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Exploratory assessment of the correlates of lifestyle medicine among Spanish university students: UNILIFE-M study

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Abstract

Background University students are at a key life stage in their lives for the development of health-related behaviors, yet few studies have explored their overall lifestyle using multidimensional tools. The present exploratory study aimed to assess lifestyle through the *Short Multidimensional Inventory Lifestyle Evaluation for University Students (U-SMILE)* and to determine its sociodemographic and health correlates in a sample of Spanish university students.

Methods This cross-sectional analysis was based on baseline data collected at *Universidad Loyola Andalucía* (Spain) as part of the *UNIversity students' LIFEstyle behaviors and Mental health (UNILIFE-M)* multicenter project during the 2024 academic year. A total of 671 first-year students (median age = 18 years, 50.1% female) completed validated self-report questionnaires assessing lifestyle behaviors, sociodemographic variables, body mass index (BMI), and diagnosed health conditions. Lifestyle was evaluated using the U-SMILE. Descriptive statistics and robust linear models were applied to identify associated factors.

Results The median overall U-SMILE score was 69.0 points (interquartile range [IQR] = 64–73). Older students (> 18 years old) presented lower scores (unstandardized beta coefficient [B] = −1.59; $p = 0.006$), as did those enrolled in non-health science degrees (B = -1.47; $p = 0.005$), single students (B =−1.40; $p = 0.013$), and those with a mental disorder (B = −2.79; $p = 0.001$). Heterosexual students scored higher than non-heterosexual peers (B = 2.49; $p = 0.007$), and students with normal weight showed better results than underweight participants (B = 2.08; $p = 0.020$). Domain-specific analyses revealed that males scored higher in physical activity, sleep, and social support, whereas females performed better in stress management. Students residing outside university accommodation generally achieved higher domain scores.

Conclusions These exploratory findings suggest that lifestyle, as measured by the U-SMILE, is associated with several sociodemographic and health-related characteristics in Spanish university students. Lower scores were associated with older age, enrolment in non-health science degrees, underweight status, non-heterosexual orientation, single

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marital status, and the presence of a diagnosed mental disorder. Sex, BMI status, accommodation, and employment status were associated with specific lifestyle domains.

Keywords College students, Lifestyle behaviors, Nutrition, Physical activity, Sleep, Spain

Background

Understanding lifestyle behaviors during university years is critical for promoting long-term health and preventing non-communicable diseases. University is a decisive period in personal and professional development, coinciding with the transition to emerging adulthood. During these years, young people experience a significant reorganization of their routines and responsibilities, facing new academic, social, and emotional demands that can substantially change their health-related behavior [1, 2]. This adaptation process usually involves greater autonomy in decision-making, but also an increase in risk factors associated with unhealthy habits, such as an unbalanced diet, lack of sleep, a sedentary lifestyle, or alcohol and tobacco consumption [3–5]. Unhealthy lifestyle factors among university students (such as lack of sleep, poor diet, and lack of physical activity) are strongly associated with higher rates of depression, anxiety, stress, and lower quality of life [6–8].

Numerous studies have shown that behavioral patterns acquired during this stage have been associated with persistence into adulthood, suggesting that unhealthy lifestyle patterns established during the early years of university may be linked to adverse health outcomes in the medium and long term [9, 10]. University environments, characterized by heavy academic workloads, social pressure, and limited free time, may make it more difficult to adopt and maintain healthy habits on a long-term basis [5, 11]. In this context, a growing body of research has examined lifestyle behaviors among university students worldwide, consistently reporting suboptimal patterns in domains such as physical activity [12, 13], sleep [14], diet [15, 16], and mental health [17]. However, most of these studies have analyzed these behaviors independently, limiting a comprehensive understanding of overall lifestyle.

Lifestyle Medicine has been defined as the "evidence-based practice of assisting individuals and their families to adopt and sustain behaviors that can improve health and quality of life" [18] and focuses on key domains such as physical activity, nutrition, sleep, stress management, social connection, avoidance of risky substances, and exposure to healthy environments [19]. Lifestyle Medicine provides a theoretical and clinical framework for understanding how multiple health-related behaviors interact to influence well-being and disease prevention. This field emphasizes the modification of key behavioral domains as fundamental components of long-term health promotion. Rather than examining these behaviors in isolation, lifestyle medicine promotes an integrated perspective that recognizes their cumulative and synergistic effects on physical and mental health.

Traditionally, studies on lifestyle in young adults have addressed dimensions such as physical activity, diet, and sleep independently. However, this fragmented perspective contrasts with the emerging field of Lifestyle Medicine. Recent evidence highlights the importance of a holistic approach that considers the dynamic interaction between the different components that determine well-being [20, 21]. In this context, the Short Multidimensional Inventory Lifestyle Evaluation (SMILE) [22] is aligned with the principles of lifestyle medicine, as it was developed to assess various core domains of this field (physical activity, diet, sleep, substance use, stress management, social support, and environmental exposure) in a concise and simultaneous manner. By integrating these multiple dimensions into a single instrument, SMILE allows for a more comprehensive understanding of lifestyle patterns and their potential associations with health and well-being. Its abbreviated version has proven to be a reliable and easy-to-use tool in the university population, allowing for a comprehensive analysis of healthy behavior [23].

Despite its potential, SMILE and its correlates among European university students has hardly been explored, and the Spanish context lacks studies that integrate the multiple determinants of lifestyle. Existing research in this population has focused on isolated variables, such as physical activity or adherence to the Mediterranean diet, without considering the interdependence of the different behaviors that make up a healthy lifestyle [24, 25]. In this regard, recent evidence shows that the Spanish university population has unhealthy lifestyles, characterized by high levels of sedentary behavior, sleep disturbances and poor eating habits, which were reported to intensify during the Coronavirus Disease 2019 (COVID-19) pandemic [26]. These patterns are particularly relevant in Mediterranean countries such as Spain, where traditional dietary patterns and social lifestyles are undergoing rapid transformation due to globalization, academic pressures, and changing social environments [24, 27]. This reveals a significant deterioration in key lifestyle variables, confirming the vulnerability of this group to situations of stress or environmental change. However, despite these findings, there are still significant gaps in the comprehensive assessment of the lifestyle of Spanish university students, as there remains a paucity of studies that jointly examine different health behaviors using validated tools such

as the SMILE. Therefore, this study addresses these gaps by applying a validated multidimensional lifestyle instrument (i.e., U-SMILE) in a Spanish university population and by simultaneously analyzing its associations with a wide range of sociodemographic and health-related factors.

In this context, the present study aims to examine lifestyle patterns as measured by the Short Multidimensional Inventory Lifestyle Evaluation for University Students (U-SMILE) and to explore their potential sociodemographic and health correlates in a sample of Spanish university students. This study, part of the UNIversity students' LIFEstyle and Mental health (UNILIFE-M) project [28], seeks to provide scientific evidence to guide educational policies and health promotion strategies in the university environment, encouraging the development of healthy and sustainable behaviors among a sample of Spanish university students.

Methods

Population and study design

The UNILIFE-M project is an international, longitudinal, and prospective cohort study designed to examine the complex relationships between lifestyle behaviors and mental health outcomes among university students throughout their academic trajectory [28]. The cohort comprises students from 84 universities across 27 countries and follows participants for a period of 3.5 years, with assessments conducted at baseline and subsequently at 1-, 2-, and 3.5-year intervals. This design enables the monitoring of behavioral, psychosocial, and health-related changes over time within a diverse and multicultural population.

Data collection is conducted through a comprehensive online self-administered questionnaire developed for this study that integrates standardized and validated instruments to assess both mental health indicators and lifestyle dimensions (supplementary material 1). Concurrently, the lifestyle assessment encompasses variables related to dietary patterns, physical activity, tobacco and alcohol consumption, stress management, social support, sleep quality, environmental factors, and sedentary behavior, allowing for a multidimensional understanding of health and well-being in emerging adulthood.

The present analysis constitutes a cross-sectional study using baseline data collected at *Universidad Loyola Andalucía* (Spain) during the 2024 academic year. A total of 923 students initially participated, of whom 671 met the inclusion criteria and completed the entire battery of questionnaires. Participants were excluded if they failed to meet eligibility requirements ($n = 130$), submitted blank responses ($n = 114$), or left one or more items unanswered ($n = 8$). The inclusion criteria specified that participants must be first-year undergraduate students, aged between 16 and 35 years, and enrolled in their first academic semester. This study followed a census-based approach, whereby all eligible individuals within the target population were invited to voluntarily participate. Therefore, no a priori sample size calculation was performed, as the objective was to include the entire accessible population. Students from multiple faculties and degree programs were invited to enhance the diversity of the sample across academic disciplines and student profiles.

Recruitment was coordinated by a team of psychologists trained in the study protocol, who implemented standardized procedures across faculties. Participants were informed about the research objectives during in-class sessions conducted in the first weeks of the semester and through official university communication channels, including institutional emails, virtual learning environments, and online announcements. Participation was strictly voluntary, and all procedures adhered to current national and institutional data protection regulations, ensuring participant confidentiality and ethical integrity throughout the process.

The study protocol received ethical approval from the Research Ethics Committee of *Universidad Loyola Andalucía* (Approval ID: 240605/CE24544). All study activities were performed in accordance with the ethical standards of the Declaration of Helsinki and its subsequent amendments. Prior to enrolment, all participants provided written informed consent, confirming their voluntary participation and understanding of the study procedures.

This manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies (Table S1).

Variables

Lifestyle

Lifestyle behaviors were evaluated according to the core domains defined by the American College of Lifestyle Medicine, encompassing nutrition, regular physical activity, restorative sleep, stress management, avoidance of risky substances, and positive social connection. These domains were assessed using the Short Multidimensional Inventory Lifestyle Evaluation for University Students (U-SMILE).

The U-SMILE is an abridged version of the SMILE questionnaire [22], specifically adapted for university populations. It was developed through a process of item reduction and psychometric evaluation to preserve the multidimensional structure of lifestyle behaviors while improving feasibility for use in large epidemiological studies. The original instrument was psychometrically validated in Brazilian university students. Although a Spanish-language version is available (which was used

in this study), formal validation in Spanish populations remains limited. The U-SMILE is also available in Brazilian Portuguese and English, and translations into other languages are ongoing for international applications. In the pilot sample, the instrument demonstrated satisfactory internal consistency (Cronbach's alpha [α] = 0.73; McDonald's omega [ω] = 0.79), supporting its reliability for cross-cultural use [23]. While the original SMILE includes 43 items, the U-SMILE comprises 24 items distributed across seven domains (diet/nutriton, substance use, physical activity, stress management, restorative sleep, social support, and environmental exposures domains). Each item assesses the frequency of engagement in lifestyle behaviors during a typical week over the previous month using a four-point Likert scale (always, often, seldom, never). Total scores range from 0 to 96, with higher values reflecting healthier lifestyle patterns.

Sociodemographic characteristics

Participants provided self-reported sociodemographic data, including age, sex, sexual orientation, marital status, student residence, employment, ethnicity, and academic field. Original response categories encompassed multiple options for sexual orientation (heterosexual, homosexual, bisexual, pansexual, or other), marital status (single, married, separated, divorced, or widowed), and ethnic background.

For analytical consistency, variables were recoded into binary categories. Age was stratified as ≤ 18 years old and > 18 years old based on the median. Sexual orientation was classified as heterosexual or Lesbian, Gay, Bisexual, Transgender, Queer/Questioning and Others (LGBTQ+) (including homosexual, bisexual, pansexual, and other identities). Marital status was collapsed into single or non-single. Both student residence and employment status were coded as yes or no. Ethnicity was grouped as Caucasian or non-Caucasian, and degree programs were aggregated by disciplinary area into health sciences and non–health sciences.

Health characteristics

Self-reported height (cm) and weight (kg) were used to calculate body mass index (BMI, kg/m²). Classification followed the World Health Organization (WHO) criteria: underweight (< 18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obesity (≥ 30.0 kg/m²) [29]. For analytical purposes, BMI categories were dichotomized as underweight/normal weight versus overweight/obesity.

Infoation regarding mental and physical health status was obtained through self-report. Participants indicated whether they had ever been diagnosed with a mental health or developmental disorder by a qualified psychiatrist or psychologist (yes/no). They were also asked to specify diagnoses related to mental disorders (e.g., depression, anxiety, eating disorders, attention-deficit/hyperactivity disorder, autism spectrum disorder) and chronic physical conditions (e.g., asthma, diabetes, cardiovascular, respiratory, metabolic, neurological, or gastrointestinal diseases).

Two composite variables were created: (1) Mental health disorders (presence of any previously diagnosed psychiatric condition); and (2) physical health conditions (diagnosis of any chronic somatic illness).

Statistical analyses

The distribution of continuous variables, including age, BMI, the total U-SMILE score, and its domain scores (diet/nutrition, substance use, physical activity, stress management, restorative sleep, social support, and environmental exposures), was evaluated using the Shapiro-Wilk test and visual inspection of histograms and quantile-quantile (Q-Q) plots. As most variables did not follow a normal distribution ($p < 0.05$), continuous data were presented as medians and interquartile ranges (IQR), whereas categorical variables were presented as frequencies and percentages.

To identify factors associated with overall lifestyle and its domains (diet, substance use, physical activity, stress management, sleep, social support, and environmental exposure), robust linear regression models ('lmrob' function, 'robustbase' package) were carried out. These analyses provide reliable estimates in the presence of outliers and heteroskedasticity. Total U-SMILE score and its different domains) were included as the dependent variable in separate models. Both ociodemographic (age group, sex, sexual orientation, marital status, residence, employment, ethnicity, and academic field) and health characteristics (BMI status, presence of diagnosed mental or chronic physical disorders) were included as independent variables. For each independent variable, unstandardized beta coefficient (B) with its 95% confidence interval (95% CI) was reported.

All statistical analyses were conducted using R statistical software (version 4.3.2) in conjunction with RStudio (version 2023.12.1 + 402). The threshold for statistical significance was established at $p < 0.05$. Given the exploratory nature of the study and the large number of statistical comparisons performed across eight dependent variables and multiple predictors, no correction for multiple testing (e.g., Bonferroni correction) was applied. Accordingly, all results should be interpreted as exploratory, and statistically significant associations are subject to an elevated risk of type I error. Findings should be treated as hypothesis-generating and require replication in confirmatory studies before definitive conclusions are drawn.

Results

Table 1 presents the descriptive data of the 671 university students included in the study (50.1% female). The median age was 18 years (IQR = 18-19), with 70.3% of participants aged ≤ 18 years old. The sample consisted mainly of heterosexual students (91.5%) and Caucasian students (93.7%). Most students were single (72.0%), unemployed (86.1%), and enrolled in non-health science degrees (60.7%). The mean BMI was 21.9 kg/m², with 75.2% classified as normal weight and 15.9% overweight or obesity. In terms of mental health, 10.0% reported having received a previous diagnosis of mental disorder, and 26.2% reported having a chronic physical condition. The overall median U-SMILE score was 69.0 points (IQR = 64-73). By domain, the medians were 7.0 for diet/nutrition, 14.0 for substance use, 9.0 for physical activity, 4.0 for stress management, 8.0 for restorative sleep, 19.0 for social support, and 8.0 for environmental exposures.

Table 1 Descriptive data of the study participants

Variable	*N* = 671[1]
Age (years)	18.0 (18.0, 19.0)
Age group	
≤ 18 years old	472 (70.3%)
> 18 years old	199 (29.7%)
Sex	
Female	336 (50.1%)
Male	335 (49.9%)
Sexual orientation	
Non-heterosexual	57 (8.5%)
Heterosexual	614 (91.5%)
Race/ethnicity	
Caucasian	629 (93.7%)
Non-Caucasian	42 (6.3%)
Height (cm)	172.0 (165.0, 179.0)
Marital status	
Non-single	188 (28.0%)
Single	483 (72.0%)
Student accommodation	140 (20.9%)
Work status	93 (13.9%)
Degree program	
Health sciences	264 (39.3%)
Non-health sciences	407 (60.7%)
Weight (kg)	64.5 (56.0, 73.0)
Missing	2
BMI (kg/m^2)	21.9 (20.0, 23.7)
Missing	2
BMI status	
Underweight	60 (9.0%)
Normal weight	503 (75.2%)
Overweight	90 (13.5%)
Obesity	16 (2.4%)
Missing	2
Mental disorder status	67 (10.0%)
Physical disorder status	176 (26.2%)
Diet and nutrition domain - U-SMILE (score)	7.0 (6.0, 8.0)
Substance use domain - U-SMILE (score)	14.0 (12.0, 15.0)
Physical activity domain - U-SMILE (score)	9.0 (7.0, 11.0)
Stress management domain - U-SMILE (score)	4.0 (3.0, 5.0)
Restorative sleep domain - U-SMILE (score)	8.0 (6.0, 9.0)
Missing	1
Social support domain - U-SMILE (score)	19.0 (17.0, 20.0)
Missing	1
Environmental exposures domain - U-SMILE (score)	8.0 (7.0, 10.0)
Missing	1
Overall - U-SMILE (score)	69.0 (64.0, 73.0)
Missing	2

[1]Median (interquartile range) or number (percentage)

BMI Body mass index, *N* Sample, *U-SMILE* Short Multidimensional Inventory Lifestyle Evaluation for University Students

According to the robust linear model (Table 2), participants >18 years old obtained significantly lower lifestyle scores compared with younger students (B = – 1.59, 95% CI – 2.73 to – 0.45, $p = 0.006$). Heterosexual students reported higher scores than their non-heterosexual peers (B = 2.49, 95% CI 0.68 to 4.30, $p = 0.007$). Being single was also associated with lower scores compared with non-single students (B = – 1.40, 95% CI – 2.50 to – 0.30, $p = 0.013$). Students enrolled in non-health science degrees exhibited lower scores (B = – 1.47, 95% CI – 2.49 to – 0.45, $p = 0.005$). Participants with normal weight had higher scores than their underweight peers (B = 2.08, 95% CI 0.33 to 3.84, $p = 0.020$). Moreover, students reporting a mental disorder showed significantly poorer lifestyle scores (B = – 2.79, 95% CI – 4.45 to – 1.13, $p = 0.001$).

Results from the robust linear model assessing determinants of the diet and nutrition domain in the U-SMILE instrument are presented in Table 3. It was observed that students >18 years old had significantly higher scores in this domain compared to their peers aged ≤ 18 years old(B = 0.29; 95% CI: 0.00–0.59; $p = 0.049$). Likewise, students in non-health science degrees obtained significantly lower scores in nutrition than those in health sciences (B = – 0.32; 95% CI: –0.58 to – 0.06; $p = 0.018$).

The findings from the robust linear model identifying correlates of the U-SMILE substance use domain are summarized in Table 4. Students over the age of 18 obtained significantly lower scores in the substance use domain compared with younger students (B = – 0.67; 95% CI: –1.04 to – 0.30; $p < 0.001$). In addition, male students also scored lower than female (B = – 0.66; 95% CI: –0.99 to – 0.33; $p < 0.001$). Unemployed students scored higher than those in employment (B = 0.50; 95% CI: 0.02 to 0.98; $p = 0.042$), and those in non-health science degrees scored lower than their health science peers (B = – 0.40; 95% CI: –0.73 to – 0.07; $p = 0.018$).

Table 5 reports the results of the robust linear model for the physical activity domain of the U-SMILE questionnaire. The analyses revealed significant associations

Table 2 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (overall score)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	-1.59	-2.73, -0.45	0.006
Sex			
Female	—	—	
Male	0.40	-0.62, 1.41	0.443
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	2.49	0.68, 4.30	0.007
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	-0.91	-2.93, 1.11	0.378
Marital status			
Non-single	—	—	
Single	-1.40	-2.50, -0.30	0.013
Student accommodation			
Yes	—	—	
No	1.09	-0.13, 2.31	0.080
Work status			
Yes	—	—	
No	-0.37	-1.86, 1.11	0.622
Degree program			
Health sciences	—	—	
Non-health sciences	-1.47	-2.49, -0.45	0.005
BMI status			
Underweight	—	—	
Normal weight	2.08	0.33, 3.84	0.020
Overweight	1.10	-1.05, 3.26	0.315
Obesity	0.80	-2.75, 4.36	0.657
Mental disorder status			
No	—	—	
Yes	-2.79	-4.45, -1.13	0.001
Physical disorder status			
No	—	—	
Yes	-0.50	-1.62, 0.61	0.379

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

Table 3 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (diet and nutrition domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	0.29	0.00, 0.59	0.049
Sex			
Female	—	—	
Male	0.05	-0.20, 0.31	0.679
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	-0.22	-0.68, 0.25	0.363
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	0.09	-0.43, 0.61	0.740
Marital status			
Non-single	—	—	
Single	-0.09	-0.37, 0.19	0.528
Student accommodation			
Yes	—	—	
No	0.00	-0.32, 0.31	0.991
Work status			
Yes	—	—	
No	-0.23	-0.61, 0.15	0.232
Degree program			
Health sciences	—	—	
Non-health sciences	-0.32	-0.58, -0.06	0.018
BMI status			
Underweight	—	—	
Normal weight	0.05	-0.39, 0.50	0.810
Overweight	0.28	-0.27, 0.83	0.317
Obesity	0.48	-0.42, 1.39	0.297
Mental disorder status			
No	—	—	
Yes	-0.37	-0.80, 0.07	0.097
Physical disorder status			
No	—	—	
Yes	0.00	-0.28, 0.29	0.988

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

for sex, sexual orientation, BMI, and the presence of mental disorders. Specifically, male students scored significantly higher than female students (B = 1.58; 95% CI: 1.23–1.93; $p < 0.001$), as did heterosexual students compared to non-heterosexual students (B = 0.97; 95% CI: 0.34–1.61; $p = 0.003$). Similarly, participants of normal weight (B = 1.28; 95% CI: 0.66–1.89; $p < 0.001$) and overweight (B = 1.01; 95% CI: 0.26–1.76; $p = 0.009$) had higher levels of physical activity than underweight students. In contrast, those who reported having been diagnosed with a mental disorder showed significantly lower scores (B = – 0.81; 95% CI: –1.40 to – 0.22; $p = 0.007$).

The results of the robust linear model for the stress management domain of the U-SMILE questionnaire are presented in Table 6. Significant associations were observed for sex, type of accommodation, BMI and the presence of mental disorders. Males had significantly lower scores than females (B = – 0.39; 95% CI: –0.63 to – 0.14; $p = 0.002$). Furthermore, students who did not reside in university accommodation obtained higher values in this domain (B = 0.29; 95% CI: 0.00–0.58; $p = 0.049$). In terms of weight status, participants with normal weight (B = 0.54; 95% CI: 0.13–0.96; $p = 0.011$) and obesity (B = 1.04; 95% CI: 0.16–1.92; $p = 0.021$) had better scores than those who were underweight. Finally, students who reported a diagnosis of mental disorder showed significantly higher scores (B = 0.92; 95% CI: 0.51–1.32; $p < 0.001$).

Table 4 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (substance use domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	-0.67	-1.04, -0.30	< 0.001
Sex			
Female	—	—	
Male	-0.66	-0.99, -0.33	< 0.001
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	0.17	-0.43, 0.76	0.586
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	0.27	-0.38, 0.92	0.422
Marital status			
Non-single	—	—	
Single	-0.05	-0.40, 0.31	0.793
Student accommodation			
Yes	—	—	
No	0.18	-0.22, 0.58	0.372
Work status			
Yes	—	—	
No	0.50	0.02, 0.98	0.042
Degree program			
Health sciences	—	—	
Non-health sciences	-0.40	-0.73, -0.07	0.018
BMI status			
Underweight	—	—	
Normal weight	-0.15	-0.71, 0.42	0.617
Overweight	0.17	-0.53, 0.87	0.636
Obesity	-0.64	-1.81, 0.52	0.281
Mental disorder status			
No	—	—	
Yes	-0.16	-0.70, 0.39	0.579
Physical disorder status			
No	—	—	
Yes	-0.13	-0.49, 0.23	0.484

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

Table 5 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (physical activity domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	-0.34	-0.74, 0.05	0.092
Sex			
Female	—	—	
Male	1.58	1.23, 1.93	< 0.001
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	0.97	0.34, 1.61	0.003
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	-0.39	-1.09, 0.31	0.270
Marital status			
Non-single	—	—	
Single	-0.23	-0.61, 0.15	0.234
Student accommodation			
Yes	—	—	
No	0.15	-0.27, 0.58	0.474
Work status			
Yes	—	—	
No	-0.10	-0.62, 0.41	0.691
Degree program			
Health sciences	—	—	
Non-health sciences	-0.25	-0.61, 0.10	0.167
BMI status			
Underweight	—	—	
Normal weight	1.28	0.66, 1.89	< 0.001
Overweight	1.01	0.26, 1.76	0.009
Obesity	1.23	-0.02, 2.47	0.054
Mental disorder status			
No	—	—	
Yes	-0.81	-1.40, -0.22	0.007
Physical disorder status			
No	—	—	
Yes	0.10	-0.29, 0.49	0.611

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

Robust linear model results for the restorative sleep domain of the U-SMILE questionnaire are shown in Table 7. Analyses revealed significant associations for sex, type of accommodation, BMI, and presence of mental disorders. Males had higher scores in the sleep domain than females (B = 0.56; 95% CI: 0.23–0.90; $p = 0.001$). Futhermore, students who did not reside in university accommodation showed higher scores (B = 0.70; 95% CI: 0.30–1.10; $p < 0.001$). In contrast, participants with obesity (B = – 1.32; 95% CI: –2.51 to – 0.12; $p = 0.031$) and those who reported a diagnosis of mental disorder (B = – 0.90; 95% CI: –1.46 to – 0.35; $p = 0.002$) obtained significantly lower scores.

Table 8 presents the results of the robust linear model for the social support domain of the U-SMILE questionnaire. Significant associations were identified for sex, sexual orientation, marital status, and the presence of mental disorders. Males scored significantly lower than females in this domain (B = – 0.40; 95% CI: –0.71 to – 0.09; $p = 0.012$). Heterosexual students reported higher social support scores compared to non-heterosexual peers (B = 0.77; 95% CI: 0.21–1.34; $p = 0.007$). Single students had significantly lower scores compared to non-single students (B = – 0.37; 95% CI: –0.71 to – 0.03; $p = 0.031$). Additionally, participants who reported a diagnosed mental disorder had significantly lower social support scores (B = – 1.04; 95% CI: –1.56 to – 0.52; $p < 0.001$).

Table 6 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (stress management domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	-0.22	-0.49, 0.05	0.116
Sex			
Female	—	—	
Male	-0.39	-0.63, -0.14	0.002
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	0.12	-0.31, 0.56	0.580
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	0.00	-0.48, 0.49	0.992
Marital status			
Non-single	—	—	
Single	0.03	-0.23, 0.29	0.809
Student accommodation			
Yes	—	—	
No	0.29	0.00, 0.58	0.049
Work status			
Yes	—	—	
No	0.02	-0.33, 0.38	0.903
Degree program			
Health sciences	—	—	
Non-health sciences	0.03	-0.22, 0.27	0.825
BMI status			
Underweight	—	—	
Normal weight	0.54	0.13, 0.96	0.011
Overweight	0.23	-0.28, 0.74	0.380
Obesity	1.04	0.16, 1.92	0.021
Mental disorder status			
No	—	—	
Yes	0.92	0.51, 1.32	< 0.001
Physical disorder status			
No	—	—	
Yes	0.03	-0.24, 0.30	0.840

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

Table 7 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (restorative sleep domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	-0.26	-0.64, 0.11	0.168
Sex			
Female	—	—	
Male	0.56	0.23, 0.90	0.001
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	0.48	-0.12, 1.07	0.118
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	-0.43	-1.10, 0.23	0.199
Marital status			
Non-single	—	—	
Single	-0.07	-0.43, 0.29	0.703
Student accommodation			
Yes	—	—	
No	0.70	0.30, 1.10	< 0.001
Work status			
Yes	—	—	
No	0.36	-0.13, 0.85	0.155
Degree program			
Health sciences	—	—	
Non-health sciences	-0.25	-0.59, 0.09	0.155
BMI status			
Underweight	—	—	
Normal weight	0.08	-0.50, 0.65	0.795
Overweight	-0.26	-0.97, 0.45	0.473
Obesity	-1.32	-2.51, -0.12	0.031
Mental disorder status			
No	—	—	
Yes	-0.90	-1.46, -0.35	0.002
Physical disorder status			
No	—	—	
Yes	-0.31	-0.68, 0.06	0.100

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

Table 9 shows the results of the robust linear model applied to the environmental exposures domain of the U-SMILE questionnaire. Significant associations were observed for marital status and work status. Single students had significantly lower scores in this domain compared to non-single students (B = – 0.65; 95% CI: –0.97 to – 0.32; $p < 0.001$). Additionally, students who were not in paid employment showed significantly lower scores (B = – 0.50; 95% CI: –0.94 to – 0.06; $p = 0.027$). No significant associations were identified for sex, type of accommodation, BMI, or the presence of mental disorders.

Discussion

This study analyzed, for the first time in Spanish university students, lifestyle patterns as measured by the U-SMILE and its sociodemographic and health correlates. Overall, the results suggest associations between lifestyle behaviors and sociodemographic and health-related characteristics based on age, sex, academic field, weight status, and presence of mental disorders. The median overall U-SMILE score (69 out of 96 points) reflects the coexistence of both favorable and less favorable health-related behaviors within the studied population, with particularly notable variation observed in domains such as stress management, diet/nutrition, physical activity, and restorative sleep. Previous studies

Table 8 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University Students (social support domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	-0.35	-0.70, 0.00	0.051
Sex			
Female	—	—	
Male	-0.40	-0.71, -0.09	0.012
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	0.77	0.21, 1.34	0.007
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	-0.28	-0.90, 0.34	0.376
Marital status			
Non-single	—	—	
Single	-0.37	-0.71, -0.03	0.031
Student accommodation			
Yes	—	—	
No	0.10	-0.28, 0.47	0.607
Work status			
Yes	—	—	
No	-0.11	-0.56, 0.34	0.634
Degree program			
Health sciences	—	—	
Non-health sciences	-0.10	-0.42, 0.21	0.530
BMI status			
Underweight	—	—	
Normal weight	0.51	-0.03, 1.06	0.064
Overweight	0.24	-0.43, 0.91	0.487
Obesity	0.06	-1.05, 1.17	0.913
Mental disorder status			
No	—	—	
Yes	-1.04	-1.56, -0.52	< 0.001
Physical disorder status			
No	—	—	
Yes	-0.31	-0.66, 0.03	0.073

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

Table 9 Robust linear model determining the correlates of the Short Multidimensional Inventory Lifestyle Evaluation for University students (environmental exposures domain)

Correlate	B	95% CI	*p*-value
Age group			
≤ 18 years old	—	—	
> 18 years old	0.11	-0.23, 0.45	0.538
Sex			
Female	—	—	
Male	0.03	-0.27, 0.33	0.844
Sexual orientation			
Non-heterosexual	—	—	
Heterosexual	-0.38	-0.91, 0.15	0.162
Race/ethnicity			
Caucasian	—	—	
Non-Caucasian	0.11	-0.49, 0.71	0.718
Marital status			
Non-single	—	—	
Single	-0.65	-0.97, -0.32	< 0.001
Student accommodation			
Yes	—	—	
No	-0.06	-0.42, 0.31	0.768
Work status			
Yes	—	—	
No	-0.50	-0.94, -0.06	0.027
Degree program			
Health sciences	—	—	
Non-health sciences	-0.21	-0.51, 0.10	0.180
BMI status			
Underweight	—	—	
Normal weight	-0.04	-0.56, 0.48	0.878
Overweight	-0.34	-0.98, 0.30	0.302
Obesity	-0.04	-1.10, 1.02	0.939
Mental disorder status			
No	—	—	
Yes	0.03	-0.47, 0.53	0.897
Physical disorder status			
No	—	—	
Yes	0.27	-0.07, 0.60	0.116

B Unstandardized beta coefficient, *BMI* Body mass index, *CI* Confidence interval

in university populations have described similar profiles, with low levels of physical activity, poor sleep quality, and unhealthy eating patterns [7, 30].

In terms of overall lifestyle scores, students over the age of 18 scored lower than their younger peers. This is consistent with longitudinal studies showing a progressive deterioration in healthy habits as university studies progress, with increases in alcohol consumption, worsening diets, and decreases in physical activity and sleep [31, 32]. This could be attributed to the increase in academic responsibilities and the intensification of social and occupational demands [33].Likewise, heterosexual students and those who were not single obtained higher overall scores than their LGBTQf+ and single peers. The literature suggests that young people belonging to sexual minorities face higher levels of stress, discrimination, and stigmatization [34], which are associated with poorer mental health and with risk behaviors such as increased substance use [35, 36]. The higher scores among students in a relationship could be explained by greater social support [37], which may be particularly relevant given the mediating role of self-esteem and social support in the relationship between health awareness and healthy lifestyle behaviors in this population [38].

The academic field emerged as a relevant factor of a healthy lifestyle. Students in health sciences showed higher overall scores and better results in specific domains such as diet and substance use compared with

their peers from other disciplines. This pattern has been previously described in studies indicating greater knowledge of healthy habits, increased awareness of health risks, and, in some cases, an academic culture more oriented towards health promotion within these degrees [39, 40]. Our findings reinforce the notion that academic training in health may act as a protective factor, since university initiatives and curricula that promote health can enhance students' health perceptions and healthy lifestyle behaviors while reducing risk behaviors [41]. Therefore, the need to incorporate health education content into non-health-related degree programs is emphasized. The between-discipline gap observed in our sample, particularly in diet and substance use, is consistent with patterns reported in prior Spanish studies [39, 40], though our data extend those findings by demonstrating that the lifestyle advantage of health sciences training encompasses the full multidimensional profile measured by the U-SMILE, and not only isolated domains such as diet or physical activity.

Regarding BMI, students with a normal weight presented higher overall scores than those underweight, and in the physical activity domain, both normal-weight and overweight students scored higher compared with their underweight peers. Traditionally, research has focused on the negative consequences of overweight and obesity; however, underweight status has also been associated with poorer perceived health, lower muscular strength, reduced engagement in physical activity, and potential body image disturbances [42–44]. In this sense, our findings may suggest that, within the university context, being underweight (rather than representing a "healthy ideal") is linked to lower levels of physical activity, higher stress, or dysregulated eating patterns, which in turn result in poorer lifestyle scores [42, 45]. This pattern contrasts with the prevailing focus on overweight and obesity in the literature and suggests that interventions should adopt a weight-sensitive approach, recognizing that underweight students represent a vulnerable subgroup whose lifestyle deficits are easily overlooked when research and policy attention is concentrated on excess weight.

Students with a diagnosed mental disorder scored consistently lower in overall lifestyle and in specific domains such as physical activity, restorative sleep, social support, and environmental exposures, confirming the bidirectional relationship previously described between health behaviors and mental health [6, 8]. Depression and anxiety are frequently accompanied by fatigue, anhedonia, social withdrawal, sleep dysregulation, and reduced motivation for physical activity [46, 47], which may account for part of these findings. However, in the stress management domain, students with mental disorders obtained higher scores. The interpretation of this finding warrants caution. Whileit may reflect greater engagement in stress-management behaviors, coping strategy use, psychological care exposure, and stress sensitivity were not directly measured in this study, and alternative explanations (including response bias or heightened symptom awareness) cannot be excluded [48]. This paradoxical finding stands in apparent contrast to studies reporting globally poorer lifestyle scores across all domains in students with mental health conditions [6, 8], and highlights the need to interpret domain-specific results independently rather than assuming uniform deficits across all lifestyle dimensions in this subgroup.

Domain-specific analyses provided relevant information. In terms of diet, older students and those enrolled in health sciences displayed healthier behaviors, consistent with studies associating increased age and nutritional knowledge with better dietary choices [39, 49]. This may be linked to greater maturity, heightened health awareness, and broader exposure to nutrition education. Regarding substance use, male and older students obtained lower scores, in line with evidence indicating higher alcohol and tobacco consumption among men and in more advanced academic years [50, 51]. The higher scores observed among unemployed students could be related to lower financial stress, although the relationship between employment status and substance use is complex. Unemployed students may engage in less substance use, possibly due to reduced exposure to social contexts that facilitate consumption [52], yet the findings remain inconsistent and warrant further investigation.

In the physical activity domain, our results confirm well-documented patterns. Men showed higher levels of activity than women, while students with mental disorders exhibited lower levels. Previous studies among university students have reported lower engagement in physical activity among women and a strong association between physical inactivity and depressive and anxiety symptoms [7, 8]. Furthermore, as noted in the scientific literature [53, 54], heterosexual students scored higher than non-heterosexual students, which may again be linked to the impact of minority stress on motivation and opportunities to participate in organized physical activity [55]. Specifically, Parchem et al. (2024) documented that LGBTQ+ college students face disproportionate structural barriers, including safety concerns, discrimination, and lack of inclusive sports environments, that constrain their physical activity engagement [55]. Our findings extend those observations to a Spanish university context, suggesting that minority stress mechanisms operate similarly across different national settings.

In the sleep domain, male students and those not residing in university accommodation tended to score higher. In line with this, the literature indicates that women more frequently experience insomnia and difficulties

initiating sleep [56]. Conversely, living off campus may be associated with a more stable environment or greater control over sleep and dietary routines, whereas living in university residences has been linked in some studies to more irregular schedules, higher noise levels, and poorer sleep quality [57]. Regarding social support, the finding that students with mental disorders reported lower perceived support is consistent with existing literature [58]. Furthermore, males reported lower social support scores than females, heterosexual students scored higher than non-heterosexual peers, and single students showed lower perceived support compared to non-single counterparts, highlighting the role of sex, sexual orientation, and marital status in shaping social support perceptions among university students. Several studies have highlighted its role as a protective factor against psychological distress [59] and as a mediator between stigma and mental health [60], demonstrating that social support plays a crucial mediating role between experienced stigma and mental health. Similarly, these findings reinforce the notion that stigma can erode available social resources and, consequently, amplify its negative impact on mental health, which may partly explain the lower social support scores observed among more vulnerable groups. Therefore, health promotion programs should explicitly address social connectedness in these populations, as preventive health behaviors and social support have been shown to partially mediate the relationship between discrimination and mental health outcomes [61]. Regarding the environmental domain, significant associations were found for marital status and work status. Single students and those not in paid employment showed lower scores, suggesting that social integration and economic stability may shape students' access to supportive environmental resources [62, 63].

From a lifestyle medicine perspective, these findings reinforce the importance of addressing health behaviors as interconnected components rather than isolated factors. While previous studies in university populations have often examined physical activity, diet, or sleep separately, the use of the U-SMILE instrument allows the identification of multidimensional lifestyle patterns and their simultaneous associations with sociodemographic and health-related characteristics. This integrative approach contributes to the growing body of evidence supporting comprehensive lifestyle assessment as a key component of preventive strategies in young adult populations. However, given the exploratory design and the absence of multiple-comparison adjustment, statistically significant associations should be interpreted with caution and treated as hypotheses for future confirmatory investigation rather than established findings.Thus, in terms of practical implications, the results of this study highlight the need to design comprehensive university interventions that address lifestyle holistically, considering the interaction between diet, sleep, stress management, social support, and substance use. These strategies should not focus on isolated behaviors, but rather on developing academic environments that promote healthy habits in a comprehensive and sustained manner. In this regard, Lucini et al. [64] showed that students express interest in receiving support to improve their lifestyle, which reinforces the opportunity to implement specific programs within educational institutions. Such programs should prioritize the most vulnerable subgroups identified in this study (older students, those enrolled in non-health degrees, LGBTQ+ individuals, those who are underweight, and those with mental disorders) through personalized and diversity-sensitive interventions. Integrating health education into the curriculum, expanding psychological support services, and fostering an inclusive university culture free of stigma regarding mental health and sexual diversity could significantly contribute to improving both emotional well-being and the adoption of healthy lifestyles among the university population.

Among the strengths of the study are the use of a validated multidimensional tool (i.e., U-SMILE) and the simultaneous integration of sociodemographic, anthropometric, and mental health variables in a large sample of students. Also, our findings provide additional evidence on the applicability of the U-SMILE in Spanish university students, contributing to its cross-cultural use. However, although the U-SMILE is available in Spanish, formal psychometric validation in Spanish populations remains limited, which should be considered when interpreting the findings. On the other hand, several limitations should be considered. First, the cross-sectional design prevents the establishment of causal relationships. Second, the use of self-reported measures may introduce reporting bias, and the reliance on self-reported height and weight for BMI computation is known to produce systematic biases, particularly underreporting of weight in overweight individuals. Third, the sample comes from a single private university, which may limit the generalization of the results to other Spanish university contexts. Fourth, the study focused exclusively on first-year students, resulting in a relatively homogeneous age distribution, which may limit both the generalizability of the findings to students at more advanced stages of their academic training and comparisons across broader age groups. Fifth, although a census-based approach was used, the voluntary nature of participation may have introduced self-selection bias. Finally, a substantial number of statistical tests were conducted across eight dependent variables (the overall U-SMILE score and seven domain scores), with multiple predictors included in each model. No adjustment for multiple comparisons (such as Bonferroni correction or false discovery rate control) was applied, which

substantially inflates the probability of type I error. Given p-values ranging from < 0.001 to values approaching 0.05, several nominally significant associations may represent false positives. This study should therefore be considered hypothesis-generating, and all statistically significant findings require replication in independent, adequately powered confirmatory studies before conclusions can be drawn about their robustness.

Future research should incorporate longitudinal designs, more diverse samples (including public universities and different regions) and objective measures of physical activity, BMI and sleep, as well as explore in greater depth the mechanisms linking mental health, sexual identity and lifestyles in university youth. Specifically, future analyses within the UNILIFE-M cohort will allow longitudinal follow-up of these students to examine how lifestyle behaviors evolve throughout their university trajectory and to inform targeted health promotion strategies.

Conclusion

The results of this study suggest that lifestyle patterns among Spanish university students, as measured by the U-SMILE, are associated with age, academic field, sex, weight status, sexual orientation, and the presence of mental disorders. Older students, those enrolled in non-health science degrees, underweight students, those who identify as non-heterosexual, and those who report a diagnosis of mental disorder appear to constitute the subgroups with the most unfavorable lifestyle profiles. These exploratory findings highlight the need for universities to implement multidimensional health promotion strategies that are sensitive to sexual diversity and mental health, and that are integrated into both student support services and academic curricula. Future actions should prioritize high-risk groups through personalized interventions, while longitudinal studies are needed to further explore the directionality of the relationship between lifestyle behaviors and mental health in order to inform more effective and equitable university policies.

Abbreviations

BMI	Body mass index
CI	Confidence interval
IQR	Interquartile range
LGBTQ+	Lesbian, Gay, Bisexual, Transgender, Queer/Questioning and Others
PA	Physical activity
SMILE	Short Multidimensional Inventory Lifestyle Evaluation
U-SMILE	Short Multidimensional Inventory Lifestyle Evaluation for University Students
UNILIFE-M	UNIversity student's LIFEstyle behaviors and Mental health Study
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

MM-M and JFL-G designed the study. SM-C, JAM-E, PG-L and JFL-G collected and organised the data. JFL-G performed the statistical analysis, analysed the data, and interpreted the results. MM-M prepared the original manuscript. MM-M, SM-C, JAM-E, FQ-C, RY-S, JO-A, DKY, FBS, PG-L and JFL-G guided the study and revised the original manuscript. All authors have reviewed and approved the manuscript.

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Data availability

The datasets generated and/or analysed during the current study are not publicly available due for privacy reasons but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol received ethical approval from the Research Ethics Committee of *Universidad Loyola Andalucía* (Approval ID: 240605/CE24544). The participants provided written consent. All methods procedures were carried out in accordance with Declaration of Helsinki. All participants were informed about the purpose of the study, assured of confidentiality, and provided written consent prior to participation. Participation was voluntary, and respondents could withdraw at any time without consequence.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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