

Health Risk Behaviors Among University Students: A Latent Class Analysis and its Association With Mental Health

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Abstract

Health behaviors (HB) are critical for university students, as they are closely associated with academic and overall well-being. This cross-sectional study aimed to explore health behaviors in a sample of university students, identify patterns of HB, and examine the association between these patterns and mental health outcomes. The sample consisted of 1085 university students enrolled at a private higher-education institution. Participants were predominantly female (83.4%), with a mean age of 22.74 years ($SD = 7.03$). Latent Class Analysis (LCA) was employed to identify distinct classes of HB. Three classes were identified: Class 1, labelled as the Unhealthy habits - high-stress profile (15.7%); Class 2, labelled as the Healthy/Low-risk group (68%); and Class 3, labelled as the Unhealthy habits - substance-use profile (16.3%). Significant differences in mental health outcomes were observed, with the Unhealthy habits - high stress profile displaying significantly worse mental health compared to the Healthy/

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Data Availability Statement included at the end of the article

Unhealthy habits - substance use profile. These findings reinforce the idea that HB do not operate in isolation but are interdependent components of a broader lifestyle pattern. The findings may inform the development of targeted interventions to promote healthier lifestyle patterns and support mental health among university students, particularly for the Unhealthy habits - high stress profile in the student population.

Keywords

health behaviors, lifestyle, mental health, university, latent class analysis

Introduction

University life exposes students to several stressors, namely financial hardship, course loads, perceived faculty shortcomings, unsupportive climates, geographic separation from family, and the need to manage study with work and other commitments, among other issues (Hutchesson et al., 2025; Porru et al., 2022; Richardson et al., 2017). These pressures and stress may be associated with reduced engagement in healthy behaviors, potentially through diminished self-regulation (e.g., Annesi et al., 2020). Health behaviors refer to observable actions, both voluntary and involuntary, that exert measurable effects on physical and psychological health outcomes; they include protective practices (e.g., adherence to dietary guidelines, engagement in regular moderate-to-vigorous exercise, and maintenance of sufficient sleep duration) as well as risk behaviors (e.g., tobacco use, excessive alcohol consumption) (Short & Mollborn, 2015).

These behaviors deserve close attention in university populations. First, because they frequently deteriorate during the transition to university life, often falling below recommended guidelines (e.g., Oftedal et al., 2024; Whatnall et al., 2020). Indeed, empirical data indicate that university students exhibit suboptimal health behaviors. Becker et al. (2018) found that around 62% of undergraduates experience poor sleep quality. Almoraie et al. (2024) similarly documented unhealthy dietary patterns, including regular consumption of energy-dense snacks, frequent meal skipping, and heavy reliance on fast food. Substance use is also pronounced: around 75% of college-enrolled young adults consumed alcohol in the past year, 22% engaged in binge drinking over the previous two weeks, nearly 40% used cannabis in the past 12 months, 26% vaped nicotine in the past 30 days (with 4% smoked cigarettes) (Patrick et al., 2024). In Portugal, only 33.9% of students reported engaging in physical exercise; 29.9% reported having an unhealthy diet; 54.4% were dissatisfied with their sleep; 49.7% reported alcohol consumption; 18.7% reported tobacco use; and 3.9% reported using illicit drugs (Valentim et al., 2022).

Second, health behaviors are likely to influence both academic outcomes and mental health. A recent review has concluded that sleep disturbances, excessive alcohol consumption, and illicit drug use are consistently linked to poorer academic

performance (Whatnall et al., 2024). In contrast, the relationship between physical activity and academic performance remains equivocal, with some studies reporting no significant association (Whatnall et al., 2024). Moreover, inadequate sleep and poor physical activity have been identified as key predictors of elevated psychological distress and other mental health outcomes among university students (Hutchesson et al., 2025).

Finally, health behaviors and lifestyles established during youth are likely to be associated with health outcomes in later life (e.g., Lawrence et al., 2017). Unhealthy patterns in diet, physical activity, tobacco use, and alcohol consumption are the leading modifiable causes of many chronic diseases (e.g., cardiovascular disease, type 2 diabetes, and cancers), being responsible for most preventable illness and death worldwide (Hacker, 2024; Rahelić et al., 2024).

Patterns of Health Behaviors

Traditional research has often examined health behaviors in isolation. However, evidence suggests that they cluster into distinctive lifestyle patterns, with cumulative effects that exceed the sum of their individual impacts (Meader et al., 2016; Nobel et al., 2015; Suhag et al., 2024). Thus, understanding the interdependence of health behaviors requires a person-centered approach that moves beyond single-variable analyses to identify the constellations of practices that define real-world lifestyles. Latent class or profile analyses enable researchers to identify subgroups of students who exhibit similar behavioral patterns. Across diverse university-student samples, person-centered analyses consistently reveal multiple lifestyle profiles that span from low to very high health risk groups. In Macedo et al. (2020), four classes emerged - low-risk, moderate-risk, high-risk, and very high-risk, with nearly 38.5% of students clustered in the highest-risk groups. Similarly, Kwan et al. (2016) identified three patterns - typical, high-risk, and moderately healthy - while Hutchesson et al. (2021) also found three classes labelled healthier, moderate, and unhealthy. Bennasar-Veny et al. (2020) and Dodd et al. (2010) each delineated three risk groups: low-risk or healthy, moderate-risk or moderately healthy, and high-risk or unhealthy. El Ansari et al. (2018) described four clusters distinguished by combinations of health consciousness, nutrition, physical activity, and substance use, ranging from a health-conscious, active group to a risk-taking group with elevated alcohol, tobacco, and drug use. Together, these studies demonstrate that health behaviors among university students combine into distinct profiles, highlighting subgroups that may benefit from tailored health-promotion interventions. Also, most of these studies found significant associations between these profiles and mental health outcomes (e.g., Jao et al., 2019; Kwan et al., 2016).

The objectives of this study were (1) to describe health behaviors of university students in terms of physical activity, nutrition habits, tobacco, alcohol and other drugs use, and sleep and stress dimensions; (2) to describe classes/groups/patterns based on these health behaviors among university students; (3) to examine associations of these classes with mental health. This focus builds on theoretical and empirical evidence that

health behaviors tend to co-occur rather than operate in isolation, forming lifestyle patterns that may have cumulative or interactive effects on wellbeing. By examining clusters of behaviors instead of single practices, we aimed to capture a more comprehensive picture of health-related lifestyles among university students, a group in transition to adulthood and particularly vulnerable to both risky behaviors and mental health difficulties.

Method

Participants

From 1,139 participants, 54 were excluded because did not provide informed consent. Thus, the final sample consisted of 1,085 undergraduate and graduate students enrolled at a private higher education institution in the Lisbon metropolitan area of Portugal. Participants were predominantly female (83.4%), with a mean age of 22.74 years ($SD = 7.03$; range 17–65 years). The vast majority were Portuguese nationals (95.9%), and most lived with their family of origin (81.2%). A large proportion resided in the municipality of Lisbon (72.1%). In terms of academic level, 64.4% were pursuing a bachelor's degree, 33.6% a master's degree, and 87.1% were enrolled in Psychology programs. The majority reported no special educational needs (83.0%), while 32.3% held concurrent worker-student status. Regarding mental health, 34.4% self-reported a diagnosed condition, and 38.3% were currently receiving psychological support. For a detailed description, see [Table 1](#).

Measures

Health Behaviors. To assess students' health behaviors, we used the FANTASTIC Lifestyle Questionnaire developed by [Wilson and Ciliska \(1984\)](#) and validated for the Portuguese context by [Silva et al. \(2014\)](#). The FANTASTIC Lifestyle Questionnaire is a self-report screening tool designed to assess key domains of health-related behaviors and overall lifestyle balance. This is a reliable tool which allows for a simple method for individuals to quickly assess lifestyle behaviors, and it has been extensively applied in several countries, contexts, and populations, also used to design health intervention strategies and programs ([Batista et al., 2023](#)).

It comprises 25 items grouped into nine dimensions: (1) Family & Friends - Quality of social support and relationships; (2) Activity - Frequency and intensity of physical exercise; (3) Nutrition - Dietary patterns, including fruit, vegetable, and macronutrient intake; (4) Tobacco - Use of tobacco; (5) Alcohol - Patterns of alcohol consumption and related risk behaviors; (6) Sleep & Stress - Sleep quality, stress management, and relaxation practices; (7) Type of Personality - Coping style, optimism, and emotional resilience; (8) Insight - Self-awareness regarding one's own health needs and risks; (9) Career - Job satisfaction, work-life balance, and career goals.

For this study only five dimensions were used: Activity (3 items), Nutrition (3 items), Tobacco (2 items), Alcohol and Other drugs (6 items), and Sleep and Stress

Table 1. Sociodemographic Characteristics of the Participants (N = 1085)

Variables	N (%)
Gender	
Male	170 (15.7)
Female	905 (83.4)
Other gender identity	10 (0.9)
Nationality	
Portuguese	1041 (91.4)
Other	44 (8.6)
Household composition	
Alone	61 (5.6)
Parents and/or siblings	881 (81.2)
Spouse/partner	81 (7.5)
Children	36 (3.3)
Other	59 (5.4)
Parental education	
Both parents completed secondary education	404 (37.2)
Only one parent completed secondary education	303 (27.9)
No higher education	353 (32.5)
No answer	25 (2.4)
Change of residence	
No	947 (87.3)
Yes, but same district	22 (2.0)
Yes, different district	93 (8.6)
Yes, out of the country	23 (2.1)
Sexual orientation	
Heterosexual	829 (76.4)
Bisexual	161 (14.8)
Homosexual	41 (3.8)
Other	21 (1.9)
No answer	33 (3.1)
Educational level	
Bachelor's degree	699 (64.4)
Master's degree	365 (33.7)
Doctorate	14 (1.3)
Other	7 (0.6)
Course study	
Psychology	945 (87.2)
Biology	58 (5.4)
Education	73 (6.7)
Cognitive and behavioral sciences	7 (0.6)
Other	2 (0.1)

(continued)

Table 1. (continued)

Variables	N (%)
Professional status	
Student	734 (67.6)
Worker-student (part-time)	232 (21.4)
Worker-student (full-time)	118 (10.9)
Other	1 (0.1)
Special educational needs	
No	901 (83.0)
Yes	159 (14.7)
No answer	25 (2.3)
Special status	
No	890 (82.0)
Yes	180 (16.6)
No answer	15 (1.4)
Scholarship	
No	915 (84.3)
Yes	170 (15.7)
Mental health diagnosis	
No	677 (62.4)
Yes	373 (34.4)
No answer	35 (3.2)
Medication	
No	873 (80.5)
Yes	183 (16.9)
No answer	29 (2.6)
Psychotherapy	
No	656 (60.5)
Yes	416 (38.3)
No answer	13 (1.2)

Note. Frequencies and percentages do not sum to $N = 1085$ or 100%, respectively, because participants could report more than one living arrangement (e.g., living with both a romantic partner and children).

dimensions (3 items). Each item offers three response options, scored 0, 1, or 2. Items were classified as either risk/no risk as detailed in the data analysis section.

Mental Health. To assess mental health, we used the Clinical Outcomes in Routine Evaluation - Outcome Measure (CORE-OM) developed by [Evans et al. \(2002\)](#) and adapted for the Portuguese population by [Sales et al. \(2012\)](#). It is a self-report measure of psychological distress that includes 34 items. It assesses four domains: well-being deficits (four items; item example: “*I have felt like crying*”), problems/symptoms (12 items; item example “*I have felt tense, anxious or nervous*”), life functioning

difficulties (12 items; item example “*I felt terrible alone and isolated*”), and risk/harm (six items; item example “*I have thought on hurting myself*”).

Each item is rated on a 5-point scale, ranging from 0 (*Not at all*) to 4 (*Most or all the time*). Higher scores indicate greater levels of psychological distress. The CORE-OM demonstrated good internal consistency (Cronbach’s $\alpha = 0.94$).

Procedure

This study is part of the broader UNI_R research and action project and was approved by the institutional Ethics Committee (I-158-9-24). Data were collected via an online survey created on Qualtrics and administered between October and December 2024, in full compliance with the Declaration of Helsinki and the EU General Data Protection Regulation (GDPR). Participants completed a more extensive online assessment battery that included additional instruments not examined in the current manuscript (e.g., sense of belonging). The measures analyzed in the present study comprised only a subset of the full protocol, which required approximately 20–25 min to complete in total.

Recruitment was conducted through two complementary channels: first, digital invitations and study information sheets were distributed via closed student social media groups; second, professors across multiple years and programs briefly introduced the study during lectures and provided the QR code with the survey link directly to their classes.

Upon accessing the survey, participants reviewed an electronic information sheet describing the study’s aims, procedures, data confidentiality, and their right to withdraw at any point without consequence. Participation was entirely voluntary, and no incentives were offered. All data were stored on secure university servers, accessible only to the research team.

Data Analysis

All statistical analyses were conducted using SPSS (version 30) and Jamovi (version 2.6.26). First, descriptive statistics and frequency distributions were generated in SPSS to summarize participant characteristics in terms of their health behaviors.

Next, LCA was performed using the *glca R package* (version 1.3.3) (Kim & Chung, 2021) of *snowlatent* (Seol, 2025) (Version 2.5.6) in JAMOMI. The FANTASTIC Lifestyle Questionnaire was recoded as follows: the response reflecting the highest-risk behavior was coded as 1 (risk), whereas the two lower-risk responses were coded as 0 (no risk). Then, considering all items, models specifying two through six classes were fitted, and model fit was evaluated using the Akaike Information Criterion (AIC), the Consistent Akaike Information Criterion (CAIC) and the Bayesian Information Criterion (BIC), with lower values indicating better fit, and entropy, where values above 0.70 indicated clear class separation (Nylund & Choi, 2018; Weller et al., 2020). The optimal number of classes was selected based on the combination of fit indices

(lowest AIC/BIC and highest entropy), as well as classification accuracy and interpretability (Nylund & Choi, 2018; Weller et al., 2020).

Finally, one-way analyses of variance (ANOVAs) were conducted to test whether class membership was associated with mean CORE-OM scores. Post hoc comparisons (Tukey's HSD) were used to locate specific between-profile differences.

Results

Descriptive Statistics

As presented in Table 2, most participants reported engaging in at least some daily physical activity; however, high-calorie or fast-food consumption was also common. Although non-smoking prevailed, a minority of participants smoked occasionally or heavily. Alcohol consumption was generally moderate, with few participants engaging in heavy drinking or using psychoactive drugs. Participants reported moderate levels of sleep quality, stress management, and ability to relax, as well as to manage stress.

Latent Class Analysis

Of the initial sample of 1085 participants, 54 presented null response patterns, endorsing no risk behaviour across all 17 indicators. These cases were automatically excluded, resulting in an analytic sample of $N = 1031$.

As shown in Table 3, the model fit improved with increasing class number, as evidenced by progressively less negative log-likelihood values and decreasing AIC. However, the parsimony criteria (BIC and CAIC) reached their minimum at the three-class solution. While four- and higher-class models yielded marginally lower AIC and higher entropy, these gains were minimal relative to the added complexity (with classes having less than 5% of prevalence). The three-class model thus presents the optimal balance of fit and parsimony, exhibiting the lowest BIC and CAIC alongside satisfactory entropy, and was therefore selected as the best representation of the underlying data structure.

Class 1 was labelled "*Unhealthy habits - high stress profile*" and included 15.7% of the participants ($n = 134$). Participants in this class exhibited high daily physical activity (79.0% walked ≥ 30 min/day; 80.8% engaged in ≥ 30 min vigorous exercise weekly) but very low social engagement (19.9% belonged to a community or self-help group). Nutritional risk was moderate: 44.8% met the fruit and vegetable guidelines, 30.8% consumed fast food regularly, and 17.2% were at risk of weight gain. Substance use was minimal - 19.1% had smoked in the past year; none smoked daily; <0.1% drank heavily (≥ 7 drinks/week), used illicit psychoactive substances, or overused prescriptions; 3.6% reported binge drinking; <1% drove after drinking or consumed ≥ 6 caffeinated drinks daily. Indicators of sleep quality and stress management were generally low to moderate: 31.8% reported good sleep, 47.1% managed stress effectively, and 51.6% could relax and enjoy leisure activities.

Table 2. Frequencies of Health Behaviors for Original Answers and the Risk/No Risk Classification

Dimensions	Items	Original answer (%)	Risk (%)
Activity	Be member of a community and/or self-help group	Almost never-71.2 Sometimes-14.5 Almost always-14.3	71.2
	Walk for at least 30 min every day	Almost never-11.4 Sometimes-26.8 Almost always-61.8	11.4
	Engage in at least 30 min of intense physical activity daily	Nothing-8.2 1/week-18.6 3 or more/week-73.2	8.2
Nutrition	Eat 2 servings of vegetables and 3 of fruit every day	Almost never-29.3 Sometimes-50.8 Every day-19.9	29.3
	Consume high-calorie foods or fast food.	None-11.2 Some of them-72.5 All of them-16.3	16.2
	I am above my ideal body weight by: _____	0-4 kg-76.0 4-8 kg-13.6 +8 kg - 10.4	10.4
Tobacco	Smoke cigarettes last year	No, last 5 years - 57.1 No, last year-11.2 Yes, this year-31.7	31.7
	Smoke ____ cigarettes per day.	None-75.1 1-10/day-19.4 +10/day-5.5	5.5

(continued)

Table 2. (continued)

Dimensions	Items	Original answer (%)	Risk (%)
Alcohol and other drugs	The Average weekly intake of alcoholic beverages is: __	0-7 drinks-95.7 7-12 drinks-3.3 +12 drinks-1.0	0.9
	Drink more than 4–5 alcoholic beverages on 1 occasion.	Never-52.9 Occasionally-41.8 Often-5.3	5.3
	Drive motor vehicles after consuming alcoholic beverages	Never-93.5 Rarely-6.0 Often-0.5	0.5
	Use illegal psychoactive substances	Never-85.5 Occasionally-11.3 Often-3.2	3.1
	Excessively use prescription or over-the-counter medications.	Almost never-93.8 Sometimes-5.4 Daily-0.8	0.8
	Drink coffee, tea, or other caffeinated beverages.	–3/day-85.7 3-6/day-13.3 +6/day-1.0	1.0
Sleep and stress	Sleep well and feel rested	Almost never-22.0 Sometimes-52.0 Almost always-26.0	22.0
	Feel capable of managing day-to-day stress.	Almost never-14.9 Sometimes-61.2 Almost always-23.9	14.9
	Relax and enjoy leisure time	Almost never-13.2 Sometimes-52.5 Almost always-34.3	13.2

Note. Percentages represent the proportion of participants classified as being at risk for each lifestyle behavior. For each FANTASTIC Lifestyle Questionnaire item, the response reflecting the highest-risk behavior was coded as 1 (risk), whereas the two lower-risk response options were combined and coded as 0 (no risk), resulting in dichotomous variables used in the analyses.

Class 2 was labeled “*Healthy group/Low risk group*” and included 68% of the participants ($n = 734$). This largest group showed moderate social engagement (32.4%), very high physical activity (91.6% walked; 94.6% exercised vigorously), and strong nutrition (78.5% met guidelines; 89.9% infrequently consumed fast food; 91.2% had low weight-gain risk). Smoking and substance use were virtually absent - 19.2% had smoked in the past year; none smoked daily; <0.1% engaged in heavy drinking, illicit psychoactive substances, or prescription misuse; 2.2% reported binge drinking; no one drove after drinking; <1% drank ≥ 6 caffeinated beverages. Nearly all participants reported good sleep quality (91.1%), effective stress management (95.7%), and the ability to relax (95.6%).

Table 3. Adjustment Indices for the LCA

Classes	Log likelihood	AIC	CAIC	BIC	Entropy	G ²	% per class
2	−5598	1127	1148	1144	0.59	1513	33.5%; 66.5%;
3	−5502	1111	1143	1137	0.73	1320	15.7%; 68.0%; 16.3%;
4	−5471	1108	1151	1144	0.75	1258	19.4%; 16.7%; 61.6%; 2.3%
5	−5446	1107	1160	1151	0.77	1208	1.8%; 17.9%; 3.0%; 16.9%; 60.4%;
6	−5426	1107	1171	1160	0.85	1169	16.7%; 11.6%; 2.8%; 51.7%; 15.6%; 1.6%

Note. AIC = akaike information criterion; CAIC = consistent akaike information criterion; BIC = bayesian information criterion; G² = likelihood ratio chi-square; % = prevalences for latent classes. Bold values indicate the latent class solution retained.

Class 3 was labelled “Unhealthy habits - substance use profile” and included 16.3% of the participants ($n = 163$). Members had low social engagement (22.8%) but high activity (85.3% walked; 90.6% exercised). Nutrition was intermediate: 62.9% met produce guidelines; 27.8% ate fast food, and 10.8% were at risk of weight gain. Smoking and substance use were elevated - 96.2% had smoked in the past year; 34.0% smoked daily; 5.6% drank heavily; 19.7% binge drank; 1.8% drove after drinking; 18.1% used illicit psychoactive substances; 3.1% overused prescriptions; 2.9% consumed ≥ 6 caffeinated drinks. Sleep (67.8%) and stress management (77.3%) were moderate-to high, as was relaxation capacity (83.9%).

Associations Between Class Membership and Psychological Functioning. Assumption checks indicated a significant deviation from univariate normality (Shapiro–Wilk $W = 0.983$, $p < .001$), whereas Levene’s test suggested that variances did not differ significantly between groups ($F(2, 1\ 028) = 2.60$, $p = .075$). Given the non-normality, the Welch adjustment was used to guard against heteroscedasticity.

The Welch ANOVA revealed a statistically significant effect of class membership on CORE-OM, $F(2, 251) = 3.50$, $p = .032$. Post-hoc Tukey tests (adjusted for unequal variances) showed that Class 1 had a significantly higher CORE-OM mean than Class 2 (mean difference = 0.15, $t(1\ 028) = 2.91$, $p = .010$). Differences between Class 1 and Class 3 (mean difference = 0.14, $t(1\ 028) = 2.17$, $p = .078$) and between Class 2 and Class 3 (mean difference = -0.01 , $t(1\ 028) = -0.24$, $p = .969$) were not significant. Class 1 reported the highest mean on CORE-OM ($M = 1.29$, $SD = 0.61$), followed by Class 3 ($M = 1.16$, $SD = 0.56$) and Class 2 ($M = 1.14$, $SD = 0.53$).

Discussion

The present study aimed to identify patterns of health behaviors among university students and to examine their association with mental health.

Overall, community involvement was low among university students. Given that civic engagement, particularly volunteering and community participation, was positively associated with psychological and social well-being, as well as mental health (Mužik et al., 2025), our findings underscore the need to foster greater civic engagement among university students. Also, most students exhibited high levels of daily walking and vigorous exercise. These findings contrast with previous reports of predominantly sedentary patterns among Portuguese university students, often attributed to time constraints and academic demands (e.g., Alves & Iglesias, 2021). Self-reported rates of our sample may be inflated, as undergraduates tend to overestimate their physical activity on questionnaires compared to objective measures (e.g., Nelson et al., 2019).

In terms of nutrition, our findings indicate that most students reported consuming fruits and vegetables at least occasionally and limiting their intake of fast food to moderate levels. However, only a small proportion meets daily dietary guidelines, and a significant minority reported being above their perceived ideal weight. As emphasized by Alves (2024), the dietary habits of university students warrant close attention due to their significant influence on the risk of non-communicable diseases. Reported tobacco, alcohol, and other (illicit) drug use were low in our sample, in comparison to other studies (Patrick et al., 2024), including studies conducted with Portuguese university students. For example, Amaro et al. (2024) reported that approximately 64% of participants consumed four to five alcoholic drinks on a single occasion. Notably, over half of the sample (53%) had moved out of university-provided housing, a factor that may contribute to their poorer health behaviors. These self-reported estimates, however, may understate true prevalence. Social desirability bias may have suppressed self-reports (e.g., Davis et al., 2010), and our survey did not capture alternative nicotine delivery systems, whose use is increasing among university students (Albadrani et al., 2024), potentially obscuring vaping and other substance use.

Finally, in terms of sleep, relaxation, and stress management, although the majority reported at least intermittent engagement (78% for sleep, 85.1% for stress coping, and 86.8% for leisure), 22%, 14.9%, and 13.2%, respectively, reported almost never engaging in these behaviors. These proportions delineate a considerable subgroup of students who lack fundamental self-care practices.

Our findings demonstrated considerable heterogeneity in health behaviors among university students, with three distinct groups identified: the Unhealthy habits - high stress profile, the healthy/low-risk group, and the Unhealthy habits - substance use profile. Our identification of three distinct classes is consistent with prior research (Bennasar-Veny et al., 2020; Dodd et al., 2010; Kwan et al., 2016), including a recent study of Portuguese university students (Alves, 2024). Notably, around 68% clustered into the low-risk profile, reflecting engagement in protective behaviors across physical activity, nutrition, sleep, and stress management, a finding consistent with Alves (2024), who reported that 51.4 % of Portuguese students were in the healthy/low-risk class. Other investigations, however, have found that most students tend to fall into higher-risk categories (e.g., Bennasar-Veny et al., 2020; Dodd et al., 2010; Macedo

et al., 2020). These discrepancies may be related to cultural differences, variations in measurement thresholds for risk behaviors, temporal variations (e.g., exam periods, the beginning of the academic year), or the presence and effectiveness of institutional health promotion initiatives. It should also be noted that most participants in the present study were Psychology students attending a private university, which may reflect a relatively homogeneous socioeconomic background. This sampling characteristic needs to be considered when interpreting the findings and comparing them with studies conducted in more diverse or public university contexts.

The cumulative burden of poor health behaviors appears to be associated with poorer mental health. We found that students in the Unhealthy habits - high stress profile reported the highest CORE-OM distress scores in comparison to low- and Unhealthy habits - substance use profiles. These findings are consistent with prior work (e.g., Jao et al., 2019; Kwan et al., 2016). These demonstrated that cumulative health-risk behaviors, especially poor nutrition, low social engagement, and substance use, combine to worsen mental health outcomes. From a preventive standpoint, these findings suggest that early screening of health-behavior patterns may help identify students at greater risk of poor mental health.

It is important to note, however, that members of the Unhealthy habits - substance use profile, despite elevated tobacco use, showed lower levels of mental health than the Unhealthy habits - high stress profile in which tobacco use (and overall substance use) is rare. One possible explanation is the short-term mood-modulating effects of nicotine since addictive substances are often employed to cope with psychological distress, which has been proposed to temporarily alter emotional states (Friedman, 2020). Indeed, students in this group exhibit moderate to elevated sleep quality, effective stress-coping, and regular relaxation, which may coexist with tobacco use. However, the present cross-sectional data do not allow conclusions about whether tobacco use contributes to, results from, or is unrelated to these characteristics. These findings suggest that targeted interventions focusing on healthier stress-coping strategies and tobacco reduction may be beneficial.

Overall, the present evidence reinforces the principle that health behaviors do not operate in isolation but are interdependent components of a broader lifestyle pattern. The clear clustering of physical activity, dietary habits, sleep quality, stress management, and substance use into distinct profiles underscores the need for a holistic analytic framework.

Limitations and Future Research

Some limitations of the present study warrant consideration. First, the cross-sectional design limits causal inference and our ability to examine how health-behavior patterns evolve over time. Second, although the sample was large ($N = 1085$), participants were drawn from a single private institution, which may restrict generalizability to students at public universities or in other cultural contexts. Also, the sample consisted predominantly of young, female, native Portuguese psychology students recruited from a single private university. As such, the identified latent classes may not generalize to

students from other academic disciplines, public institutions, different age groups, or more socioeconomically and culturally diverse populations. Psychology students may also be more aware of health-related issues and engage in healthier lifestyle behaviors than the broader student population, potentially contributing to the relatively high levels of physical activity and low prevalence of overweight observed in this sample.

Third, the operationalization of some lifestyle behaviors was constrained by the response options available in the FANTASTIC Lifestyle Questionnaire. For example, the weight-related item identifies participants who perceive themselves as being above their ideal weight but does not distinguish those who may be underweight. Consequently, health risks associated with underweight status or other atypical weight-related patterns were not captured and may have been underrepresented in the identified profiles. Future studies should replicate these findings in more diverse samples and consider more comprehensive assessments of weight status and lifestyle behaviors.

Fourth, as data were collected at the start of the academic year, stressors and risk behaviors (e.g., poor sleep, increased substance use) may intensify as coursework and examinations progress. Fifth, self-report measures are vulnerable to social desirability bias, potentially leading to underestimation of stigmatized behaviors such as alcohol or drug use, as previously discussed. Finally, our coding strategy related to health behaviors classified only the most extreme responses as “risky,” which may have overlooked subtler risks in intermediate categories.

Future research should employ longitudinal designs to monitor changes in health behaviors as well as their temporal relationship with mental health outcomes. Expanding recruitment to multiple institutions, including public universities, would enhance external validity. Incorporating ecological momentary assessment or objective measures (e.g., accelerometry, smartwatches, apps) could help mitigate reporting biases.

Practical Implications

From a psychological perspective, our identification of three distinct health-behavior profiles suggests that interventions should be tailored to students’ specific needs. For the Unhealthy habits - high stress profile, who combine high physical activity with very low social engagement, only moderate nutritional adherence, and limited relaxation, sleep, and leisure, psychologists can promote brief, context-sensitive nutritional prompts into existing exercise routines (e.g., suggesting a post-workout fruit or vegetable snack) and deliver short, skills-based modules on guided relaxation, mindfulness, and sleep-hygiene through familiar channels such as group chat networks. Facilitating icebreaker-style exercises within routine classes or workout sessions can foster social connection without imposing additional time demands.

In contrast, the Unhealthy habits - substance use profile, characterized by occasional substance use (e.g., tobacco) for stress relief with otherwise average health behaviors, would benefit from targeted emotion-regulation training. Psychologists can offer brief psychoeducational sessions on diaphragmatic breathing, progressive muscle

relaxation, and cognitive reappraisal, then reinforcing these strategies through micro-interventions delivered via mobile applications and small-group practice sessions that build peer support.

By aligning intervention content and delivery with each profile's existing strengths and challenges and leveraging familiar contexts and digital platforms, psychologists can efficiently promote more holistic, healthier lifestyles across the student population.

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Consent to Participate

Informed consent was obtained from all participants involved in the study.

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Data Availability Statement

Data presented in this study is available on request from the corresponding author. The data is not publicly available due to privacy and ethical restrictions.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this work the authors used ChatGPT to improve language and readability. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

IRB Approval

All participants gave their informed consent for inclusion before they participated in the study. All data was obtained in a confidential form and data are not externally accessible. The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the ISPA Ethics Committee (Reference: I-158-9-24).

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