0.6 kg) or soccer specific training group based on small sided games (SSG) drills ($n = 10$, $9.5 \pm$

0.6 yrs; 1.34 ± 0.05 m, 32.4 ± 0.5 kg). They were tested pre and post interventions on physical (5 m sprint, 20 m sprint and sprint with turns of 90°) and cognitive (inhibitory control by means of the Flanker task and perceptual speed by means of the visual search task) performance.

Results:

Although neither variable showed a significant time \times group interaction ($p > 0.05$), the main effects of time were significant for 5 m sprint, inhibitory control, and perceptual speed ($p < 0.05$), apparently showing de facto improvements after both training programme. Of note, the post-hoc analysis revealed that SAQ group improved 5 m sprint velocity, inhibitory control and perceptual speed ($p < 0.05$) as compared to the SSG group ($p > 0.05$).

Conclusions:

These findings suggest that a 4-week training programme based on SAQ would seem to be superior to soccer-specific training programme based on SSG for improving cognitive and physical performance in young soccer players. Non-sport-specific activities targeting speed, agility and quickness combined with cognitive engagement (i.e., SAQ) might be useful strategies to be included within a soccer training routine (perhaps also including SSG) at promoting both physical and cognitive domain of agility in youth soccer.

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PP75B—What are the judgements about recovery status based on? a correlational study in professional soccer players

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Purpose: In order to minimize fatigue on match day whilst trying to maximize the training effect, coaches often ask players to judge, either formally or informally, their state of recovery. The aim of this study was to explore the factors (such as internal training load and fatigue) on which such judgements of recovery are based on in a group of professional soccer players.

Methods: 57 players from two professional Italian soccer clubs competing in the third Italian division (Serie C) were recruited from this study. The data recording was conducted between January 2nd 2021 and May 11th 2022. A total of 6430 training or match sessions were recorded. Every morning, the players rated fatigue, sleep quality, muscle soreness, stress and mood using the Wellness Questionnaire (WELQUE). At the same time, they formally judged

their recovery status using the Total Quality Recovery questionnaire (TQR).

Moreover, at the end of each training session and match, the session rating of perceived exertion (sRPE) was obtained. A framework of big data analytics of time series was employed to detect the factors associated with the players' judgement of their recovery status.

Results: Big data analytics (Extreme Gradient Boosting Regressor (XGBR) model fitted on 22 independent features) suggest that judgements of recovery status are primarily associated with the perception of fatigue and muscle soreness at the time of such judgements. Other factors such as sRPE of the previous training session and sleep quality during the previous night seem to be less important.

Conclusions: The findings of this study suggest that, in order to maximize perceived recovery of professional soccer players, coaches should minimize fatigue and muscle soreness on match day using appropriate training periodization and recovery strategies. Future experimental studies are required to confirm these correlational findings.

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PP75C—Effects of warm-ups with and without the ball in young soccer players

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Purpose: The aim of this study was to investigate effects of two different warm up

protocols on performance both at the end of warm up (PRE) and at the end of training session (POST) by controlling the rating of perceived exertion (RPE), with Borg Category Ratio 10 scale (CR10) in young soccer players.

Methods: 58 young soccer players (age = 11.5 ± 0.9 yrs, weight = 41.4 ± 6.2 kg, height = 149.9 ± 7.7 cm, body mass index = 18.3 ± 1.6 kg/m²) from Under 11 (U11) to Under 13 (U13) category participated in the study. Each category was divided into 2 subgroups, one for Warm Up protocol without ball (WU) and the other one for Warm Up protocol with Ball (WUB). Physical tests (Countermovement Jump arm swing, CMJ; 20 m Linear sprint, 20 m L; 505 agility, 505) were performed by players at PRE and POST conditions. The players' CR10 was also registered to verify eventual difference between the two subgroups' internal training load. A Linear Mixed Model was applied to determine differences between subgroups; Tukey test was used as a Post Hoc.

Results: For all physical tests, an improvement was reported for WU subgroup between PRE and POST conditions. On the contrary, for the same comparison, a performance decrease emerged for WUB subgroup. In particular, WUB subgroups showed a decrease in CMJ (estimate = -1.140 cm, SE = 0.337, $p < 0.001$), 20 m L (estimate = 0.0784 s, SE = 0.0113, $p < 0.001$), and 505

(estimate = 0.0551 s, SE = 0.0114, $p < 0.001$). For RPE data, no difference was observed between WU and WUB protocols at PRE and POST sessions, despite differences emerged between PRE and POST conditions ($p < 0.001$) in both subgroups.

Conclusions: With the same RPE trend, the present findings indicate WU performance not decrease during training session while WUB protocol highlighted a performance decrease from the end of warm up to the end of practice. Exercises with an increasing metabolic intensity and attention threshold, such as WU protocol, seems to be optimal for young soccer players in order to make them to be ready for practicing or competing. However, further studies are needed to clarify if an absolute choice to provide WU is successful in young soccer players or optimal distributions between warm up exercises with and without ball are associated even to better performances.

PP76A—Relationships between perceived exertion and game performance indicators in women's ultimate frisbee

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Purpose: The impact of fatigue on technical and physical performance during match play is of particular concern in team sports.^[1] It was previously reported that physical outputs are not impaired throughout a match in elite women's ultimate frisbee.^[2]

Nevertheless, several factors such as the management of players substitutions during a match, game status and the level of competition may influence the impact of fatigue on performance during match play. Therefore, the purpose of this study was to assess the interrelationships between fatigue and indicators of match performance in elite women's ultimate frisbee.

Methods: 19 female players from an Italian elite team (age: 20.7 ± 3.2 years; height: 167.9 ± 6.1 cm; weight: 57.2 ± 3.9 kg) were involved. A total of 7 games played by the team was examined. After the end of each game, the rate of perceived exertion (RPE) was assessed. The following performance indicators were examined: number of points played, number of points played in succession, throwing and receiving errors, number of breaks performed and conceded. Repeated-measure correlations (rmcorr) were calculated to assess the relationships between the examined variables.

Results: A very high correlation was observed between RPE and total points played (rmcorr = 0.70, 95% CI 0.57 to 0.79). RPE was also highly correlated with points played consecutively (rmcorr = 0.50, 95% CI 0.32 to 0.64), whereas it was lowly though significantly correlated with throwing errors (rmcorr = 0.23, 95% CI 0.02 to 0.41) and breaks performed (rmcorr = -0.27, 95% CI -0.45 to -0.06). No significant correlations were observed between RPE and the other examined variables (all $p > 0.05$).

Conclusions: The results demonstrate that fatigue can negatively affect players' performance during elite female ultimate frisbee games. From a coaching perspective, it is important to reduce fatigue

with appropriate substitution strategies aiming to limit the number of points played consecutively and in total by each player.

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PP76B—Proprioception in rhythmic gymnastics training programmes. A preliminary study

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Purpose: Rhythmic gymnastics is a technical-combinatorial sport that requires distinct coordination skills and significant physical talent. The ability to maintain one's balance is a basic requirement for this discipline. In fact, it is possible to perform the technical elements of rotation, jumping and balance only if one possesses such skill, and it can be improved according to a very specific protocol. This aspect is often disregarded by the technical staff due to the frenetic pace of training required for the learning difficulties in body and apparatus training. The aim of this research is to demonstrate the effectiveness and efficiency of proprioceptive training as a foundation for the development of the ability to maintain balance in rhythmic gymnastics.

Methods: In-depth bibliographic research of scientific texts and articles regarding this topic was conducted. Initially the focus was on the ability to maintain balance when standing upright and then our research shifted to the specific technical gesture of the sport. Finally, the study turned towards proprioceptive training, highlighting the benefits on both a coordination and a preventative level.

Results: Thanks to the scientific literature it was possible to observe how the addition of a proprioceptive training protocol can contribute to technical and qualitative performance improvements in rhythmic gymnastics.

Conclusions: The introduction of a proprioceptive methodology within the training sessions is useful especially for improving the subject's sensorimotor and proprioceptive function. It can be used as measure for preventive articulation reinforcement and, in the case of an injury, it can be included in the recovery phase. In a specific way, proprioception can be utilized as a means to reinforce the ankle which is the joint that is often most at risk in rhythmic gymnastics.

Acknowledgments: (non obbligatorio).

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PP76C—Publishing in the field of exercise and sports research: is there a gender bias?

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Purpose: Despite undoubted recent progresses made in the last decades, gender bias is still present in publication rates (1). The under-representation in academic publishing, especially in medical fields (2) has been preliminary reported also in the area of Sport and Exercise Sciences (3). This study aims to examine the representation of women as first and last authors in publications reporting results of randomized controlled trials (RCTs) published in the exercise and sports research fields in the last 5 years.

Methods: We collected all the RCTs published from April 2017 to March 2022 via the Medline dataset using the inclusive MeSH term "Exercise therapy". The identification of the gender of the first and the last authors was done through photographs and pronouns on the authors' profiles on Researchgate and other platforms. When the gender of an author could not be identified, the study was excluded from further analyses. Other variables of interest were: the research field and year of publication, Country of affiliation of the first author, and ranking of the Journal.

Results: A total of 5504 articles were extracted. For the impossibility to determine the gender of the principal authors, 254 (4.6%) papers, were excluded from the final analysis, which was conducted on 5259 articles. In total, across all the years and the journals, 2449 (47%) articles had a female as the first author, 1756 (33%) a female as the last author, and 1105 (21%) articles had females as both first and last authors (in comparison to 41% with males as both first and last authors). The distribution of authorship by women remains constant in the considered years (p for trend = 0.34 first author; p for trend = 0.99 last author) with a higher percentage of males. In particular, the percentage of females as last authors is about one-third of the published articles each year (ranging from 35.9% in 2020 and 32.0% in 2018). Only in Oceania there are a majority of female first authors (53.1%) but in no Continents the percentage of female last authors is higher than males. Africa is the Continent with the lowest percentage of females first (33.0%) and last (27.7%) authors.

Conclusions: Over the last five years, in the field of exercise and sports research, both sexes are almost equally represented as first authors, in contrast with other medical areas. However, women still represent the minority of the last authors in all the Continents, confirming an existing gender bias in academia also in this field.

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PP77A—Correlation between fear of falling and functional fitness in older adults: results from the PAP & DAP project

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Purpose: The fear of falling and decline in functional abilities are the most relevant factors of constraint in social and daily activities among the elderly. Therefore, the aim of this study was to analyze the correlation between fear of falling and functional fitness variables in older adults.

Methods: Two hundred and three participants (25 men and 178 women) were randomly recruited for participating in the “Promotion of Physical Activity and Prevention of Domestic Accidents” project (PAP & DAP). Age of participants ranged between 60 and 86 (mean 70.7 years old), 68.5 kg body weight, 160.3 cm height, 26.6 kg/m² BMI and reported that they had not fallen in the last year. The fear of falling was assessed with a shortened version of the fall efficacy scale-international (FES-I) questionnaire. The functional fitness was measured with the Senior Fitness Test 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), time up and go (dynamic balance and walking ability) and two-minute step (aerobic endurance). Pearson’s *r* correlation and multiple regression models were used to determine the association between the FES-I scores and the output variables. The strength of correlation was rated as per Hopkins: small (0–0.30), moderate (0.31–0.49), large (0.50–0.69), very large (0.70–0.89), and almost perfect (0.90–1). The alpha level was set a priori at 0.05.

Results: Negative correlations were found between fear of falling and the examined variables, except for the time up and go test. However, the correlations were significant and large with the performance in the time up and go test ($r = 0.599$), and moderate with the outcomes in the chair stand ($r = -0.428$), arm curl ($r = -0.335$), sit and reach ($r = -0.386$), and two-minute step ($r = -0.377$) tests. Moreover, the fear of falling was significantly and positively associated with the age ($r = 0.169$). In the multiple regression model, the time up and go test and sit and reach test were the best predictors of the fear of falling.

Conclusions: These findings show that it is fundamental to plan interventions aimed to develop dynamic balance, walking ability and back and hamstring flexibility for reducing the fear of falling and improving the quality of life among older adults.

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PP77B—Effect of endurance training on the perception of effort: a systematic review

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Purpose: Parameters used to track endurance training adaptation are still matter of debate and apart from measuring the performance directly with a maximal exercise test, none have emerged as a reliable reference. Even maximal oxygen uptake is unable to detect the variations in endurance performance that occur in trained endurance athletes. To date, different theoretical models recognize the perception of effort (PE) at least as an important if not a determinant of endurance performance. Furthermore, its assessment using rating of PE (RPE) or other psychophysical methods during submaximal exercise may be a practical marker of training adaptations and endurance performance. However, to the best of our knowledge, the effect of endurance training on PE has not been systematically

reviewed. Therefore, the aim of this study was to review systematically the PE adaptation to endurance training and evaluate its hypothesised relation to endurance performance variations.

Methods:

This systematic review was conducted in line with the PRISMA guidance using the following inclusion criteria: 1) The outcome was composed of whether a record of RPE estimation, RPE production, or RPE ratio (RPE/workload); 2) The study included an endurance performance test; 3) The study included a period of minimum 5 days of endurance training. Studies were excluded if they did not include direct statistical comparison pre- to post-training for RPE.

Results:

Our hypotheses were that endurance training reduces PE and improves endurance performance whilst an increase in PE reduces endurance performance. Among the 50 studies who met the inclusion criteria, 47 used RPE estimation method among which 87% are in line with such expectations. One study used RPE ratio method and 2 used RPE production method, and for both, outcomes were in line with our hypotheses.

Conclusions:

Our results demonstrates that various methods to assess PE are sensitive to training- induced adaptations. Furthermore, changes in PE are generally associated with endurance performance as predicted by current theoretical models. Therefore, PE assessment during submaximal exercise, may be a practical marker of endurance performance and training adaptations that can be used frequently to monitor endurance athletes. Further experiments are needed to improve our understanding of the link between these two variables and understand the mechanisms underlying the reduction in PE observed with endurance training.

PP77C—Differences in proprioceptive acuity in the reproduction of different angular positions

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Purpose: Proprioception is of crucial importance both in the sports context and in the daily life movements; therefore, several methods have been proposed in order to assess proprioceptive acuity. However, the tests proposed in the literature do not clarify the analytical assessment of the various components underlying proprioception (position sense and discrimination of different positions); in fact, no correlation has been found between the various methods proposed. Our purpose is to assess proprioceptive acuity through a joint position reproduction (JPR) task. In addition, we want to compare the JPR with a task of reaction to a stimulus indicating a joint position that allows us to measure position sensitivity to stimulus. In particular, the aim of our work are: to test whether there are differences in angular error (AE) between different joint angles in an angular position reproduction task (JPR); to test whether there are differences between the errors made in JPR and those made in angular reaction task (AR).

Methods: Ten subjects ($F = 5$) were subjected to a JPR task, in which they received an electrical stimulus during the concentric phase of a forearm flexion–extension movement on arm at 45, 60, 90° of movement. The speed of all flexion–extension movements was controlled through the use of a metronome set at 45 bpm. After completing the movement they were requested to reproduce the position in which they perceived the stimulation. Then subjects were tested on an AR task at the same angles as before, in which subjects had to stop the movement as soon as they perceived the electrical stimulus.

Results: A significant difference emerged between AEs of different joint angles ($F(2, 18) = 11.72, p < 0.01$) Post hoc analysis showed significant differences between all angles: 45° vs 60° $p < 0.05$; 45° vs 90° $p < 0.01$; 60° vs 90° $p < 0.05$. Taking CVs into consideration, a significant difference emerged between the two tasks ($F(1, 9) = 18.51, p < 0.01$) and angles ($F(2, 18) = 7.35 p < 0.01$). Post hoc analysis showed significant differences between the two task: JPR vs AR $p < 0.01$ and between: 90° vs 60° $p < 0.01$ and 45° $p < 0.01$.

Conclusions:

Subjects reproduce the 90° angle more easily than the other two independently of the task type. Further studies should clarify the role of angular acceleration at different positions in relation to motion and its different phases (concentric-eccentric). In addition, subjects are less variable in the AR task than in the JPR.

PP78A—Are our teachers physically active? A description of the physical activity rate in the preservice primary school teachers using the international physical activity questionnaire

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Purpose: The role of physical activity in enhancing health is well recognized. However, more industrialized countries are declining physical activity rates (Brownson et al. 2005). To fight against this phenomenon, institutions and organizations institute physical activity promotion projects in primary schools to sensitize children with physical activity (Smedegaard et al. 2016). Thus, this study aimed to describe the physical activity profile of a community of preservice primary school teachers.

Methods: Physical activity was assessed using the official Italian short form of IPAQ, intended for digital use (Saran et al. 2018). 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 168 preservice teachers (86% female and 14% male). Analyzing the years of practice, 30% of the participants did not practice any sport or activities. Conversely, 21% started practising from one to three years ago, 18% from four to seven years ago, 7% from seven to ten years ago and 24% declared to have started more than ten years ago. In addition, data showed a percentage of 13% of inactive subjects (MET < 600), 54% of moderate active (MET 600–3000), and 33% of active people (MET > 3000). Finally, the more experienced showed a higher MET consumption ($p < 0.001$).

Conclusions. Primary teaching students tend to be gender imbalanced and moderately active. Future studies should investigate if this behaviour will positively reflect children's attitudes.

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PP78B—Infrared thermal classification of the spine of sportive individuals

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Purpose: The aim of this study is to employ infrared thermography (IRT) to evaluate the thermal profile of the back of healthy subjects and associate it to the type of sport practiced. IRT is a non-harmful, risk-free imaging technique that can detect mid to long-wave infrared radiation emanating from a body, and it can be used in humans to evaluate abnormalities of the musculoskeletal system

Methods: The back of 160 healthy subjects were evaluated, 85 female and 75 male, mean age of 26,6 (5,31), male mean height 176.2 (7.97), female mean

height 163,4 (6,04), male mean weight 74.4 (11.9), female mean weight 58.4 (8.74), male BMI of 23.4 (2.75), and female mean BMI 22.1 (3.36). The participants were grouped considering their sport practice: team sport (TS), individual sport (IS), weight training (WT), inactive (I). Three ROI were identified to analyze the cervical, dorsal and lumbar temperatures of the back. All the Thermal images were taken with a professional FlirE54 infrared thermal imaging camera (Wilsonville, OR, USA).

Results: Kruskal-Wallis test resulted statistically significant for cervical ($p = 0.00123$) and dorsal area ($p=0.0164$), and non-statistically significant for the lumbar area ($p = 0.403$) between groups. Benjamini & Hochberg adjusted method was applied and showed significant differences for the cervical ROI between WT (temperature 33.82° SD=0.88°) and TS group (temperature 34.19° SD=0.64°) ($p < 0.05$), TS and I group (temperature 34.48° SD=0.18°) ($p < 0.05$), I and IS group (temperature 33.65° SD=0.93) ($p<0.005$), I and WT group ($p < 0.05$). Significance was also spotted between the dorsal ROI of the IS (temperature 32.92° SD=0.92°) and TS group (temperature 32.83° SD= 0.68°) ($p < 0.05$). The lumbar ROI did not present any statistically significant difference.

Conclusions: From the statistical analysis it came to light that the IS group showed a statistically lower temperature of the cervical ROI in

comparison to the other groups, while the WT group exhibited a statistically higher average temperature of the dorsal ROI than the other groups. We could not find any significant differences for the lumbar ROI between groups. The explanation for these findings lies in the different muscles involved for the typical training routine of each discipline. These findings will be useful for the future evaluation of the thermal patterns of individuals with alterations caused by musculoskeletal pathologies

PP79A—Improve ergonomic assessment tools and interventions to reduce industry work-related musculoskeletal disorders

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Purpose: Work-related musculoskeletal disorders (WRMSDs) can be defined as abnormalities in the soft tissues of the upper limbs and lower limbs, bones, and joints, such as the spine. WRMSDs are one of the main problems in occupational health, decreased productivity and poorer health-related quality of life. Preventive actions are therefore necessary to lower the incidence of WRMSDs and to reduce pain symptoms.

Methods: The project develops in 2 phases. The first one is an observational phase divided into two stages with the aim of identifying factors (variables) to be included in a new predictive model of ergonomic risk assessment. Phase 1.a concerns the assessment (ergonomic, electromyographic, musculoskeletal and physical efficiency, objective, subjective physical activity quantification and sleep quality) of the selected workers. Phase 1.b involves data integration into a single equation model for a more refined musculoskeletal risk indicator. This equation will identify a potential relationship between measures of “man–machine” equipment and parameters of workers’ physical efficiency. The second phase of the research project will include an exercise intervention (intervention phase).

Results: 120 subjects for both sexes, aged 40–65 years, BMI 18–30 kg/m, with a sedentary lifestyle of > 6 months will be recruited. Patients will be randomized into two groups: a control group receiving and an intervention group treated with an exercise programme supervised for 12 months.

Conclusions: This trial verifies whether a supervised exercise programme will be able to stimulate an improvement in workers’ physical efficiency and other ergonomic parameters by means of a tailored training protocol.

PP79B—How to get active professor at university of l’aquila? Project ateneo in movimento

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Purpose: Jobs with a sedentary time have an huge negative impact on the life behaviour of the employees. Specially on the productivity,

Daily Energy Expenditure (DEE) and Physical Activity Level (PAL). In fact Professors spend many hours to study, to make a research and to teach to the other students at university by increasing their time of sedentarism. Aim of the study, was to create a strategy plan of movement during day works with a specific program, improving physical activity level and avoid the sedentarism directly at university.

Methods: 36 Professor at the University of l’Aquila (UNIVAQ) have been enrolled for this project to entire 4 academic years. We were evaluated Work Ability Index (WAI) and Energy Expenditure (EE) changing the paradox of: “I have no time to go into the gym” bringing Functional Training directly in the University. Exercise protocol made by Training Lab Italia® (CTLIP) built as circuit training was introduced in daily time of the University.

Results: Our data suggest that WAI and EE was significant ($p < 0.05$) Student’s t-Test. Work pressure was decreased ($p < 0.05$), self efficacy increased ($p < 0.05$) and quality of sleep was high ($p < 0.05$).

Conclusions: Promote exercise session in the workplace avoid the limit of the people to go into the gym. On the other hand, investment by the company about this topic could be the vision of each university governance in Italy. In fact, health people works better and prevents issues related to stress. Job performances skill are influenced by exercise, physical activity level and well-being.

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PP80A—Effects of nutritional supplementation and unsupervised physical activity on testosterone levels, body composition and muscular fitness in males with symptoms of subclinical hypogonadism

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Purpose: Subclinical hypogonadism (SH) is characterized by deficient testosterone (T) production, resulting in increased body fat and reduced muscle mass. Nutraceutical approaches combined with lifestyle changes (e.g., increase in physical activity (PA) levels) have gained considerable interest. The combination of myo-inositol, alpha-lipoic acid, and folic acid has been reported to improve sperm parameters. However, no studies investigated their effects on T and physical fitness (PF) in combination with SelectSIEVE® Apple (named SINOPOL® forte). Its antioxidant properties may favour an anabolic environment that could be enhanced when combined with PA. This pilot study aimed to investigate the effects of 12 weeks of unsupervised PA combined with SINOPOL® forte on T levels and PF components in adult males with symptoms of SH.

Methods: Ten males (age: 36.1 ± 12.2 years) with symptoms of SH (assessed using a validated questionnaire) and with a sedentary lifestyle (< 5000 steps/day) were randomly assigned to two groups: A) unsupervised PA (9.000 steps/day) and supplement (15 g/day of SINOPOL® forte); B) supplement only. Total T, body composition, and muscular fitness variables were evaluated at baseline and after 12 weeks of intervention. Skeletal muscle mass (SMM) and percentage

fat mass (%FM) were measured by bioimpedance analysis. The handgrip strength (HG) test and the chair stand test (CST) were performed to assess muscular fitness.

Results: Total T increased by 14.4% in Group A and by 11.2% in Group B. SMM increased by 4.0% and 1.1% in Group A and Group B, respectively. Group A showed a reduction in %FM of 12.8%, while group B showed a reduction of 9.4%. HG increased in both groups (+ 1.1% in Group A and + 1.2% in Group B). The time to perform CST was higher in Group A (+ 3.1%) and lower in Group B (– 1.5%).

Conclusions: Preliminary data showed that SINOPOL® forte, probably due to its antioxidant properties, may have a greater effect when combined with PA on %FM and SMM, thus improving T levels in males with symptoms of SH.

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PP80B—Corporate wellness in gemata S.P.A.: intervention to promote physical activity, ergonomics and an active lifestyle with a year follow-up

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Purpose: This study evaluated the effectiveness of an informative workplace wellness program in increasing physical activity levels, reducing sedentary behaviour and musculoskeletal disorders in staff. **Methods:** In the beginning, 89 employees (E) (average age=45.2 years, 8.9% female (F) - 50 Operational Staff (OS) - 39 Offices Employees (OE)) completed three questionnaires: International Physical Activity Questionnaire (IPAQ short form), Occupational Sitting and Physical Activity Questionnaire (OSPAQ), Nordic Musculoskeletal Questionnaire (NMQ). At the same time, postures during work were observed, photographed and analysed. These observations were followed by 3 information bimonthly phases: company training meeting for E, distribution of an information brochure on the physical activity benefits and distribution of different protocols of adapted physical exercise for OS and OE.

At the 1-year FOLLOW-UP, 73 E, (average age=45 years, 7.3% F, OS = 38, OE = 35), compiled the questionnaires IPAQ, OSPAQ, NMQ and Client Satisfaction Questionnaire-8 (CSQ-8) which contained a space for suggestions. Data were analyzed with chi-Quadro and ANOVA for repeated tests.

Results: In initial data it was observed that only 15% of E used the company gym, and 69.66% could be considered very active (IPAQ).

Many of the E suffer or have suffered in the last 12 months from musculoskeletal disorders (NMQ): lumbar area E=51.69%, OS=60%, OE=41.03%; cervical area E=49.44%, OS=44%, OE=56.41%.

In the follow-up (dropout 17.98%), there were significant changes in OSPAQ: in the OS a reduction in time spent standing (P = 0.004) and an increase in time spent walking (P = 0.008) in one day, in E the time spent standing is reduced (P <0.05) which goes from 40.57% to 30.41% of the total time.

No significant differences were observed in physical activity levels (MET-min/wk), working day sitting time and musculoskeletal disorders by anatomical district (NMQ) although a tendency to decrease in general is noted.

Conclusions: This informative corporate wellness operation does not increase

Scientific journals of physical education in Brazil: agents, structures and disputes in the legitimization process of a field

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Purpose: Understand the scientific journals of Brazilian Physical Education (P.E) within the current dynamics of the scientific field. Therefore, we sought to identify the scientific journals of Brazilian P.E, understand the editorial work, and investigate the relationships that journals establish with other agents and institutions in the field.

Methods: Qualitative research was carried out, whose data were collected and analyzed in three phases. In the first one, we searched the Qualis Periódicos da CAPES - Brazil, available data on the journals of Brazilian P.E. In the second phase, the websites of the identified journals was downloaded. In the third phase, 10 semi-structured interviews were carried out with the editors-in-chief of the selected journals, to understand the functioning and demands of these journals.

Results: 39 journals were delimited, implemented mostly in the 1990s and 2000s, whose focus and scope cover several themes and objects in P.E. and have as their main link the Higher Education Institutions, specifically public universities, and scientific associations. They are indexed in databases and catalogues, with a higher proportion in Google Scholar and Latindex, with the minority being in the collections of the most sought-after indexers such as Web of Science and Scopus. Interviews with the editors-in-chief indicate that these agents entered the journals in four different ways, categorized into creation, progression, readiness, and transfer, and are directly responsible for performing various tasks necessary for the journals to function. Journals have faced challenges of different orders, which include aspects of Editorial Management, Professionalization, Financing, Indexing and Internationalization, and vary according to the state of consolidation of these journals in scientific field.

Conclusions: Scientific journals of Brazilian P.E expresses the particularities of this field, specifically its organization as an activity connected to the scientific field, its disputes and internal logic.

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