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Assessment of Dietary Supplement Consumption among Italian University Students: the Multicenter DiSCo Study

Dietary Supplementation in Italian University Students

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Highlights

- The use of dietary supplements is growing, especially among university students.
- A high prevalence of supplements use was found among Italian undergraduates.
- Diet supplementation is associated with particular dietary regimens and sport.
- Women use diet supplements following specialists' indications more than men.

Abstract

Objective: To analyze the consumption of dietary supplements (DSs) and related sociodemographic characteristics or behaviors among Italian undergraduates.

Research Methods & Procedures: A questionnaire-based cross-sectional study was carried out between October 2021 and May 2022 involving undergraduates from twelve public universities. The use of DSs in the previous six months, the aim and the reason for use, the purchasing channel and related adverse effects were explored and compared by gender. A logistic regression was performed to highlight possible associations between sociodemographic, anthropometric and behavioral characteristics of participants and supplement consumption.

Results: The use of DSs was reported by 71.5% of the 2,165 respondents. Supplementation was related with greater age (OR 1.266, CI95% 0.965-1.660), gender (OR 1.266, CI95% 0.965-1.660 for males), particular diet regimens (OR 3.559, CI95% 1.247-10.159), sport (OR 1.713, CI95% 1.138-2.581) and type of sport (0.608, CI95% 0.411-0.899 for team sports). Women were more keen to use DSs following a doctor's prescription and to buy them in a pharmacy ($p<0.001$) but

reported more adverse effects (p=0.018) than men. The main aim pursued was general health; proteins, amino acids and non-caffeinated energy supplements were consumed to improve physical performance, and caffeinated energy supplements for mental performance.

Conclusions: Diet supplementation was common in the sample examined, especially among females, and associated with particular dietary regimens and sport, especially individual sports. Female consumers follow specialists' indications more than males. These results highlight the need of educational interventions about diet supplementation for this category of users.

Keywords

Diet supplementation; Undergraduate; Lifestyle; Nutrition; Sport

Introduction

In the last decades, the use of dietary supplements (DSs) to maintain, enhance or recover health has increased worldwide [1-4].

Dietary supplements are defined as "products intended to integrate the common diet and which are a concentrated source of nutrients, such as vitamins and minerals, or other substances having a nutritional or physiological effect, in particular but not only amino acids, essential fatty acids, fibers and vegetables extracts both single and multicompound, in pre-dosed forms [5].

Previous studies have shown a prevalence of DSs use higher than 50% in the populations examined, with differences in use, beliefs and pursued effects across different subgroups [1, 3, 4, 6]. The use of DSs is consistently reported to be higher in women and to increase with age and educational level [4]. Literature shows that college and undergraduate students commonly use DSs to comply with their nutrients' needs related to study, sport and extracurricular activities, with higher proportions of consumers among females [7].

In Italy, a prevalence of DSs users of 49% was found among adult population [8]. Some studies have examined the DSs consumption among Italian university students, showing a prevalence of users higher than 40% and related with area of study, Body Mass Index (BMI), and sport practice [9, 10]. However, these experiences were focused to specific local populations.

This study was aimed at analyzing the consumption of DSs among Italian undergraduates. To this aim, a sample of university students was obtained from twelve Italian universities. Motivations and features of diet supplementation were investigated in the study population, and possible associations between supplements consumption and sociodemographic characteristics and lifestyles of participants were explored.

Materials and Methods

The "Study on Dietary Supplements Consumption"— DiSCo — is a cross-sectional study carried out between October 2021 and May 2022 involving undergraduate students from twelve public universities selected by convenience throughout the whole Italian territory. The investigation was performed through a web-based questionnaire. Ethical approval was obtained from the Research Committee of the University of Rome "Foro Italico" (approval n CAR 104/2021) and from the academic deans. The study was performed in accordance with the principles of the Declaration of Helsinki.

Participants

Students attending universities located in northern, central and southern Italy were invited to participate. The estimated total population included 468,967 undergraduates.

A sample of at least 384 students would have been required, assuming a 95% confidence level and a 50% response proportion. A total of 2,188 students completed the questionnaire.

Questionnaire

An anonymous online questionnaire was used in this study. For this purpose, the questionnaires used in the studies of Malinauskas et al. [11] and Barnes et al. [12] were adapted to the Italian language and to the dietary supplement guidelines of the Italian Ministry of Health [13], and structured in a Google module. It included three sections. The first was aimed at collecting socio-demographic information: gender, age, nationality, educational level of parents, university and degree course attended, residential status (resident in the university area/commuter/non-resident but domiciled in the university area). The second part was focused on behavioral features of

participants: weight and height to obtain their BMI, and information about the type of dietary regimen adopted (no particular regimen/Mediterranean diet/other regimens), tobacco (smoker/quitter/no smoker) and alcohol use (yes/no, during meals or not, frequency of use), the amount of weekly time spent in moderate-vigorous activities (MVPA), the practice of sport (yes/no) and possibly its characteristics (amateur/competitive level; endurance/strength sport; individual/team sport). The third section was used to specifically investigate the undergraduates' habits of dietary supplements consumption. In particular, students were asked to refer about their use of multivitamin/multimineral products, vitamin A/B/C/D/E/K, coenzyme Q10, iron, magnesium, calcium, zinc, folic acid, selenium, potassium, iodine, fluorine, chromium, linseed, fish oil, pro-/prebiotics, herbal products, cannabis sativa products, fiber supplements, protein supplements, amino acids, non-caffeinated energy supplements, caffeinated energy supplements, glucosamine or chondroitin, melatonin in the last six months. For each product, consumers were asked to report also the reason for their consumption (my own knowledge/physician/nutritionist's prescription/pharmacist's suggestion/trainer's suggestion/relative, friend, teammate's suggestion/advertising), the aim pursued (to deal with a specific deficiency, improve general health, improve appearance, recover after an injury or a disease, improve physical performance, improve mental performance, taste appreciation), the purchasing channel (pharmacy/specialized shop/supermarket/specialized website/general trade website/sport facility) and the possible adverse effects. A researcher from each university presented to the undergraduates the aims of the study and the questionnaire during a lesson and gave them a link to the online questionnaire.

Statistical analyses

A descriptive analysis was performed on the sample characteristics. Continuous variables were expressed as mean±SD, median, and range while categorical variables were summarized as number and percentage of respondents for each category. All the variables showed a non-normal distribution. Therefore, non-parametric tests were used to perform comparisons and correlations. The Mann-Whitney test and the chi-squared test were used to compare continuous and categorical variables respectively between males and females. A univariate analysis was performed to highlight significant associations between supplements use and the other variables using the chi squared test (with Yates's correction). All those variables which showed significant relationships with supplements consumption were included in a final logistic regression analysis. For these purposes, the use of at least a supplement in the previous 6 months was considered as outcome (expressed as no use=0, use=1) and the independent variables were categorized as follows: female gender=0, male=1; age <median value=0, ≥median value=1; university from Northern Italy=0, Center=1, Southern=2; life science area of study=0, other=1; mother's or father's educational mandatory level=0, high school=1, degree or more=2; underweight=0, normal weight=1, overweight=2, obese=3; no particular diet=0, Mediterranean diet=1, other regimens=2; MVPA level <median value=0, ≥median value=1; no sport practice=0, sport player=1; endurance sport=0, strength sport=1; individual sport=0, team sport=1; no smoker=0, former smoker=1, non-smoker=2; no alcohol use=0, alcohol use=1.

Results

A total of 2,165 properly completed questionnaires were obtained. The main characteristics of the sample are reported in Table 1. The sample was composed mainly by female (69.6%) and by students attending universities from South Italy and life sciences courses. The high school

educational level was the most commonly reported for both parents. The majority of the sample had a normal weight, did not follow particular diets and play sports, did not smoke and use alcohol 2-4 times in a month. As for gender differences, females report lower BMI values, lower MVPA levels and sport practice, lower alcohol use and higher adoption of particular dietary regimens than males.

Table 1. Characteristics of participants in the whole sample and grouped by gender with p values related to gender comparison

Variable	Whole sample n=2,165	Males n=659	Females n=1,506	p value
Age mean±SD, median (IQR), range	22.5±3.7, 22 (20-24), 18-45	22.9±3.7, 22 (22-23), 18-45	22.4±3.7, 22 (22-23), 18-45	0.001[a]
Geographical area (n,%)				
North	861 (39.8)	227 (39.8)	634 (42.1)	0.004[b]
Center	269 (12.4)	88 (12.4)	181 (12.0)	
South	1035 (47.8)	344 (47.8)	691 (45.9)	
Study area (n,%)				
Life Sciences	1624 (75.0)	553 (83.9)	1071 (71.2)	<0.001[b]
Other	540 (25.0)	106 (16.1)	434 (28.8)	
Residential status				
resident in the university area	704 (32.5)	234 (35.5)	470 (31.2)	0.050[b]
commuter	687 (31.7)	187 (28.4)	500 (33.2)	
domiciled in the area	774 (35.8)	238 (36.1)	536 (35.6)	
Mother's educational level				
mandatory	457 (21.1)	115 (17.5)	342 (22.7)	0.003[b]
high school	1046 (48.3)	315 (47.8)	731 (48.5)	

degree	662 (30.6)	229 (34.7)	433 (28.8)	
Father's educational level				
mandatory	562 (26.0)	148 (22.5)	414 (27.5)	<0.001[b]
high school	989 (45.7)	289 (43.9)	700 (46.5)	
degree	614 (28.4)	222 (33.7)	392 (26.0)	
BMI				
mean±SD, median (IQR), range	22.3±3.5, 21.6 (19.9-24.0), 14.8-44.6	23.6±3.3, 23.3 (23.0-23.7), 16.-444.5	21.7±3.5, 20.9 (20.8-21.1), 14.8-44.6	<0.010[a]
Ponderal status				
underweight	179 (8.3)	19 (2.9)	160 (10.6)	
normal weight	1607 (74.2)	463 (70.3)	1144 (76.0)	<0.010[b]
overweight	298 (13.8)	152 (23.1)	146 (9.7)	
obese	81 (3.7)	25 (3.8)	56 (3.7)	
Diet				
no particular regimen	877 (40.5)	282 (42.8)	595 (39.5)	<0.010[b]
mediterranean diet	616 (28.5)	137 (20.8)	479 (31.8)	
other regimen	272 (31.0)	240 (36.4)	432 (28.7)	
MVPA/week (min) mean±SD, median (IQR)	172.8±281.4, 120 (40-240)	217.9±238.4, 180 (180-200)	153.1±296.3, 100 (90-120)	<0.001[a]
Sport				
no	1033 (47.7)	222 (33.7)	811 (53.9)	
amateur	937 (43.3)	352 (53.4)	585 (38.8)	
competitive	195 (9.0)	85 (12.9)	110 (7.3)	<0.010[b]
endurance	597 (52.6)	221 (50.6)	376 (54.1)	
strength	535 (47.4)	216 (49.4)	319 (45.9)	
individual	924 (81.6)	321 (73.4)	603 (86.8)	

team	208 (18.4)	116 (26.5)	92 (13.2)	
Smoke habit (n,%)				
no smokers	1368 (63.2)	415 (63.0)	953 (63.3)	0.635
quitters	101 (4.7)	209 (31.7)	487 (32.3)	
smokers	696 (32.1)	35 (5.3)	66 (4.4)	
Alcohol use				
no	307 (15)	71 (11.4)	236 (16.7)	0.008
yes	1733 (85)	552 (88.6)	1181 (83.3)	

[a]Independent samples Mann-Whitney test; [b]chi-squared test
BMI: Body Mass Index; MVPA: Moderate-Vigorous Physical Activity; IQR: Inter-Quartile Range

Table 2 shows the information regarding participants' use of dietary supplements.

Table 2. Features related with dietary supplement use in the whole sample and in gender groups with corresponding p values (chi-squared test)

Variable	**Whole sample n=2165**	**Males n=659**	**Females n=1506**	**p value**
Supplement use (n,%)				
no	616 (28.5)	222 (33.7)	394 (26.2)	<0.001
yes	1549 (71.5)	437 (66.3)	1112 (73.8)	
Reason for use				
my own knowledge	268 (18.1)	143 (34.2)	125 (11.7)	
physician/nutritionist's prescription	719 (48.5)	124 (29.7)	595 (55.9)	
pharmacist's suggestion	152 (10.2)	22 (5.3)	130 (12.2)	<0.001
trainer's suggestion	62 (4.2)	29 (6.9)	33 (3.1)	
relative/friend/teammate's suggestion	238 (16.1)	77 (18.4)	161 (15.1)	
advertising	44 (2.9)	23 (5.5)	21 (2.0)	
Purchasing channel				<0.001

pharmacy	1060 (70.2)	217 (51.1)	843 (77.7)	
specialized shop	69 (4.6)	40 (9.4)	29 (2.7)	
supermarket	177 (11.7)	71 (16.7)	106 (9.8)	
specialized website	133 (8.8)	74 (17.4)	59 (5.4)	
general trade website	60 (4.0)	17 (4.0)	43 (3.9)	
sport facility	11 (0.7)	6 (1.4)	5 (0.5)	
Adverse effects				
no	2109 (97.4)	650 (98.6)	1459 (96.9)	
yes	56 (2.6)	9 (1.4)	47 (3.1)	0.018

More than two thirds of the sample declared the consumption of at least a dietary supplement in the last 6 months. Women were more interested than men by this habit and reported more adverse effects but were more keen to assume them following a doctor's prescription and to buy them in a pharmacy.

Table 3 shows the proportions of supplement users in the sample for each supplement category, with gender comparison. Multivitamin and multimineral compounds were the most commonly reported products. Greater proportions of females consumed vitamin D, iron, magnesium, folic acid, probiotics, herbal products and melatonin, while the use of fish oil, proteins, amino acids, and caffeinated energy supplements was more common in males.

As for the aim pursued, in the whole sample the majority of the DS categories was taken to improve general health, with the exceptions of iron and folic acid, whose use was reported mainly to deal with a specific deficiency; proteins, amino acids and non-caffeinated energy supplements, taken mainly to improve physical performance; and caffeinated energy supplements, which were mainly consumed to improve mental performance. With regards to this aspect, in the gender comparison higher proportions of females declared that their DS use was

related to specific deficiency for multivitamin/multimineral products, group B Vitamins, vitamin D, magnesium, folic acid and potassium, linseed and fish oil, to recover from a disease for probiotics and herbal products and to improve general health for proteins, amino acids and energy DS than their male counterparts (data not shown).

Table 3. Number and percentage of supplements consumers in the whole sample and among male and female participants with related p value from the chi-squared test, with the main aim pursued reported by users

Supplement	**Consumers in the whole sample** **n=2165** ***n (%)***	**Male consumers** **n=659** ***n (%)***	**Female consumers** **n=1506** ***n (%)***	**p value**	**main aim pursued** ***n (%)***
Multivitamin/ multimineral products	764 (35.3)	207 (31.4)	557 (37.0)	0.013	395 (51.7)* general health
Vitamin A	206 (9.5)	61 (9.3)	145 (9.6)	0.786	120 (58.3) general health
Group B Vitamins	433 (20.0)	114 (17.3)	319 (21.2)	0.038	193 (44.6)* general health
Vitamin C	503 (23.2)	144 (21.9)	359 (23.8)	0.314	318 (63.2) general health
Vitamin D	502 (23.2)	123 (18.7)	379 (25.2)	<0.001	204 (40.6)* general health
Vitamin E	204 (9.4)	65 (9.9)	139 (9.2)	0.642	123 (60.3) general

					health
Vitamin K	169 (7.8)	52 (7.9)	117 (7.8)	0.923	103 (60.9) general health
Coenzyme Q10	114 (5.3)	38 (5.8)	76 (5.0)	0.490	64 (56.1) general health
Iron	394 (18.2)	65 (9.9)	329 (21.8)	<0.001	207 (52.5) specific deficiency
Magnesium	623 (28.8)	147 (22.3)	476 (31.6)	<0.001	261 (41.9)* general health
Calcium	220 (10.2)	69 (10.5)	151 (10.0)	0.753	103 (46.8) general health
Zinc	196 (9.1)	66 (10.0)	130 (8.6)	0.302	97 (49.5) general health
Folic acid	285 (13.2)	55 (8.3)	230 (15.3)	<0.001	115 (40.3)* specific deficiency
Selenium	102 (4.7)	34 (5.2)	68 (4.5)	0.515	61 (59.8) general health
Potassium	399 (18.4)	112 (17.0)	287 (19.1)	0.255	182 (45.6)* general health
Iodine	116 (5.4)	34 (5.2)	82 (5.4)	0.786	62 (53.4) general health

Fluorine	89 (4.1)	26 (6.9)	63 (4.2)	0.798	52 (58.4) general health
Chromium	77 (3.6)	22 (3.3)	55 (3.7)	0.717	46 (59.7) general health
Linseed	133 (6.1)	31 (4.7)	102 (6.8)	0.065	70 (52.6)* general health
Fish oil	117 (5.4)	56 (8.5)	61 (4.1)	<0.001	63 (53.8)* general health
Probiotics	575 (26.6)	141 (21.4)	434 (28.8)	<0.001	262 (45.6)* general health
Prebiotics	138 (6.4)	42 (6.4)	96 (6.4)	0.999	73 (52.9) general health
Herbal products	199 (9.2)	35 (5.3)	164 (10.9)	<0.001	77 (38.7) general health
Cannabis sativa products	43 (2.0)	17 (2.6)	26 (1.7)	0.190	24 (55.8) general health
Fiber supplements	139 (6.4)	40 (6.1)	99 (6.6)	0.660	73 (52.5) general health
Protein supplements	248 (11.5)	145 (22.0)	103 (6.8)	<0.010	74 (29.8)* physical performance
Amino acids	155 (7.2)	83 (12.6)	72 (4.8)	<0.001	55 (35.5)* physical

					performance
Non-caffeinated energy supplements	170 (7.9)	61 (9.3)	109 (7.2)	0.108	51 (30.0)* physical performance
Caffeinated energy supplements	329 (15.2)	156 (23.7)	173 (11.5)	<0.001	71 (21.6)* mental performance
Glucosamine or chondroitin	49 (2.3)	18 (2.7)	31 (2.1)	0.333	19 (38.8) general health
Melatonin	367 (17.0)	89 (13.5)	278 (18.5)	0.005	159 (43.3) general health

*significant differences in reported aims between genders from chi-squared test

In the univariate analysis, DSs consumption resulted significantly related with age, gender, geographical area, diet, MVPA level, playing sport, sport category and type (Table S1). Table 4 shows the results of the multivariate regression analysis performed including these independent variables.

Table 4. Results of the logistic regression performed on supplement consumption as outcome

Variable	**Odds Ratios (CI95%)**
Age	
<22 years	*reference*
≥22 years	1.266 (0.965-1.660)
Gender	
female	*reference*

male	0.722 (0.542-0.962)*
Geographical area	
North	*reference*
Center	0.946 (0.622-1.439)
South	1.239 (0.917-1.675)
Diet	
no particular regimen	*reference*
Mediterranean diet	0.856 (0.636-1.152)
other diets	3.559 (1.247-10.159)*
MVPA level	
<120 min/week	*reference*
≥120 min/week	1.191 (0.867-1.638)
Playing sport	
no	*reference*
yes	1.713 (1.138-2.581)*
Sport category	
endurance	*reference*
strength	1.246 (0.919-1.689)
Sport type	
individual	*reference*
team	0.608 (0.411-0.899)*

*p<0.05

The adoption of particular dietary regimens and the practice of sport show positive associations with supplements use, while being males and playing team sport seems to be negatively related with this habit.

Discussion

This study shows a high prevalence of DSs consumption among Italian undergraduates, with important differences between genders. The users' prevalence overcomes the two thirds of participants and was higher than that registered in the study by Traversi et al. [10] (45.1%) and by Sirico et al. [9] (41.9%) in two different Italian universities from Northern and Southern Italy. This inconsistence may be related with the different extent of the geographical areas considered in our investigation, which involved universities throughout the whole Italian territory.

In our sample females seem to be more interested than males by DSs use, especially for some product categories, but their consumption was more often related to a doctor's indication while males more often declared a consumption based on their own knowledge. This is in line with previous studies highlighting a higher use in females [1], also in undergraduate populations [14, 15]. Furthermore, female consumers were more keen to buy supplements at a pharmacy while other purchase channels were more declared by males. Probably as a consequence, adverse effects were more frequently reported by males than by females.

As for the type of DS, multivitamin/multimineral products were the most reported in our sample, as previously found [9]. Nowadays, multivitamin/multimineral supplements are widely used [1, 6]. In 2018, a Delphi consensus panel stated that these products can improve the intake of micronutrients that are consumed insufficiently or have limited bioavailability within a specified population [16]. Although there is insufficient evidence to indicate that multicomponent supplements are effective for the primary prevention of chronic diseases, for certain otherwise healthy categories such as pregnant women or older adults and for individuals with some medical conditions and inadequate micronutrient intake, the consumption of these products can provide health benefits. The consensus report established that the long-term use of multicomponent DSs

not exceeding the upper limit of recommended intakes is safe in healthy adults. Therefore, healthcare practitioners should consider specific patients' dietary risk of micronutrients inadequacy and the potential benefits of this type of supplementation.

Literature shows that the consumption of DSs is associated with the adoption of healthy lifestyles, such as better dietary habits, regular exercise, maintenance of a healthy body weight, and avoidance of tobacco smoking [1].

In our sample, DSs use was associated with particular dietary regimens. As previously reported, people who use DSs are more likely to be conscious about the importance of a healthy diet and pay more attention to their own diet than non-users [17, 18].

Furthermore, our findings showed associations between DSs consumption and sport practice, and in particular with individual sport. These results are in accordance with previous investigations [7, 9]. In a systematic review on the use of DSs among athletes, Knapik et al. [19] reported a higher proportion of DS consumers among athletes than in the general US population and among elite athletes than in their non-elite counterparts. For most DSs, the prevalence of use was similar for men and women except that a larger proportion of women used iron while a larger proportion of men used vitamin E, protein, and creatine. In line with these findings, our investigation showed gender differences in the type of supplement taken. In particular, the use of proteins and amino acid, often associated with sport performance, was mainly observed among males.

As for the aim pursued while taking DSs, our results are in line with previous surveys [4] which reported overall health purposes as the main goal to reach. This could be related with the reasons to use reported by participants. In fact, more than the half of the DSs consumers in our sample declared that their use did not follow a specific prescription. Evidence shows that the use of DSs is not always driven by a specialist's indication, which poses doubts on the safer and effective

use of DS [3, 20]. Notably, significant differences were detected between genders regarding these aspects: female use DSs to address nutritional needs following a doctor's indication and buy them at a pharmacy more frequently than males.

This study has some limitations. First of all, the individuals enrolled in the investigation came from public universities enrolled by convenience. Therefore, although coming from the whole national territory, the sample cannot be representative of the whole population of Italian undergraduates. Moreover, due to the design of the study, all the variables investigated were self-reported, which could have led to under- or overestimation of some characteristics and habits. Furthermore, in order to contain the length of the questionnaire, we did not pose questions regarding other important aspects that may be related with diet supplementation, such as for example nutritional knowledge and other health-related behaviors. Further research should address these aspects to better characterize this phenomenon. However, to the authors' knowledge, this is the first investigation about the use of DSs in young adults which was performed nationwide in Italy. The results offer a picture of dietary supplementation among university students in our country and could be useful to plan information campaigns for this target population.

Conclusions

Since adequate nutrients intake is necessary for normal biological functioning, allowing individuals to comply with dietary reference values represents a public health goal. The use of DSs can help to address specific nutritional needs and support the biological functions needed to maintain or recover health. However, in order to not exceed the nutritional recommendations, DSs use should follow specialists' indications and should be individualized according to gender,

age, health conditions and daily activities. The findings of this study testify a wide spread of DSs use among Italian undergraduates, which seems to be associated with the adoption of specific dietary regimens and the practice of sport, specifically individual sports. Females seem to be particularly interested in diet supplementation, mainly to deal with specific nutritional needs and following a doctor's prescription, while males appear to use more frequently products aimed at improving physical performance without a professional's indication. These results highlight the need of targeted educational interventions aimed at enhancing the awareness about diet supplementation.

Table S1. Results of the univariate analyses performed on the supplement consumption as outcome

Variable	Consumers n=1549	Non-consumers n=616	p value
Gender			
Female	1112 (71.8)	394 (64.0)	<0.001
Male	437 (28.2)	222 (36.0)	
Age			
<22 years	697 (45.0)	324 (52.6)	0.001
≥22 years	852 (55.0)	292 (47.4)	
Geographical area (n,%)			
North	757 (48.9)	278 (45.1)	
Center	176 (11.4)	93 (15.1)	0.044
South	616 (39.8)	245 (39.8)	
Study area (n,%)			
Life Sciences	1173 (75.8)	451 (73.2)	0.214
Other	375 (24.2)	165 (26.8)	
Residential status			
resident in the university area	502 (32.4)	202 (32.8)	
commuter	497 (32.1)	190 (30.8)	0.850
domiciled in the area	550 (35.5)	224 (36.4)	
Mother's educational level			
mandatory	320 (20.7)	137 (22.2)	
high school	753 (48.6)	293 (47.6)	0.718
degree	476 (30.7)	186 (30.2)	
Father's educational level			
mandatory	390 (25.2)	172 (27.9)	0.064

high school	698 (45.1)	291 (47.2)	
degree	461 (29.8)	153 (24.8)	
BMI			
underweight	133 (8.6)	46 (7.5)	
normal weight	1150 (74.2)	457 (74.2)	0.651
overweight	212 (13.7)	86 (14.0)	
obese	54 (3.5)	27 (4.4)	
Diet			
no particular regimen	556 (35.9)	321 (52.1)	
Mediterranean diet	454 (29.3)	162 (26.3)	<0.001
other regimen	539 (34.8)	133 (21.6)	
MVPA/week (min)			
<120 min/week	690 (44.5)	305 (49.5)	0.036
≥120 min/week	859 (55.5)	311 (50.5)	
Sport			
no	716 (46.2)	317 (51.5)	0.050
amateur	684 (44.2)	253 (41.1)	
competitive	149 (9.6)	46 (7.5)	
endurance	424 (50.9)	173 (57.9)	0.039
strength	409 (49.1)	126 (42.1)	
individual	697 (83.7)	227 (75.9)	0.003
team	136 (16.3)	72 (24.1)	
Smoke habit (n,%)			
no smokers	983 (63.5)	385 (62.5)	
quitters	497 (32.1)	199 (32.3)	0.745
smokers	69 (4.5)	32 (5.2)	
Alcohol use			

no	220 (15.0)	87 (15.2)	0.899
yes	1248 (85.0)	485 (84.8)	

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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