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Mental health and adherence to Mediterranean Diet among university students: an Italian cross-sectional study

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Mental health and adherence to Mediterranean Diet among university students: an Italian cross-sectional study

Objective

This study aimed to explore Severe Mental Illness (SMI), Mental Well-Being (MWB), and Mediterranean Diet adherence (MedDiet) among university students.

Participants

University students in Northern Italy (sample size=502)

Methods

Cross-sectional survey conducted in 2019. The questionnaires included: Warwick-Edinburgh Mental Well-Being Scale for MWB, K6 for SMI, Mediterranean Diet Adherence Screener for MedDiet. Multivariable regressions were mainly performed ($p < 0.05$ as significant).

Results

MWB was high in 3.93%, low in 23.97%. SMI was probable in 21.87%. MedDiet adherence was high in 2.19%, low in 35.06%. Mainly, poor/very poor perceived health, Economics/Legal/Strategic Sciences courses, and not being on time with exams showed associations with both lower MWB and probable SMI. Gender and some lifestyle, dietary, and university factors predicted MedDiet. MWB and MedDiet were significantly associated.

Conclusions

This study found high levels of mental health issues and low MedDiet. Modifiable factors at university-level should be further investigated to design preventive interventions.

Keywords: universities; students; mental health; psychological distress; mediterranean diet

Introduction

University might represent a time of transition and challenge.^{1,2} University students showed high levels of psychological distress¹ and increasing rates of mental disorders.³ Across studies, the most frequent symptoms were anxiety, depression, and anger.¹ Notably, a survey involving first-year students across 8 countries reported 31% of students positive for at least one 12-month mental disorder.³ Psychological distress and mental problems seem to be consequence of the demands associated with university lifestyle and academic pressure, both regardless of prior functioning and as a result of intensified pre-existing problems.^{1,2} In addition to academic stress, students deal with new responsibilities, e.g. increased autonomy, significant relationships, having housemates, and the possibility to reinvent themselves.^{2,3} High levels of psychological distress are an issue per se and additionally they are associated with low academic performance and serious health outcomes such as substance use and suicidal behaviours.¹

It is recognized that mental well-being (MWB) is not just the flipside of psychological distress nor the absence of mental illness, indeed MWB and psychological distress are both essential indicators of overall mental health.⁴ Although several MWB dimensions have been associated with good physical health and reduced risk of premature mortality,^{5,6} only recently MWB has gained importance at a population-level while it has been overlooked in the public health debate in the past.⁶ Interventions focused on increasing MWB with a universal approach (e.g. at university-level), compared to an approach targeted to high-risk people, might reduce the total number of people with long-term mental illnesses.⁵

University is not only a stressful event, but it represents a significant setting for health promotion by working on modifiable factors and prevention.⁷ Some authors identified clustering of high psychological distress and unhealthy lifestyles (including unhealthy diet) among university students.^{8,9} Additionally, health behaviours during university might have

implications for students' future health.⁸ Among health behaviours, Mediterranean diet (MedDiet) might represent a key player in health promotion due to its widely recognized protective role in overall mortality,¹⁰ neoplastic diseases,^{10,11} cardiovascular diseases^{10,11} and intermediate cardiovascular outcomes.¹¹ MedDiet seems also protective considering brain function, e.g. cognition¹¹ and depression.¹¹⁻¹³ Even if strong evidence about relationships between MedDiet and overall mental health is still lacking, especially concerning young adults, some studies reported significant findings.¹⁴⁻¹⁶ Indeed, adherence to MedDiet has been associated with better psychological well-being and improved mental health^{14,15} and improved psychological functioning.¹⁶ Interestingly, already over a decade ago, results about university students of two Mediterranean countries (Italy and Spain) showed a decreased MedDiet adherence.¹⁷

Given the above, mental health and dietary habits of university students appear to be important key factors involved in students' health. Remarkably, although findings about university students' mental health from different areas of the world are mostly consistent, the overwhelming majority of researches was conducted in US or UK,¹ leading to a substantial gap in knowledge about students from other countries. Moreover, medical or nursing students have been disproportionately often assessed and diverse study disciplines should be included in the current researches⁷ to thoroughly describe students' mental health. In addition, exploring the current MedDiet adherence among university students appears to be essential as MedDiet is an important determinant of better physical and mental health. Estimating the adherence and exploring potential predictors might be useful to understand whether strategies aimed at increasing MedDiet are necessary and what factors can be modified. In fact, eating behaviours during the transition from adolescence to young adulthood might be influenced by factors at different level: individual, interpersonal, and environmental (e.g. characteristics of eating environment).¹⁸ Interestingly, the higher modifiability was reported for the

environmental level¹⁸ and interventions at university-level might be useful if poor MedDiet adherence is identified.

Therefore, the present study aimed to estimate mental health in a sample of an Italian university, through the assessment of both mental illness risk and MWB. Another purpose was to estimate MedDiet adherence. Lastly, factors that might be associated with mental health and MedDiet adherence were explored to evaluate potentially modifiable elements.

Methods

A cross-sectional survey was carried out between May and July 2019 in Northern Italy. Inclusion criteria were being a student currently enrolled in the University of Turin (UniTO) or in the Polytechnic of Turin (PoliTO) and being able to understand the questionnaire in Italian. All procedures performed were in accordance with the 1964 Helsinki declaration and its later amendments. The Ethics Committee of the University of Torino approved the protocol. Raosoft[®] was used to determine that the minimum sample size was 383, based on a 5% margin of error, 95% confidence level, 50% response distribution and population of 110200 students in 2018/2019.

The research was conducted using the Computer-Assisted Web Interview (CAWI) method. Participants were recruited by convenience sampling on Facebook groups of the degree courses of UniTO and PoliTO. People entering the online survey received an explanation of the study and an informed consent form. Participation was voluntary and anonymous, and participants received no compensation.

The questionnaire

The 76-item questionnaire was composed of a first section developed by the researchers followed by three validated tests, selected to assess MWB, serious mental illness (SMI), and MedDiet adherence.

The first section collected information about demographics (e.g. age, gender, nationality, weight and height to calculate Body Mass Index BMI, relationship status, education level, living condition, exercise more than 150 minutes weekly) and health-related characteristics (e.g. perceived health status, diagnosis of psychiatric disorders, hours of sleep per night, seeing a psychologist/psychiatrist). It also explored university-related information (e.g. degree course, year of course, course of study) and dietary habits (e.g. diet, location of meals, having enough time to eat, cooking personally at home, frequency of food shopping, frequency of out-of-home meals). Additionally, it included variables that were reported in literature as potentially involved in university students' mental health, such as relationship with family and peers, family history of psychiatric disorders and personal disease, being on time with exams, satisfaction with the course of study chosen, distance from home, and thinking university hinders spare time activities.^{1,9,19–21}

To measure MWB, the Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) was used, a 14-item scale for monitoring MWB at a population-level by focusing entirely on positive aspects of mental health.²² WEMWBS questions refer to the last two weeks. Each item has a 1 to 5 Likert scale. Total score is calculated by summing each item score and ranges from 14 to 70. Higher score represents higher MWB.²² Although this tool was not designed to have cut-offs and there are no commonly used thresholds, scores ≤ 40 could represent low MWB, scores from 41 to 59 average MWB, and scores ≥ 60 high MWB.²³

To estimate presence of SMI, the K6 was used, a 6-item screening scale of non-specific psychological distress developed by Kessler and colleagues.^{24,25} K6 investigates symptoms over the last month. Each item has a score from 0 to 4, and total score ranges from 0 to 24. A validated cut-off of 13 or higher is commonly used to identify people as having probable SMI.^{24,25} K6 was reported to perform well in screening mood disorders and anxiety disorders in addition to non-specific SMI.²⁶

To evaluate MedDiet adherence, the Mediterranean Diet Adherence Screener (MEDAS) questionnaire was used, a 14-item tool developed and validated by the PREDIMED group.²⁷ The score ranges from 0 to 14: the greater the score, the higher the adherence.²⁷ Cut-offs have been used to define high (≥ 10), average (6-9) and low (≤ 5) adherence.²⁸

Data analysis

Descriptive analyses were performed for all variables. The Shapiro-Wilk test indicated continuous variables did not have normal distributions. Descriptive analyses of WEMWBS and MEDAS cut-offs^{23,28} were executed, however these outcomes were considered as continuous scores for all analyses. The outcome SMI was considered binary according to the validated threshold.^{24,25} Independent variables were coded from the first section.

Kruskal-Wallis and Mann-Whitney U test were used to assess differences in distribution of WEMWBS and MEDAS scores across independent variables. Relationships between WEMWBS, MEDAS, and age were tested with Spearman's correlation. Chi-squared tests were computed to assess differences between participants with and without probable SMI (Mann-Whitney U test for age, WEMWBS and MEDAS scores).

Multivariable models adjusted for age and gender were executed to explore predictors and adjust for possible confounders. Linear regression models were executed for WEMWBS and MEDAS scores. Independent variables were selected by backward elimination (results expressed as unstandardized coefficients B, 95% CI). A logistic regression model was performed for probable SMI. Final model was achieved with a backward stepwise method (results expressed as odds ratios OR, 95% CI). MEDAS score was included among the independent variables to be selected for mental health outcomes, while WEMWBS score and SMI were included among independent variables for MEDAS model.

SPSS software (version 25) was used, and a two-tailed p -value < 0.05 was considered to be statistically significant. Missing values were excluded by pairwise deletion (except regressions: listwise deletion).

Results

Descriptive and univariable analyses

A total of 502 questionnaires were collected. No missing values were recorded for MEDAS and K6, while 18 participants (3.59%) did not complete WEMWBS. Females accounted for 76.10% and median age was 23 years (IQR=21-25). The majority was Italian (98.2%). WEMWBS mean and median scores were 46.14 (SD=8.28) and 46 (IQR=41-46); MWB was high for 19 participants (3.93%), average in 349 (72.11%), and low in 116 (23.97%). K6 mean and median scores were 8.48 (SD=4.98) and 8 (IQR=4-12); 110 students (21.87%) scored above the cut-off for SMI. MEDAS mean and median scores were 6.19 (SD=1.63) and 6 (IQR=5-7); 11 participants (2.19%) reported high adherence, 315 (62.75%) average and 176 (35.06%) low adherence. The distribution of MEDAS score was the same across the categories of K6 ($p=0.594$). There was a very weak, positive correlation between MEDAS and WEMWBS scores (Spearman's $\rho=0.097$, $p=0.033$). There was a strong negative correlation between the K6 and the WEMWBS scores (Spearman's $\rho=-0.632$, $p<0.001$).

The distribution of age was the same across categories of K6 ($p=0.878$) and did not report any significant correlation with WEMWBS score ($p=0.628$). Age of participants reported a very weak positive correlation with MEDAS score (Spearman's $\rho=0.095$, $p=0.034$). The 62.95% declared to be in a relationship (no significant differences across any outcome). The 6.78% stated to live alone, while 53.69% with parents/relatives, 29.34% with flatmates or in dorms, and 10.18% with the partner (no significant differences across any outcome). The 6.6% declared to have a chronic disease (no significant differences across any outcome). The 15% declared to have a first degree relative with a diagnosed psychiatric

disorder, with no significant association with mental health outcomes. The 51.12% was attending a Bachelor's degree and the most common kind of course of studies was "Humanities, Arts, Languages and Psychology" (39.55%). Most of participants were not following a diet (78.56%). The 54.40% declared to always/often do food shopping personally (no significant differences across any outcome).

Variables that reported significant relationships with outcomes or that were included in the regression models are described in Table 1 and 2.

Multivariable regression models

Table 3 shows the multivariable model with WEMWBS score as outcome. Negative associations with such score were reported for participants with a diagnosis of psychiatric disorder ($p<0.001$), students who saw a psychologist/psychiatrist in the past but not at the time of the survey ($p=0.014$) and students who never went to a psychologist/psychiatrist but thought that it would have been useful at the time of the survey ($p<0.001$). Other negative associations were found for students attending Economics, Legal and Strategic Sciences ($p=0.042$) and students who perceived their health status as good ($p<0.001$) or poor/very poor ($p<0.001$). Negative associations were reported for those who usually have their meals at university/work canteen ($p=0.021$) or packed lunch at university/work ($p=0.033$). Compared to students on time with exams, those not on time showed two different relationships with WEMWBS score: students who did consider being not on time a problem showed a negative association ($p=0.005$), while students who did not a positive association ($p=0.001$). The higher was MEDAS score, the higher was WEMWBS score ($p=0.001$). Positive associations with this score were reported for students satisfied with their choice about the course of study ($p=0.006$) and students satisfied with their friendships ($p<0.001$).

Table 4 shows the multivariable model with probable SMI as outcome. The likelihood of presenting a probable SMI was higher for students with a poor/very poor perceived health

status ($p<0.001$), students who were seeing a psychologist/psychiatrist at the time of the survey ($p=0.009$) and students who never went to a psychologist/psychiatrist but thought that it would have been useful at the time of the survey ($p<0.001$). Students attending Economics, Legal and Strategic Sciences ($p=0.021$), students that considered being not on time with exams a problem ($p<0.001$), and students who thought that university hindered spare time activities ($p<0.001$) had a higher probability of SMI. Sleeping 5-7 hours per night, compared to 8-10 hours, increased the odds of SMI ($p=0.014$). Being vegetarian or vegan also increased such probability even if with a slight significance ($p=0.048$).

Table 5 shows the multivariable model with MEDAS score as outcome. Negative associations with MEDAS score were found for students who did not cook personally at home ($p=0.005$), obese or overweight participants ($p=0.023$), and students who did not follow any specific diet ($p=0.041$). Participants studying far from family home ($p=0.038$) and students who did not consider a problem being not on time with exams ($p=0.009$) also showed a negative association. The higher was WEMWBS score, the higher was MEDAS score ($p=0.001$). Females ($p=0.001$), respondents with a diagnosis of psychiatric disorder ($p=0.012$), vegetarians/vegans ($p=0.003$), and participants who exercised more than 150 min weekly ($p=0.047$) reported a positive association with MEDAS score. Positive associations were estimated for participants who declared to have sometimes/rarely/never enough time to eat ($p=0.031$) and participants who rarely/never consume out-of-home meals ($p=0.021$).

Discussion

This study aimed to evaluate mental health, assessing MWB and SMI, and MedDiet adherence among university students. Furthermore, factors associated with such outcomes were explored.

In recent years, university students' mental health is getting increasing attention^{1,3} especially psychological distress and its consequences on health and academic performance.¹

Our findings showed 21.87% had a probable SMI according to K6 scale,^{24,25} which could also be used to screen mood disorders.²⁶ Recently, a survey investigated six mental disorders among first-year students across 8 countries: 31% screened positive for at least one 12-month disorder.³ Major depression was the most common with 18.5% 12-month prevalence.³ Furthermore, a 12-nation study reported 33.8% of students above the highest cut-off of General Health Questionnaire-12 for psychological distress.²⁹ According to a systematic review, depression among university students ranged from 10% to 85% with a weighted mean prevalence of 30.6%.³⁰ In Italy, studies on university students showed 23.1% with high psychological distress²⁹ and 32% with depression.³¹ A nationwide survey on medical students reported 29.5% with depressive symptoms.¹⁹ Considering one of the major Italian surveys, only 4.6% 18-34 year-old Italian people reported depressive symptoms.³² Overall, our sample had a lower percentage of high-risk students,^{3,19,29-31} however the comparison with Italian same-aged people³² highlighted a remarkable risk.

Generally, MWB has been often overlooked at population-level⁶ and fewer data exist compared to mental illness, especially concerning university students. We found a mean WEMWBS score of 46.14 (SD=8.28) and 24% and 4% of low and high MWB, similarly to other studies that used WEMWBS in university students' populations.³³⁻³⁶ For instance, Cilar and colleagues reported a mean score of 45.79 (SD=7.75) and 53.07 (SD=8.70) among nursing students from Northern Ireland and Slovenia.³³ Goodwin et al. reported a mean of 45.5 (SD=9.5), 29.0% low MWB, and 4.7% high MWB among Irish university students.³⁴ Aceijas et al. found 30% of low MWB among UK students.³⁵ Higher MWB levels were reported among over 2000 Irish undergraduates, with only 13% of low MWB and around 15% high MWB.³⁶

Variables covering different areas of students' life (e.g. health-related, university, social, and dietary factors) were associated with mental health outcomes in multivariable

analyses, mostly consistently with previous studies. Not seeing a psychologist/psychiatrist (but thinking that it might be useful), poor/very poor perceived health, Economics, Legal and Strategic Sciences course of study, and not being on time with exams (and considering it a problem) showed associations with both lower MWB and probable SMI.

Indeed, other works found associations between lack of help-seeking behaviour and low MWB among university students.^{34,35} Besides, in our sample only 16% of students with probable SMI were seeing a psychologist/psychiatrist. This percentage is higher than the 12.1% found among Italian medical students with depression¹⁹ and much higher than the 5.5% found among Italian Social Sciences and Education students with depression,³⁷ highlighting that barriers to seek help might be influenced by education background and studies are needed to explore needs and obstacles to improve access to care. Other health-related factors associated with poor mental health and consistent with previous literature about university students were low perceived health³¹ and irregular sleep hours.^{38,39}

Students' satisfaction with their course or self-rated level of academic achievement have been associated with psychological distress and other mental outcomes,¹ as highlighted by our study. Indeed, we found satisfaction with course of study, being on time with exams, and thinking university hinders spare time activities had associations with mental health, as already reported by previous studies.^{1,19,21} Students attending Economics, Legal and Strategic Sciences reported worst mental health outcomes, outlining the need of in-depth analyses on aspects that might be common or different across courses of study to understand factors to be improved. In fact, students within medical field are recognized to have high psychological distress,^{1,40} however this group is disproportionately often assessed.⁷ Researches conducted across other academic groups demonstrated also high distress¹ and a review suggested medical students had similar or lower depression rates than some non-medical categories.⁴¹

Although few studies focused on Economics, Legal and Strategic Sciences, some authors found law students at higher risk compared to other fields.^{42,43}

Over university life-related and dietary factors, the location where students usually eat seemed to influence MWB, as canteen and packed lunch had an association with lower MWB. Studies investigating location of lunch and well-being considered workplaces.^{44,45} However the importance of restorative environments for recovery⁴⁴ and meal satisfaction in workplace⁴⁵ should be explored also in academic context since interventions at university-level might be planned to involve a large number of students. Additionally, certain dietary habits had associations with mental health outcomes. Higher MedDiet adherence was associated with higher MWB, coherently with other studies^{14,15,46}. Although the effect of MedDiet on depression has been widely reported,¹¹⁻¹³ the role on MWB should be further investigated, considering that MedDiet could serve as tool for MWB at university-level along with improvement in meal environment. Being vegetarian or vegan was associated with SMI instead, in line with previous findings^{47,48} and, especially, with a prospective study on university students.⁴⁹ Velten and colleagues suggested vegetarian diet might be associated with other factors (e.g. rumination about animal suffering) that mediate such relation.⁴⁹ Lastly, the importance of having satisfying friendships emerged from our study, consistently with researches that found significant relationships between good mental health and social support from friends.^{19,50}

Concerning MedDiet adherence, 35% had low adherence and 2% high, with a MEDAS mean score of 6.19 (SD=1.63). Compared to surveys on Italian adults that used MEDAS, the adherence of our sample was lower.^{51,52} Indeed, Leone and colleagues reported 14% of high adherence in a large sample in Northern Italy and Caparello et al. a mean score of 7.13 (SD=1.9) in a sample in Southern Italy.^{51,52} In both these studies, older age was associated with higher adherence, therefore the differences might be partially explained by

this.^{51,52} Considering university samples, 95% of nursing students in Central Italy reported average adherence using MEDAS.⁵³ Medical students in Southern Italy reported 20.8% ‘poor’, 56.5% ‘average’ and 22.7% ‘good’ scores (KIDMED questionnaire).⁵⁴ These results about Italian students are very diversified and differences might be partially explained by Italian areas,⁵⁵ however studies are needed to investigate these hypotheses and estimate Italian university students’ adherence. Lastly, compared to university students of another Mediterranean country as Spain, our sample reported lower levels: de-Mateo-Silleras et al. and Cobo-Cuenca et al. reported 20% and 24% of high adherence using MEDAS.^{56,57} MedDiet adherence was predicted by many variables, including gender, lifestyle, mental health, dietary, and university factors.

Females were associated with higher adherence, consistently with previous researches.^{54,58,59} In literature, in line with our results, BMI was reported to have an inverse relationship with adherence^{17,51,60} and being physically active was related to higher adherence.^{51,55,61} Some authors suggested that people who exercise to stay healthy might be more health conscious and aware of the role of nutrition on health status.^{51,62} Higher MWB was associated with higher adherence. Begdache and colleagues suggested a reinforcing loop around healthy diet and good MWB: healthy diet may promote MWB and MWB may acts as positive reinforcement for healthy diet.⁶³ Additionally, low MWB was reported as risk factor for unbalanced diet in another university sample.³⁵ Interestingly, students with psychiatric disorders were more prone to adhere. Jacka et al. hypothesized reverse causality might explain the complex and bidirectional relation between diet and depression.⁶⁴ Indeed, previous depression was associated with healthier diets, maybe in an attempt to improve symptoms.⁶⁴

Lastly, out-of-home meals, time to eat, not cooking personally were associated with adherence. These factors could be considered related both to dietary habits and university

lifestyle. Further investigations are required to understand the ways universities could intervene and offer opportunities to improve nutrition and MWB together, as suggested by above-mentioned findings on mental health. Indeed, the environmental level was reported to have high modifiability regarding eating behaviours of youths.¹⁸ Along with this, students far from family home were less prone to adhere, similarly to findings of El Ansari et al. who showed students residing outside their family home had different eating habits.⁶⁵

This study had some strengths and limitations. To our knowledge, it was the first Italian study exploring the relationship between MWB and MedDiet among university students. Limitations included the cross-sectional structure, which restricts causal interpretations, opportunistic sampling and self-reported measures rather than structured interviews. However, the instruments have been widely validated.^{22,24,25} Finally, being a single-site study limited generalizability of results.

In conclusion, our study found high levels of psychological distress in an Italian university sample that included different courses of study. Furthermore, very few students reported high MWB and high MedDiet adherence. A wide range of factors was associated with mental health and diet, covering different areas of students' life, and an association between MWB and MedDiet was highlighted. Potentially modifiable factors at university-level and relationships between diet and MWB should be further investigated through longitudinal and randomized controlled trials to design interventions promoted by universities.

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Declarations of interest: None.

Data availability statement: The data that support the findings of this study are available from the corresponding author, FB, upon reasonable request.

Ethical approval: All procedures performed were in accordance with the 1964 Helsinki declaration and its later amendments. The Ethics Committee of the University of Torino approved the protocol.

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Table 1. Socio-demographic and health-related variables: descriptive analyses and associations with outcomes.

Characteristic		Total	MEDAS score			WEMWBS score			K6: Severe Mental Illness		
		(n=502) N (%)	Mean (SD)	Median (IQR)	p	Mean (SD)	Median (IQR)	p	No (n=392) N (%)	Yes (n=110) N (%)	p
Gender	Male	120 (23.9)	5.7 (1.7)	6 (5-7)	<0.001	46.1 (8.6)	46 (42-51)	0.946	96 (24.5)	24 (21.8)	0.562
	Female	382 (76.1)	6.3 (1.6)	6 (5-7)		46.2 (8.2)	46 (40-52)		296 (75.5)	86 (78.2)	
BMI	Normal (18.5– 24.9)	341 (70.2)	6.3 (1.6)	6 (5-7)	0.100	46.1 (8.3)	46 (41-52)	0.918	267 (70.6)	74 (68.5)	0.773
	Underweight (<18.5)	69 (14.2)	6.2 (1.8)	6 (5-7)		45.5 (8.5)	44 (40-51)		51 (13.5)	18 (16.7)	
	Overweight (25-29.9)	57 (11.7)	5.9 (1.8)	6 (5-7)		45.8 (8.8)	45 (39-53)		44 (11.6)	13 (12)	
	Obese (≥ 30)	19 (3.9)	5.5 (1.3)	5 (4-6)		46.9 (5.8)	46 (43-50)		16 (4.2)	3 (2.8)	
Highest education level completed	High school	324 (64.7)	6.2 (1.6)	6 (5-7)	0.160	45.3 (8.2)	45 (40-51)	0.003	242 (61.9)	82 (74.6)	0.049
	Bachelor's degree	133 (26.5)	6.1 (1.6)	6 (5-7)		47.9 (8.1)	49 (43-54)		112 (28.6)	21 (19.1)	
	Master's degree or higher	44 (8.8)	6.7 (1.8)	6 (5-8)		47.3 (8.4)	48 (44-52)		37 (9.5)	7 (6.4)	
Economic status of family	Excellent/good	427 (85.4)	6.1 (1.7)	6 (5-7)	0.096	46.6 (8.3)	47 (41.5-52)	0.001	341 (87.2)	86 (78.9)	0.030
	Poor/very poor	73 (14.6)	6.5 (1.5)	6 (6-7)		43.5 (7.9)	42 (38-49)		50 (12.8)	23 (21.1)	
Exercise	No	131 (26.1)	5.9 (1.5)	6 (5-7)	0.012	44.7 (8.6)	45 (39-51)	0.100	96 (24.5)	35 (31.8)	0.228
	<150 min weekly	228 (45.4)	6.1 (1.6)	6 (5-7)		46.9 (8.5)	47 (41-53)		179 (45.7)	49 (44.6)	
	≥150 min weekly	143 (28.5)	6.5 (1.8)	7 (5-8)		46.3 (7.4)	46 (41-51)		117 (29.9)	26 (23.6)	
Relationship with family	Excellent/good	422 (84.2)	6.2 (1.6)	6 (5-7)	0.212	47.1 (7.8)	47 (42-53)	<0.001	345 (88.2)	77 (70)	<0.001
	Poor/very poor	79 (15.8)	6.4 (1.6)	6 (5-7)		41.4 (9.1)	41.5 (37-47)		46 (11.8)	33 (30)	

Satisfaction with friendships	Poorly/not satisfied	92 (18.4)	6.1 (1.6)	6 (5-7)	0.351	41.7 (8.3)	42 (37-47)	<0.001	59 (15.1)	33 (30)	<0.001
	Moderately/very satisfied	409 (81.6)	6.2 (1.6)	6 (5-7)		47.2 (7.9)	47.5 (42-53)		332 (84.9)	77 (70)	
Perceived health status	Excellent/very good	263 (52.6)	6.3 (1.7)	6 (5-7)	0.191	49.2 (7.7)	49 (44-54)	<0.001	231 (59.1)	32 (29.4)	<0.001
	Good	181 (36.2)	6.1 (1.6)	6 (5-7)		44.4 (6.9)	44 (40-50)		135 (34.5)	46 (42.2)	
	Poor/very poor	56 (11.2)	5.9 (1.6)	6 (5-7)		37.9 (7.9)	38 (35-43)		25 (6.4)	31 (28.4)	
Usually sleeping	8-10 hours per night	178 (35.5)	6.3 (1.5)	6 (5-7)	0.488	47.8 (8)	48 (42-54)	0.007	153 (39)	25 (22.7)	0.003
	5-7 hours per night	309 (61.6)	6.1 (1.7)	6 (5-7)		45.3 (8.4)	46 (40-51)		226 (57.7)	83 (75.5)	
	<5 or >10 hours per night	15 (3)	6 (1.1)	6 (6-7)		44.4 (6.5)	44 (38-49)		13 (3.3)	2 (1.8)	
Having a diagnosis of psychiatric disorder	No	471 (94)	6.1 (1.6)	6 (5-7)	0.029	46.8 (7.9)	47 (41-52)	<0.001	373 (95.4)	98 (89.1)	0.014
	Yes	30 (6)	6.8 (1.6)	7 (6-8)		36.5 (8.7)	38.5 (30-44)		18 (4.6)	12 (10.9)	
Seeing a psychologist/psychiatrist	Never	41 (8.2)	6.2 (1.5)	7 (5-7)	0.898	42.6 (11.6)	43.5 (35.5-51)	<0.001	244 (62.2)	33 (30)	<0.001
	Yes, currently	78 (15.5)	6.3 (1.7)	6 (5-7)		44.8 (7.1)	45 (40-50)		60 (15.3)	18 (16.4)	
	Not currently, but yes in the past	106 (21.1)	6.2 (1.7)	6 (5-7)		42.5 (7.6)	43 (39-48)		63 (16.1)	43 (39.1)	
	Never, but thinking that it might be useful currently	277 (55.2)	6.2 (1.6)	6 (5-7)		48.4 (7.5)	49 (43-54)		25 (6.4)	16 (14.6)	

Abbreviations: BMI Body Mass Index; MEDAS Mediterranean Diet Adherence Screener; WEMWBS Warwick-Edinburgh Mental Well-Being Scale
n=sample size

Total: Figures are expressed as number (N) and column percentages (%).

MEDAS score: Figures are expressed as mean or median and standard deviation (SD) or interquartile range (IQR) in brackets; p-value obtained via Mann Whitney U test or Kruskal Wallis test.

WEMWBS score: Figures are expressed as mean or median and standard deviation (SD) or interquartile range (IQR) in brackets; p-value obtained via Mann Whitney U test or Kruskal Wallis test.

K6: Sever Mental Illness: Figures are expressed as number (N) and column percentages (%); p-value obtained via chi-squared test.

Table 2. University-related and dietary variables: descriptive analyses and associations with outcomes.

Characteristic		Total	MEDAS score			WEMWBS score			K6: Severe Mental Illness		
		(n=502) N (%)	Mean (SD)	Median (IQR)	p	Mean (SD)	Median (IQR)	p	No (n=392) N (%)	Yes (n=110) N (%)	p
Course of study	Medicine and allied medical professionals	106 (21.5)	6.3 (1.5)	6 (5-8)	0.020	45.3 (9.1)	47 (39.5-51.5)	0.405	82 (21.4)	24 (22)	0.134
	Pharmacological, Natural, and Agricultural Sciences	80 (16.2)	6.3 (1.8)	6 (5-7)		46.4 (7.9)	46 (41-52)		64 (16.7)	16 (14.7)	
	Polytechnic	72 (14.6)	5.7 (1.4)	6 (5-6)		47.1 (8.2)	47.5 (42-53.5)		63 (16.4)	9 (8.3)	
	Economics, Legal and Strategic Sciences	40 (8.1)	5.9 (1.5)	6 (5-7)		44 (8)	44 (40-48)		27 (7)	13 (11.9)	
	Psychology, Humanities, Languages	195 (39.6)	6.3 (1.7)	6 (5-7)		46.3 (8)	46 (40.5-52)		148 (38.5)	47 (43.1)	
Studying far from family home	No	218 (43.4)	6.3 (1.7)	6 (5-7)	0.306	46.8 (8.2)	47 (41-52)	0.327	173 (44.1)	45 (40.9)	0.547
	Yes	284 (56.6)	6.1 (1.6)	6 (5-7)		45.7 (8.3)	46 (40-52)		219 (55.9)	65 (59.1)	
Being on time with exams	Yes	312 (63.2)	6.3 (1.6)	6 (5-7)	0.098	46.9 (7.3)	47 (42-52)	<0.001	262 (67.9)	50 (46.3)	<0.001
	No (not considering being not on time a problem)	79 (16.0)	5.8 (1.6)	6 (5-7)		49.2 (9)	49 (43-57)		65 (16.8)	14 (13)	
	No (considering being not on time a problem)	103 (20.9)	6.1 (1.7)	6 (5-7)		41.4 (8.6)	41.5 (37-48)		59 (15.3)	44 (40.7)	
Being satisfied with the course of	No	77 (15.3)	6.4 (1.6)	7 (5-8)	0.133	41.9 (10)	42 (37-48)	<0.001	45 (11.5)	32 (29.1)	<0.001
	Yes	425 (84.7)	6.2 (1.6)	6 (5-7)		46.9 (7.7)	47 (42-53)		347 (88.5)	78 (70.9)	

study chosen											
Thinking university hinders spare time activities	No	187 (37.6)	6.3 (1.8)	6 (5-8)	0.319	47.9 (7.8)	49 (43-53)	<0.001	164 (42.3)	23 (21.1)	<0.001
	Yes	310 (62.4)	6.1 (1.5)	6 (5-7)		45 (8.3)	45 (40-51)		224 (57.7)	86 (78.9)	
Not following any specific diet	No	107 (21.4)	6.9 (1.6)	7 (6-8)	<0.001	46.1 (8)	46 (40-52)	0.670	76 (19.5)	31 (28.2)	0.051
	Yes	392 (78.6)	6 (1.6)	6 (5-7)		46.2 (8.4)	46 (41-52)		313 (80.5)	79 (71.8)	
Being vegetarian or vegan	No	473 (94.8)	6.1 (1.6)	6 (5-7)	<0.001	46.3 (8.3)	46 (41-52)	0.236	375 (96.4)	98 (89.1)	0.002
	Yes	26 (5.2)	7.7 (1.8)	8 (6-9)		44 (8.7)	45 (39-49)		14 (3.6)	12 (10.9)	
Weight loss diet	No	450 (90.2)	6.1 (1.7)	6 (5-7)	0.020	46.1 (8.4)	46 (41-52)	0.851	354 (91)	96 (87.3)	0.246
	Yes	49 (9.8)	6.6 (1.2)	7 (6-7)		46.1 (7.5)	47 (39-53)		35 (9)	14 (12.7)	
Usual location of meals	Home	396 (78.9)	6.2 (1.6)	6 (5-7)	0.108	46.6 (8.4)	47 (41-53)	0.003	318 (81.1)	78 (70.9)	0.041
	Pub/restaurant	8 (1.6)	4.9 (1.6)	5 (4-6)		49.1 (6.2)	47 (45-55)		7 (1.8)	1 (0.9)	
	University/work canteen	22 (4.4)	5.7 (1.9)	6 (5-7)		41.7 (8.6)	42 (37-44)		17 (4.3)	5 (4.6)	
	Packed lunch at university/work	76 (15.1)	6.4 (1.5)	6 (5-8)		44.4 (6.8)	44.5 (40-48)		50 (12.8)	26 (23.6)	
Having enough time to eat	Always/often	427 (85.1)	6.2 (1.6)	6 (5-7)	0.638	46.5 (8.3)	46.5 (41-52)	0.008	341 (87)	86 (78.2)	0.022
	Sometimes/rarely/never	75 (14.9)	6.3 (1.7)	6 (5-8)		43.8 (8.1)	43 (38-49)		51 (13)	24 (21.8)	
Cooking personally at home most of the time	Yes	271 (54.1)	6.4 (1.6)	6 (5-7)	0.005	46.1 (8.7)	46 (41-52)	0.784	211 (54)	60 (54.6)	0.914
	No	230 (45.9)	6 (1.7)	6 (5-7)		46.1 (7.7)	46 (41-51.5)		180 (46)	50 (45.5)	
Frequency of out-of-home meals	Always/often	167 (33.3)	6.1 (1.6)	6 (5-7)	0.125	45.5 (7.6)	45 (41-50)	0.142	128 (32.7)	39 (35.8)	0.605
	Sometimes	228 (45.5)	6.1 (1.7)	6 (5-7)		46.4 (8.3)	46 (41-52)		183 (46.7)	45 (41.3)	

	Rarely/never	106 (21.2)	6.5 (1.6)	6 (5-8)		46.8 (9.3)	48.5 (41.5-53)		81 (20.7)	25 (22.9)	
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Abbreviations: MEDAS Mediterranean Diet Adherence Screener; WEMWBS Warwick-Edinburgh Mental Well-Being Scale

n=sample size

Total: Figures are expressed as number (N) and column percentages (%).

MEDAS score: Figures are expressed as mean or median and standard deviation (SD) or interquartile range (IQR) in brackets; p-value obtained via Mann Whitney U test or Kruskal Wallis test.

WEMWBS score: Figures are expressed as mean or median and standard deviation (SD) or interquartile range (IQR) in brackets; p-value obtained via Mann Whitney U test or Kruskal Wallis test.

K6: Sever Mental Illness: Figures are expressed as number (N) and column percentages (%); p-value obtained via chi-squared test.

Table 3. Multivariable linear model: Warwick-Edinburgh Mental Well-Being Scale (WEMWBS) score

	adjB	95% CI	p-value
Age	0.193	-0.054; 0.441	0.125
Female	0.923	-0.714; 2.559	0.268
Having a diagnosis of psychiatric disorder	-6.261	-9.159; -3.362	<0.001
Seeing a psychologist/psychiatrist: Never	Ref.		
Seeing a psychologist/psychiatrist: Yes, currently	-2.076	-4.584; 0.432	0.104
Seeing a psychologist/psychiatrist: Not currently, but yes in the past	-2.351	-4.225; -0.477	0.014
Seeing a psychologist/psychiatrist: Never, but thinking that it might be useful currently	-3.773	-5.391; -2.154	<0.001
MEDAS score	0.676	0.277; 1.075	0.001
BMI: normal (18.5– 24.9)	Ref.		
BMI: underweight (<18.5)	0.847	-0.955; 2.65	0.356
BMI: overweight or obese (≥ 25)	1.671	-0.092; 3.433	0.063
Highest education level completed: high school	Ref.		
Highest education level completed: bachelor's degree	1.139	-0.507; 2.786	0.175
Highest education level completed: master's degree or higher	-0.733	-3.511; 2.044	0.604
Medicine and allied medical professionals	Ref.		
Pharmacological, Natural, and Agricultural Sciences	-0.030	-2.14; 2.08	0.978
Polytechnic	0.894	-1.46; 3.248	0.456
Economics, Legal and Strategic Sciences	-2.723	-5.344; -0.103	0.042
Psychology, Humanities, Languages	0.114	-1.626; 1.853	0.898
Being on time with exams	Ref.		
Not being on time (not considering being not on time a problem)	3.126	1.348; 4.903	0.001
Not being on time (considering being not on time a problem)	-2.462	-4.172; -0.752	0.005
Being satisfied with the course of study chosen	2.449	0.696; 4.201	0.006
Exercise: No	Ref.		
Exercise: <150 min weekly	1.167	-0.371; 2.704	0.137
Exercise: ≥ 150 min weekly	-0.308	-2.012; 1.395	0.722
Being satisfied with friendships	2.928	1.295; 4.56	<0.001
Perceived health status: excellent/very good	Ref.		

Perceived health status: good	-2.880	-4.27; -1.489	<0.001
Perceived health status: poor/very poor	-7.287	-9.437; -5.137	<0.001
Usual location of meals: home	Ref.		
Usual location of meals: pub/restaurant	0.613	-4.162; 5.388	0.801
Usual location of meals: university/work canteen	-3.661	-6.772; -0.549	0.021
Usual location of meals: packed lunch at university/work	-1.915	-3.673; -0.158	0.033

Abbreviations: BMI Body Mass Index; MEDAS Mediterranean Diet Adherence Screener

Figures are expressed as adjusted unstandardized coefficients B (adjB) and 95% confidence intervals (CIs).

Table 4. Multivariable logistic model: Severe mental illness according to K6

	adjOR	95% CI	p-value
Age	0.94	0.85; 1.03	0.195
Female	0.74	0.37; 1.5	0.408
Seeing a psychologist/psychiatrist: Never	Ref.		
Seeing a psychologist/psychiatrist: Yes, currently	3.51	1.37; 8.99	0.009
Seeing a psychologist/psychiatrist: Not currently, but yes in the past	2.14	0.98; 4.66	0.055
Seeing a psychologist/psychiatrist: Never, but thinking that it might be useful currently	4.34	2.22; 8.49	<0.001
Medicine and allied medical professionals	Ref.		
Pharmacological, Natural, and Agricultural Sciences	1.49	0.59; 3.77	0.399
Polytechnic	0.67	0.23; 1.99	0.469
Economics, Legal and Strategic Sciences	3.72	1.22; 11.36	0.021
Psychology, Humanities, Languages	1.84	0.85; 3.98	0.12
Being on time with exams	Ref.		
Not being on time (not considering being not on time a problem)	1.04	0.45; 2.39	0.933
Not being on time (considering being not on time a problem)	3.18	1.66; 6.09	<0.001
Being satisfied with the course of study chosen	0.51	0.26; 1	0.051
Thinking that university hinders spare time activities	3.28	1.71; 6.3	<0.001
Usually sleeping: 8-10 hours per night	Ref.		
Usually sleeping: 5-7 hours per night	2.2	1.17; 4.13	0.014
Usually sleeping: <5 or >10 hours per night	0.33	0.04; 2.98	0.326
Perceived health status: excellent/very good	Ref.		
Perceived health status: good	1.51	0.82; 2.77	0.186
Perceived health status: poor/very poor	5.64	2.53; 12.57	<0.001
Vegetarian or vegan diet	3.02	1.01; 9.06	0.048
Weight loss diet	2.15	0.91; 5.1	0.082

Figures are expressed as adjusted odds ratios (adjOR) and 95% confidence intervals (CIs).

Table 5. Multivariable linear model: Mediterranean Diet Adherence Screener (MEDAS) score

	adjB	95% CI	p-value
Age	-0.015	-0.059; 0.03	0.521
Female	0.579	0.25; 0.907	0.001
Having a diagnosis of psychiatric disorder	0.781	0.175; 1.386	0.012
WEMWBS score	0.031	0.013; 0.049	0.001
Having enough time to eat: always/often	Ref.		
Having enough time to eat: sometimes/rarely/never	0.460	0.042; 0.877	0.031
Cooking personally at home most of the time: Yes	Ref.		
Cooking personally at home most of the time: No	-0.460	-0.783; -0.136	0.005
Frequency of out-of-home meals: always/often	Ref.		
Frequency of out-of-home meals: sometimes	0.038	-0.285; 0.36	0.818
Frequency of out-of-home meals: rarely/never	0.470	0.071; 0.87	0.021
BMI: normal (18.5– 24.9)	Ref.		
BMI: underweight (<18.5)	-0.250	-0.654; 0.154	0.225
BMI: overweight or obese (≥ 25)	-0.455	-0.846; -0.063	0.023
Studying in the same city or near family home	Ref.		
Studying far from family home	-0.336	-0.654; -0.019	0.038
Being on time with exams	Ref.		
Not being on time (not considering being not on time a problem)	-0.513	-0.897; -0.128	0.009
Not being on time (considering being not on time a problem)	-0.053	-0.413; 0.306	0.771
Exercise: No			
Exercise: <150 min weekly	0.079	-0.262; 0.42	0.650
Exercise: ≥150 min weekly	0.380	0.005; 0.754	0.047
Not following any specific diet	-0.405	-0.794; -0.016	0.041
Being vegetarian or vegan	1.105	0.387; 1.823	0.003

Abbreviations: BMI Body Mass Index; WEMWBS Warwick-Edinburgh Mental Well-Being Scale
 Figures are expressed as adjusted unstandardized coefficients B (adjB) and 95% confidence intervals (CIs).