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Associations between lifestyle clusters and sociodemographic factors in Brazilian university students

Associações entre *clusters* de estilo de vida e fatores sociodemográficos em estudantes universitários brasileiros

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ABSTRACT

Objective: To identify clusters of lifestyle behaviors among Brazilian university students and their associations with social risk factors. Methods: This study presents a cross-sectional analysis of baseline data from the Unilife-M prospective multicenter cohort, recruited through non-probabilistic convenience sampling at ten Brazilian universities. Data were collected using a sociodemographic questionnaire and the Short Multidimensional Inventory Lifestyle Evolution - Confinement, which assesses seven lifestyle components: physical activity, eating behavior, screen time, substance use, sleep, stress management, and social support. The social risk factors analyzed included sex, race/ethnicity, gender identity, sexual orientation, and income. Two-step cluster analysis was used to identify clustering patterns. The associations were examined using multinomial logistic regression models. Results: The sample comprised 851 university students (56.5% female) with a mean age of 23 ± 6 years. Three different lifestyle profiles were identified: i) the At-risk cluster, with the worst outcomes across all lifestyle domains; ii) the Screeners cluster, with a negative pattern for screen time (z = -0.51 ± 0.37); and iii) the Non-screeners cluster, the group with healthier indicators for screen time (z = 1.42 ± 0.86) and eating behavior (z = 0.54 ± 0.72). A significant association was observed between sexual orientation and the clusters, with non-heterosexual individuals having a higher likelihood of belonging to the At-risk cluster (OR = 3.16, 95% CI: 1.95 - 5.12). No significant associations were identified between the clusters and sex, race/ethnicity, income, or gender identity. Conclusion: The results provide evidence for the existence of three distinct lifestyle behavior profiles among Brazilian university students, which are structured interdependently and reveal risk patterns, especially those marked by social inequalities. Additionally, an association was observed between sexual orientation and membership in a less-healthy cluster.

Keywords: Lifestyle; Sociodemographic factors; Cluster analysis; Students.

RESUMO

Objetivo: Identificar clusters de comportamentos de estilo de vida entre universitários brasileiros e suas associações com fatores sociodemográficos. Método: Este estudo trata de uma análise transversal dos dados de linha de base da coorte prospectiva e multicêntrica Unilife-M, com recrutamento realizado por amostragem não probabilística por conveniência em dez universidades brasileiras. Os dados foram coletados por meio de um questionário sociodemográfico e do Short Multidimensional Inventory Lifestyle Evolution - Confinement, que avalia sete componentes do estilo de vida: atividade física, comportamento alimentar, tempo de tela, uso de substâncias, sono, gerenciamento do estresse e suporte social. Os fatores sociais de risco analisados incluíram sexo, raça/cor, identidade de gênero, orientação sexual e renda. A análise de cluster em duas etapas foi utilizada para identificar padrões de agrupamento. Associações foram verificadas por modelos de regressão logística multinomial. Resultados: A amostra foi composta por 851 estudantes universitários (56,5% mulheres) com média de idade de 23 ± 6 anos. Foram identificados três diferentes perfis relacionados ao estilo de vida: i) o cluster At-risk, com os piores resultados para todos os domínios dos estilos de vida; ii) o cluster Screeners, com um padrão negativo de tempo de tela (z = -0,51 ± 0,37); e iii) o cluster Non-screeners, o grupo com indicadores mais saudáveis para o tempo de tela (z = 1,42 ± 0,86) e comportamento alimentar (z = 0,54 ± 0,72). Observou-se uma associação significativa entre orientação sexual e os clusters, com pessoas não-heterossexuais tendo maior chance de pertencer ao cluster At-risk (OR = 3,16, IC 95%: 1,95 - 5,12). Não foram identificadas associações significativas entre os clusters e as variáveis sexo, raça/cor, renda ou identidade de gênero. Conclusão: Os achados indicam a existência de três perfis distintos de comportamentos de estilo de vida entre estudantes universitários brasileiros, estruturados de maneira interdependente e que revelam padrões de risco marcados, sobretudo, por desigualdades sociais. Além disto, foi observada uma associação entre a orientação sexual e o pertencimento ao cluster menos saudável.

Palavras-chave: *Estilo de vida; Fatores sociodemográficos; Análise por conglomerados; Estudantes.*

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Introduction

The set of changes experienced during the transition to academic life represents a significant challenge for university students[1,2]. The need to adapt to a new environment, develop greater autonomy, meet high academic demands, and manage various types of relationships established during this period can act as barriers to adopting healthy lifestyle behaviors[1,2]. When academic demands occur in a maladaptive manner, university students tend to experience a negative impact on their quality of life due to unhealthy behaviors[3]. For example, certain lifestyle changes may lead to decreased physical activity levels and increased time spent in sedentary behaviors[4], the adoption of an inadequate diet (characterized by higher intake of sugar, fat, and sodium and suboptimal consumption of fruits, vegetables, and whole grains)[5], reduced sleep quality[6], increased alcohol and tobacco use[7], and elevated stress levels[8]. These changes are potentially harmful to health, as lifestyle is directly associated with the onset of noncommunicable diseases and conditions[9,10]. Furthermore, an unhealthy lifestyle may also be related to poorer academic performance, higher dropout rates in undergraduate programs[11], and a more negative perception of future professional competence[12].

Considering that lifestyle behaviors begin in adolescence and tend to consolidate during young adulthood[13], considering that lifestyle behaviors begin in adolescence and tend to consolidate during young adulthood[3]. However, when examining aspects associated with university students' lifestyles, it is necessary to consider the social factors that may influence this relationship[14,15]. Previous evidence suggests that socioeconomic factors affect the adoption of healthy lifestyle behaviors[16,17]. Therefore, it is essential to understand how sociodemographic factors (e.g., sex, sexual orientation, gender identity, race/ethnicity, family income, and educational attainment)[18] may be associated with the lifestyle and health of university students[17]. For instance, studies on health inequalities have shown that the social determinants of gender, race/ethnicity, and socioeconomic status may intersect to exacerbate health problems[19,20]. These intersectional approaches highlight that different sociodemographic factors interact to create complex hierarchies, shaping individuals' relationships with the world and potentially resulting in social disadvantage or oppression[21]. Given that these factors are interconnected and may influence inequalities in health-related aspects[18], it is necessary to understand lifestyle components using an intersectional approach. Nevertheless, investigations examining the clustering of multiple lifestyle behaviors among university students remain limited[22]. Such an approach may provide a more comprehensive understanding of the complex associations between lifestyle and the social, economic, and cultural determinants of health.

Given that unhealthy behaviors may coexist and exacerbate their negative effects on physical and mental health, it is essential to investigate the interactions between different lifestyle-related components[23] and their associated factors among university students. Examining the clustering of these behaviors may provide a more comprehensive understanding of how to inform public health policies for this population. This integrated approach is crucial, as considering behaviors in isolation may underestimate the cumulative and synergistic effects of these factors on students' health

and well-being. Therefore, considering that cluster analysis can help identify similar lifestyle behaviors through behavioral patterns[24] and facilitate the identification of target groups for health promotion efforts, the present study aimed to identify clusters of lifestyle behaviors among Brazilian university students and their associations with social risk factors.

Method

Study design

This multicenter observational study consisted of a cross-sectional analysis of the pilot study from the cohort entitled "Trajectories of lifestyle and mental health among university students: the prospective Unilife-M cohort"[25]. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[26].

Ethical aspects

The project was approved by the Research Ethics Committee of the Federal University of Santa Catarina (approval number 5.509.738). The project was approved by the ethics committees of all other institutions involved in this stage of the research. All participants provided consent by signing the Informed Consent Form or, when applicable, the Informed Assent Form.

Sample

This study used a sample of Brazilian university students of both sexes. Participants were recruited using non-probabilistic convenience sampling methods. The eligibility criteria were as follows: (i) regular enrollment in undergraduate or postgraduate programs and (ii) age between 16 and 35 years. Individuals who did not complete the Short Multidimensional Inventory Lifestyle Evolution - Confinement (SMILE-C), which was used for participant screening, were excluded from this study.

Variables and measurement instruments

A self-reported sociodemographic questionnaire was used, including questions on participants' contextual and personal characteristics (e.g., sex, age, gender identity, sexual orientation, race/ethnicity, marital status, average monthly household income, educational level, and diagnosis of mental disorders) to assess sociodemographic factors and to characterize the sample. Detailed information regarding the nature of each variable, categorization criteria, and assessment methods of the instruments are provided in Supplementary Material (Table S1).

The Short Multidimensional Inventory Lifestyle Evolution - Confinement (SMILE-C)

The SMILE-C[27] was used to assess lifestyle-related behaviors (physical activity, eating behavior, screen time, substance use, sleep, stress management, and social support). This instrument comprises 27 items that evaluate the frequency of behaviors over the past 30 days using a 4-point Likert scale. For example, regarding physical activity, participants are asked: "Did you exercise for at least 30 minutes/day (or 150 minutes per week)?" Response options ranged from "always" (1) to "never" (4). Higher scores indicate a healthier lifestyles[27]. The SMILE-C was validated for the Brazilian university student population and demonstrated adequate psychometric properties (α de Cronbach = 0.73; ω de McDonald's = 0.79)[28].

Jeopardy Index

The Jeopardy Index was used to assess the association between multiple social indicators and lifestyle[18]. This index is based on five sociodemographic variables reflecting different aspects of social privilege, which are categorized and scored as follows: sex (male = 0; female = 1), race/ethnicity (white = 0; non-white = 1), gender identity (cisgender = 0; non-cisgender = 1), sexual orientation (heterosexual = 0; non-heterosexual = 1), and income (divided into quartiles: first quartile = 0; second quartile = 1; third quartile = 2), based on self-reported household income. Levels five and six of the Jeopardy Index were combined into a single category. A composite index was generated by assigning a score of zero to the most privileged group within each variable (men, white, heterosexual, cisgender, and highest socioeconomic position) and a score of five to the least privileged group (women, non-white, non-heterosexual, non-cisgender, and lowest socioeconomic position)[18]. The summed scores of each indicator resulted in the Jeopardy Index, which ranged from 0–5. The lower the index, the greater the social privilege (or greater guarantee of rights) and the lower the social vulnerability of the group.

Procedures

Undergraduate and postgraduate university students from ten Brazilian universities participated in this study. Participant recruitment was conducted through

institutional dissemination on university digital platforms, academic social networks, and student groups, as well as in-person approaches in university settings (e.g., classrooms and academic centers). Data collection for the pilot phase occurred in two waves (baseline and Phase II), with a two-month interval during the second semester of 2022. All participants were informed of the study's objectives and methods. Those who agreed to participate completed self-reported questionnaires containing open- and closed-ended questions on sociodemographic and health aspects, as well as instruments related to lifestyle behaviors and mental health. Data collection was performed online using the Research Electronic Data Capture (REDCap) platform[29].

Statistical analyses

Descriptive and inferential statistics were used to analyze the data, with the results expressed as relative frequencies and measures of central tendency to characterize the sample. A Two-step cluster algorithm was applied for the cluster analysis. The variables included in the cluster analysis were eating behavior, substance use, physical activity, stress management, sleep, social support, and screen time. All the scale values were standardized using z-scores.

The number of clusters was determined using the Bayesian Information Criterion method, which seeks to find the optimal cluster solution by balancing the model complexity and data fit. Additionally, the log-likelihood value was used as a distance metric to assess the adequacy of the clustering model for observed data. The silhouette coefficient was approximately 0.40, indicating a good model fit[30].

For association and comparison analyses between clusters and sociodemographic factors, the Chi-square test and Kruskal-Wallis test were employed. Subsequently, multinomial logistic regression models were used to investigate the relationship between the Jeopardy Index components and lifestyle clusters. To ensure model adequacy, multicollinearity among the independent variables was assessed using the variance inflation factor. No significant multicollinearity issues were observed, with variance inflation factor values below 5, which is an accepted threshold[31].

Associations between lifestyle clusters and all variables comprising the Jeopardy Index individually (sex, race/ethnicity, gender identity, sexual orientation, and income) were analyzed, as well as for each main exposure level (Jeopardy Index). All models were adjusted for covariates showing bivariate associations with the primary outcome ($p < 0.20$). The results are presented as odds ratios (OR) with 95% confidence intervals (95% CI). Finally, the prevalence distribution among the lifestyle clusters was calculated for each risk-index score level. All analyses were performed using SPSS version 27 (SPSS Inc., Chicago, IL, USA), with significance set at $p < 0.05$.

Results

Sample characteristics, lifestyle clusters, and their associations

Initially, 941 Brazilian undergraduate and postgraduate students participated in the study, with a mean age of 23 ± 6 years. Of these, 90 participants (9.6%) were excluded due to incomplete lifestyle behavior data. Further details on the initial sample and the number of missing data points per lifestyle behavior are available in Supplementary Material (Tables S2 e S3).

The characteristics of the study sample are shown in Table 1. The sample comprised 851 university students with a mean age of 23 ± 6 years. Regarding educational level, most were undergraduates (91.4%), female (56.2%), and self-identified as White (43.9%). Additionally, most participants identified as cisgender (97.5%) and heterosexual (74.8%), with 32.7% of the sample reporting an average monthly income between R$2,005.00 and R$8,640.00.

Three cluster profiles were identified and categorized as follows: (i) At-risk cluster; (ii) Screeners cluster; and (iii) Non-screeners cluster, named according to the most pronounced behaviors that contributed to the distinction between groups. For example, the At-risk cluster showed a higher proportion of women (64.6%), a monthly household income between R$1,255.00 and R$2,004.00 (31.5%), and a higher proportion of individuals with a history of mental disorder diagnosis (19.5%).

Sedentary behavior, represented by screen time, contributed most to the distinction between the clusters and the similarity among group members. The At-risk cluster exhibited the poorest values (negative z-scores) across all lifestyle domains. The primary negative domains were social support ($z = -0.85 \pm 0.84$), eating behavior ($z = -0.77 \pm 0.91$), and stress management ($z = -0.77 \pm 0.80$). Regarding the Screeners cluster, this group showed positive z-scores near the mean for all variables, except for screen time ($z = -0.51 \pm 0.37$).

Conversely, the Non-screeners cluster showed the best values for screen time, with the lowest screen use (z

Table 1 – Sociodemographic characteristics and lifestyle behavior clusters of Brazilian university students: The Unilife-M Cohort – Pilot phase (n = 851), 2022.

	Total n = 851	At-risk n = 302	Screeners n = 366	Non-screeners n = 183	p
	n (%)	n (%)	n (%)	n (%)	
Sex					< 0.001[a]
Female	478 (56.2)	195 (64.6)	189 (51.6)	94 (51.4)	
Male	373 (43.8)	107 (35.4)	177 (48.4)	89 (48.6)	
Mean age (± SD)	23 ± 6	23 ± 5	22 ± 5	25 ± 8	< 0.001[b]
Gender Identity					0.10[a]
Cisgender	830 (97.5)	291 (96.4)	359 (98.1)	180 (98.4)	
Transgender	3 (0.4)	1 (0.3)	2 (0.5)	-	
Non-binary	12 (1.4)	8 (2.6)	4 (1.1)	-	
Not reported	6 (0.7)	2 (0.7)	1 (0.3)	3 (1.6)	
Sexual orientation					<0.001[a]
Heterosexual	632 (74.8)	183 (61.0)	295 (81.3)	154 (84.6)	
Homosexual	67 (7.9)	33 (11.0)	26 (7.2)	8 (4.4)	
Bisexual	126 (14.9)	68 (22.7)	39 (10.7)	19 (10.4)	
Pansexual	13 (1.5)	11 (3.7)	2 (0.6)	-	
Other	7 (0.8)	5 (1.7)	1 (0.3)	1 (0.5)	
Race/ethnicity					0.09[a]
Yellow	4 (0.5)	3 (1.0)	1 (0.3)	-	
Black	122 (14.4)	41 (13.6)	51 (14.0)	30 (16.6)	
Pardo	333 (39.4)	131 (43.5)	126 (34.6)	76 (42.0)	
Indigenous	12 (1.4)	3 (1.0)	7 (1.9)	2 (1.1)	
White	371 (43.9)	121 (40.2)	179 (49.2)	71 (39.2)	
Other	4 (0.5)	2 (0.7)	-	2 (1.1)	
Body mass index					0.25
Underweight	57 (6.7)	27 (8.9)	23 (6.3)	7 (3.8)	
Normal weight	521 (61.2)	170 (56.3)	237 (64.8)	114 (62.3)	
Overweight	192 (22.6)	71 (23.5)	76 (20.8)	45 (24.6)	
Obesity	70 (8.2)	42 (9.3)	35 (7.4)	15 (8.2)	
Not reported	11 (1.3)	6 (2.0)	3 (0.7)	2 (1.1)	
Marital status					<0.001[a]
Married	36 (4.3)	4 (1.3)	17 (4.6)	15 (8.2)	
Single	767 (90.1)	278 (92.1)	337 (92.6)	152 (83.1)	
Divorced	8 (0.9)	3 (1.0)	1 (0.3)	4 (2.2)	
Stable union	36 (4.2)	15 (5.0)	9 (2.5)	12 (6.6)	
Not reported	4 (0.5)	2 (0.6)	2 (0.5)	-	
Number of people in the household					0.90[a]
One	107 (12.7)	44 (14.6)	40 (10.9)	23 (12.6)	
Two	174 (20.6)	59 (19.5)	72 (19.7)	43 (23.5)	
Three	232 (27.5)	78 (25.8)	104 (28.4)	50 (27.3)	
Four	211 (25.0)	73 (24.2)	94 (25.7)	44 (24.0)	
Five or more	121 (14.3)	45 (14.9)	54 (14.8)	22 (12.1)	
Not reported	6 (0.7)	3 (1.0)	2 (0.5)	1 (0.5)	
Lives in student housing					0.43[a]
Yes	42 (4.9)	17 (5.7)	14 (3.9)	11 (6.0)	
No	805 (94.6)	284 (94.0)	349 (96.1)	172 (94.0)	
Not reported	4 (0.5)	1 (0.3)	3 (0.8)	-	

Continue…

Continue of **Table 1 –** Sociodemographic characteristics and lifestyle behavior clusters of Brazilian university students: The Unilife-M Cohort – Pilot phase (n = 851), 2022.

	Total n = 851	At-risk n = 302	Screeners n = 366	Non-screeners n = 183	p
	n (%)	n (%)	n (%)	n (%)	
Currently employed					0.17[a]
Yes	266 (31.3)	97 (32.1)	103 (28.1)	66 (36.1)	
No	579 (68.0)	204 (67.5)	259 (78.8)	116 (63.4)	
Not reported	6 (0.7)	1 (0.4)	4 (1.1)	1 (0.5)	
Average monthly household income					0.01[a]
Below R$ 1,254.00	164 (19.6)	73 (24.7)	55 (15.2)	36 (19.9)	
Between R$ 1,255.00 and R$ 2,004.00	235 (28.1)	93 (31.5)	91 (25.2)	51 (28.2)	
Between R$ 2,005.00 and R$ 8,640.00	274 (32.7)	84 (28.5)	131 (36.3)	59 (32.6)	
Between R$ 8,641 and R$ 11,261.00	83 (9.9)	27 (9.2)	40 (11.1)	16 (8.8)	
Above R$ 11,262.00	81 (9.7)	18 (6.1)	44 (12.2)	19 (10.5)	
Mental disorder diagnosis					<0.001[a]
Yes	123 (14.5)	59 (19.5)	47 (12.8)	17 (9.3)	
No	725 (85.2)	242 (80.2)	318 (86.9)	165 (90.2)	
Not reported	3 (0.3)	1 (0.3)	1 (0.3)	1 (0.5)	
Diagnosis of non-communicable diseases and conditions					0.18[a]
Yes	282 (33.1)	112 (37.1)	115 (31.4)	55 (30.1)	
No	569 (66.9)	190 (62.9)	251 (68.6)	128 (69.9)	
Education level					<0.001[a]
Undergraduate	778 (91.4)	285 (94.4)	339 (92.6)	154 (84.2)	
Specialization	5 (0.6)	-	4 (1.1)	1 (0.5)	
Master's degree	36 (4.3)	10 (3.3)	11 (3.0)	15 (8.2)	
Doctorate/PhD	25 (2.9)	5 (1.7)	9 (2.5)	11 (6.0)	
Not reported	7 (0.8)	2 (0.7)	3 (0.8)	2 (1.1)	

Note: a = Chi-square test; b = Kruskal-Wallis test; SD = standard deviation. Pardo = term referring to individuals of mixed ethnic origins in Brazil, often characterized by a range of brown skin tones.

= 1.42 ± 0.86), as well as positive z-scores close to zero for all other variables. Additionally, the Non-screeners cluster exhibited the healthiest eating behavior pattern, with the lowest mean consumption of ultra-processed foods (15.29 ± 1.83) and a z-score of 0.54 ± 0.72. Positive mean scores for physical activity practice were observed for both the Screeners (3.19 ± 1.00 points) and Non-screeners clusters (3.27 ± 0.84 points), both of which were higher than the total sample mean of 2.86 ± 1.10 points. The cluster characteristics based on lifestyle-related behaviors are presented in Table 2.

Association between cluster profiles and the Jeopardy Index

Logistic regression analyses indicated that non-heterosexual individuals (OR = 3.45, 95% CI = 2.18–5.46; $OR^{adjusted}$ = 3.16, 95% CI = 1.95–5.12) had higher odds of belonging to the At-risk cluster, as shown in Table 3. Associations between lifestyle clusters and sex and race/ethnicity variables were not significant after adjusting for confounders.

Table 4 presents the associations between the Screeners and At-risk clusters according to the classification levels of the jeopardy index. Although there was a tendency for increased odds of belonging to the At-risk cluster as risk levels increased, no significant association was found between the classification levels of the Jeopardy Index and lifestyle clusters.

Prevalence distribution of clusters according to the Jeopardy Index

Figure 1 shows the prevalence distribution of university students in each cluster according to variations in the Jeopardy Index. A higher prevalence of students in

Table 2 – Lifestyle behavior clusters of Brazilian university students. Unilife-M Cohort – Pilot phase (n = 851), 2022.

	Total (n = 851)	At-risk (n = 302)		Screeners (n = 366)		Non-screeners (n = 183)	
	Mean ± standard deviation	Mean ± standard deviation	Z-score ± standard deviation	Mean ± standard deviation	Z-score ± standard deviation	Mean ± standard deviation	Z-score ± standard deviation
Dietary behavior	13.91 ± 2.55	11.93 ± 2.30	-0.77 ± 0.91	14.86 ± 2.00	0.37 ± 0.78	15.29 ± 1.83	0.54 ± 0.72
Substance use	14.63 ± 1.88	13.97 ± 2.52	-0.35 ± 1.35	14.93 ± 1.33	0.15 ± 0.71	15.13 ± 1.15	0.26 ± 0.61
Physical activity	2.86 ± 1.10	2.20 ± 1.06	-0.58 ± 0.96	3.19 ± 1.00	0.31 ± 0.90	3.27 ± 0.84	0.39 ± 0.76
Stress management	15.16 ± 3.54	12.38 ± 2.87	-0.77 ± 0.80	16.63 ± 3.03	0.42 ± 0.85	16.80 ± 2.60	0.47 ± 0.73
Sleep	10.97 ± 2.41	9.31 ± 2.09	-0.68 ± 0.86	12.00 ± 2.07	0.42 ± 0.86	11.68 ± 2.04	0.29 ± 0.84
Social support	18.28 ± 3.66	15.14 ± 3.11	-0.85 ± 0.84	20.51 ± 2.57	0.60 ± 0.70	18.28 ± 2.59	0.19 ± 0.70
Screen time	1.43 ± 0.68	1.25 ± 0.50	-0.25 ± 0.73	1.07 ± 0.25	-0.51 ± 0.37	2.42 ± 0.59	1.42 ± 0.86

Table 3 – Association between lifestyle behavior cluster profiles and social factors according to Jeopardy Index classification variables. Unilife-M Cohort – Pilot Phase (n = 851), 2022.

	Cluster Screeners		Cluster At-risk	
Variables	OR (IC 95%)	$OR^{adjusted}$(IC 95%)	OR (IC 95%)	$OR^{adjusted}$(IC 95%)
Sex				
Male	REF	REF	REF	REF
Female	1.01 (0.70. 1.44)	0.88 (0.60. 1.28)	1.72 (1.18. 2.50)	1.29 (0.87. 1.92)
Race/ethnicity				
White	REF	REF	REF	REF
Non-white	0.66 (0.46. 0.95)	0.71 (0.48. 1.06)	0.94 (0.65. 1.38)	0.94 (0.62. 1.43)
Income				
AboveR$8.641,00	REF	REF	REF	REF
Between R$2.005,00 and R$8.640,00	0.92 (0.56. 1.50)	1.0 (0.50. 2.0)	1.01 (0.59. 1.73)	0.74 (0.35. 1.57)
Below R$2.004,00	0.69 (0.43. 1.11)	0.71 (0.26. 1.92)	1.35 (0.82. 2.22)	0.72 (0.25. 2.04)
Gender identity				
Cisgender	REF	REF	REF	REF
Non-cisgender	1.17 (0.29. 4.57)	1.17 (0.28. 4.90)	2.26 (0.62. 8.24)	1.44 (0.36. 5.80)
Sexual orientation				
Heterosexual	REF	REF	REF	REF
Non-heterosexual	1.27 (0.79. 2.05)	1.26 (0.77. 2.07)	3.45 (2.18. 5.46)	3.16 (1.95. 5.12)

Note: Values from the multinomial logistic regression of the association between lifestyle behavior clusters and the classification components of the Jeopardy Index; the Non-screeners cluster was used as the reference group in all models; OR adjusted for sex, age, marital status, income, sexual orientation, education, and mental disorder diagnosis; CI = 95% confidence interval; bold values indicate $p < 0.05$.

the Screeners cluster was observed in strata with greater social privilege (0–3). Conversely, the prevalence of participants in the At-risk cluster was higher at the most vulnerable levels of the Jeopardy Index (4 and 5).

Discussion

This study aimed to investigate different clustering patterns of lifestyle behaviors among Brazilian university students and their associations with sociodemographic and health-related factors. Three cluster profiles were identified among the participants (At-risk, Screeners, and Non-screeners). Additionally, certain social factors (e.g., sexual orientation) may be associated with an increased likelihood of belonging to a cluster characterized by unhealthy and high-risk behaviors.

Lifestyle cluster profiles

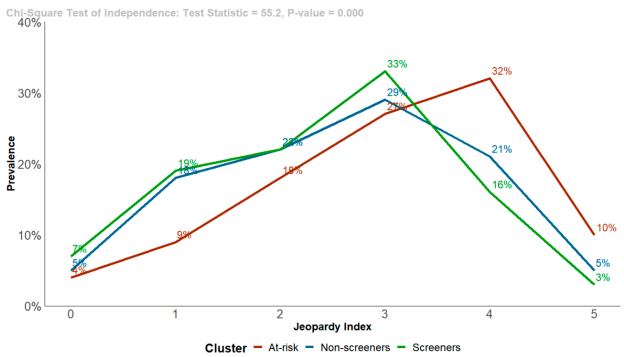
The main lifestyle behavior responsible for differentiating the profiles was screen time. Meta-analytic evidence has indicated that university students are at a higher risk of adopting sedentary behaviors than the general population because of their academic demands[32]. For example, university students spend an average of 7.29 hours per day in sedentary sitting behavior (95% CI = 6.73–7.85), while the general population (aged 18 to 25) spends an average of 5.86 hours per day (95% CI =

Table 4 – Association between lifestyle behavior cluster profiles and Jeopardy Index classification levels. Unilife-M Cohort – Pilot Phase (n=851), 2022.

Jeopardy Index	n (%)	Cluster Screeners	Cluster At-risk
		OR (IC 95%)	OR (IC 95%)
0	48 (5.7)	REF	REF
1	129 (15.2)	0.68 (0.29. 1.62)	0.63 (0.23. 1.73)
2	177 (20.9)	0.66 (0.28. 1.54)	0.98 (0.38. 2.56)
3	254 (29.9)	0.76 (0.33. 1.72)	1.13 (0.44. 2.87)
4	192 (22.6)	0.50 (0.21. 1.20)	1.89 (0.73. 4.86)
5	49 (5.78)	0.37 (0.11. 1.19)	2.66 (0.85. 8.31)

Note: Values from multinomial logistic regression for the association between lifestyle behavior clusters and Jeopardy Index classification levels; the non-screeners cluster was used as the reference in all models; ORs adjusted for sex, age, marital status, income, sexual orientation, education, and mental disorder diagnosis; CI = 95% confidence interval; bold values indicate p < 0.05.

Figure 1 – Prevalence distribution of university students in each lifestyle behavior cluster according to the Jeopardy Index. Brazilian sample. Unilife-M Cohort – Pilot phase (n = 851), 2022.



5.76–5.96)[32]. Additionally, a higher prevalence of computer use among university students was observed compared to other types of screen use (including TV, cell phone, video games, or a combination of these)[32]. These findings highlight the need for targeted interventions to reduce sedentary behavior in university students.

The results showed that the At-risk cluster exhibited the poorest lifestyle indicators, especially in the domains of social support, eating behavior, and stress management. Conversely, the Screeners cluster presented values close to the mean for most lifestyle behaviors, except for sedentary behavior. These results suggest that behavioral risk factors do not occur in isolation, indicating a probable tendency for clustering among different lifestyle behaviors[33]. Moreover, the prevalence of certain social and health factors (sex, age, sexual orientation, marital status, income, mental disorder diagnosis, and educational level) may vary according to the clustering patterns. This variation reflects the complexity associated with lifestyle behaviors, underscoring the need to consider such patterns when assessing specific risk groups.

It is important to highlight that the Non-screeners cluster presented the lowest screen time level, as well as better values for other lifestyle behaviors (physical activity, eating behavior, substance use, stress management, sleep, and social support). The Non-screeners cluster also exhibited a healthier eating behavior pattern, characterized by lower consumption of ultra-processed foods and higher regular physical activity. These results are consistent with those reported by Bennasar-Veny et al.[34], who identified that the university student group with the best lifestyle profile showed higher physical activity levels, lower stress levels, and healthier dietary patterns. These findings suggest that physically active individuals tend to have better health perceptions and greater adherence to healthy behaviors[35].

Lifestyle clusters and social health risk factors

The results showed that self-identified non-heterosexual individuals had higher odds of belonging to a group with an unhealthy lifestyle. Moreover, non-heterosexual individuals face a significantly higher risk of adverse mental health outcomes, including anxiety and depression, compared to their heterosexual cisgender peers[36]. Although no significant associations were observed between lifestyle and the variables sex, race/ethnicity, income, and gender identity in our sample, these sociodemographic factors may influence lifestyle behaviors and negatively impact mental health[37], considering that these aspects are shaped by structural systems of oppression (e.g., racism, sexism, homophobia, and transphobia) that condition access to resources, opportunities, and health-promoting environments. Additionally, it is important to highlight that social inequalities may reduce opportunities for engagement in healthy behaviors and consequently affect health outcomes. By employing intersectionality as an analytical category, it was shown that the modification of lifestyle behaviors may not be exclusively dependent on the individual[38]. It is likely that lifestyle behaviors are influenced by social markers rather than being solely determined by personal choices.

Furthermore, the association between social inequalities and health risk behaviors (e.g., smoking) has important public health implications[39]. These behaviors contribute to premature mortality and may exacerbate

health disparities if not adequately addressed[39]. Therefore, considering that discrimination is a predictor of greater engagement in risk behaviors and lower participation in health promotion activities[40], a behavioral association likely exists between experiences of discrimination, inequalities, health-related aspects[40] and lifestyle. Thus, it is necessary to implement effective actions to combat social inequalities, enabling individuals to develop healthier lifestyle behaviors regardless of their social characteristics[38].

Although there was a tendency for increased odds of belonging to the At-risk cluster as vulnerability levels rose, no significant association was found between the classification levels of the Jeopardy Index and lifestyle clusters. These findings highlight the complexity of the interactions between risk factors and behavioral patterns, emphasizing the need to monitor the health of university students closely. Identifying the clustering patterns of risk behaviors can facilitate the development of targeted health promotion strategies for different vulnerable population groups[23].

In summary, the results demonstrate that certain student groups may be more exposed to adopting unhealthy lifestyles than their peers. Therefore, identifying lifestyle behavior clusters and their sociodemographic and health characteristics can serve as a basis for developing institutional policies targeted at groups most exposed to vulnerability. Health promotion actions should be implemented to synergistically modify lifestyles, considering that these behaviors occur interdependently and intersectionally.

Regarding the study limitations, this research adopted a cross-sectional design with a non-probabilistic convenience sample, and the results should be interpreted cautiously. This strategy may have introduced selection bias, potentially overrepresenting students with greater digital access or higher academic engagement, and consequently underrepresenting groups in situations of greater social vulnerability. Although a consolidated index in the literature was used, the absence of detailed multiple stratifications limits the understanding of specific combinations of accumulated oppression in some groups, representing a limitation that indicates the need for future investigations with more in-depth approaches to sociodemographic factors associated with mental health. Moreover, the small number of participants in some subgroups may have limited the statistical power of the stratified analyses, hindering the detection of potential associations between social markers and the evaluated outcomes. Employing an approach encompassing other factors (e.g., economic, political, environmental, and cultural factors) may help understand how social determinants influence lifestyle behaviors, which was not considered in our association analysis. The results of this study may help in understanding lifestyle behavior patterns and their synergies in the university population, enabling the improvement of student support services and assisting in the formulation of assertive public policies aimed at groups with greater social vulnerabilities.

In conclusion, the results provide evidence for the existence of distinct lifestyle behavior profiles among Brazilian university students, which are structured interdependently and reveal risk patterns, particularly those marked by social inequalities. Additionally, an association was observed between sexual orientation and membership in a less-healthy cluster. By analyzing behaviors and social markers from an intersectional perspective, this study contributes to a more complex and situated understanding of lifestyle behaviors, expanding the possibilities for formulating public policies that are more sensitive to the specific vulnerabilities of the university population.

Conflict of Interest

The authors declare no conflict of interest.

Author's Contributions

Sandri A: Conceptualization; Methodology; Software development; Validation; Formal analysis; Investigation; Project administration; Data visualization; Writing – original draft; Writing – review & editing; Approval of the final manuscript. Gaia JWP: Conceptualization; Methodology; Software development; Validation; Formal analysis; Investigation; Resources; Data curation; Supervision; Project administration; Data visualization; Writing – original draft; Writing – review & editing; Approval of the final manuscript. Venera ME: Conceptualization; Methodology; Software development; Validation; Formal analysis; Investigation; Project administration; Writing – original draft; Approval of the final manuscript. Jesus EED: Investigation; Writing – review & editing; Approval of the final manuscript. Waclawovsky AJ: Conceptualization; Investigation; Resources; Data curation; Supervision; Project administration; Writing – review & editing; Approval of the final manuscript. Silva DRP, Moura HF, Jesus-Moraleida FR, Silva LEW, Galvão-Coelho NL, Monteiro-Junior RS, De Boni RB, Deslandes AC, Schuch FB: Investigation; Supervision; Project administration; Writing – review & editing; Approval of the final manuscript. Matias TS: Investigation; Supervision; Proj-

ect administration; Writing – original draft; Writing – review & editing; Approval of the final manuscript.

Declaration Regarding the Use of Artificial Intelligence Tools in the Writing Process

The authors did not use artificial intelligence tools to prepare the manuscript.

Availability of Research Data and Other Materials

The data and materials will be available at the time of article publication, upon request from the authors.

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Supplementary Material

Table S1 – Study variables, variable type, and methods of assessment.

Variables	Role	Measurement type	Questions / Survey Items
Age	Independent	Discrete quantitative	What is your age?
Sex	Independent	Nominal qualitative	What is your biological sex? 1. Female 2. Male
Gender identity	Independent	Nominal qualitative	What is your gender identity? 1. Cisgender – identifies with the sex assigned at birth 2. Transgender – does not identify with the sex assigned at birth 3. Non-binary – identifies as both or neither sex
Sexual orientation	Independent	Nominal qualitative	Regarding your sexual orientation, which option best describes you? 1. Heterosexual 2. Homosexual 3. Bisexual 4. Pansexual 5. Other
Race/ethnicity	Independent	Nominal qualitative	What is your ethnic group? 1. White 2. Other (Indigenous, Black, Pardo, or Asian)
Body mass index	Independent	Ordinal qualitative	What is your approximate weight in kilograms (kg)? And What is your approximate height in meters (m)? 1. Underweight: < 18.5 kg/m^2 2. Normal weight (eutrophic): ≥ 18.5 and < 25 kg/m^2 3. Overweight or Obesity: ≥ 25 kg/m^2
Marital status	Independent	Nominal qualitative	What is your marital status? 1. Married 2. Single 3. Widowed 4. Divorced 5. Stable union
Number of people in the household	Independent	Ordinal qualitative	How many people live in your household, including yourself? 1. One 2. Two 3. Three 4. Four 5. Five or more
Living in a student residence	Independent	Nominal qualitative	Do you live in a student residence or another space provided by your university? 1. Yes 2. No
Currently employed	Independent	Nominal qualitative	Are you currently employed? 1. Yes 2. No
Average monthly family income	Independent	Continuous qualitative	What is your approximate average monthly family income (in BRL)? 1. Below R$ 1,254.00 2. Between R$ 1,255.00 and R$ 2,004.00 3. Between R$ 2,005.00 and R$ 8,640.00 4. Between R$ 8,641.00 and R$ 11,261.00 5. Above R$ 11,262.00
Diagnosis of mental disorder	Independent	Nominal qualitative	Have you ever been diagnosed with a mental disorder (e.g., anxiety, depressive disorder, bipolar disorder, obsessive-compulsive disorder, schizophrenia, or eating disorders) by a psychiatrist? 1. Yes 2. No

Variables	Role	Measurement type	Questions / Survey Items
Diagnosis of non-communicable diseases and condition	Independent	Nominal qualitative	Have you ever been diagnosed by a healthcare professional with any of the following conditions: obesity, type 1 diabetes, type 2 diabetes, asthma, chronic bronchitis, chronic allergy, heart disease, osteoarthritis, chronic low back pain, chronic neck pain, migraine, cancer, osteoporosis, or muscle injury? 0. No 1. Yes
Educational level	Independent	Ordinal qualitative	What is your current level of education? 1. Undergraduate 2. Specialization 3. Master's 4. Doctorate
Physical activity	Dependent	Nominal qualitative	Did you exercise at least 30 minutes/day (or 150 minutes/week)? 1. Never 2. Occasionally 3. Frequently 4. Always
Dietary behavior	Dependent	Nominal qualitative	Have you consumed ready-to-eat foods (frozen, such as pizza, French fries, breaded foods in general, or canned foods)? 1. Always 2. Frequently 3. Occasionally 4. Neve
			Have you consumed healthy foods, such as fresh fruits and vegetables, legumes, whole grains, peanuts, nuts, etc.? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you maintain a regular meal schedule? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you eat fast-food, sweets, or high-calorie fatty foods when stressed or sad? 1. Always 2. Frequently 3. Occasionally 4. Never
			Do you share your main meals with friends or family? 1. Never 2. Occasionally 3. Frequently 4. Always
Sedentary behavior	Dependent	Nominal qualitative	Did you use a computer or smartphone immediately before going to sleep? 1. Always 2. Frequently 3. Occasionally 4. Never
Substance use	Dependent	Nominal qualitative	Have you used tobacco products (cigarettes, e-cigarettes, cigars, pipes, chewing tobacco)? 1. Always 2. Frequently 3. Occasionally 4. Never

Variables	Role	Measurement type	Questions / Survey Items
Substance use	Dependent	Nominal qualitative	Have you consumed 5 or more alcoholic drinks (men) or 4 or more drinks (women) on a single occasion, approximately within 2 hours? *1 drink = 1 can of beer (340 mL), OR 1 glass of wine (140 mL), OR 1 shot of distilled spirit (40 mL) such as cachaça, vodka, whisky, tequila, or gin 1. Always 2. Frequently 3. Occasionally 4. Never
			Have you used marijuana, skunk, or hashish? 1. Always 2. Frequently 3. Occasionally 4. Never
			Have you used other illicit drugs (cocaine, crack, amphetamines, ecstasy, opioids) without medical prescription? 1. Always 2. Frequently 3. Occasionally 4. Never
Sleep	Dependent	Nominal qualitative Qualitativa nominal	Did you sleep between 7 and 9 hours per day? 1. Never 2. Occasionally 3. Frequently 4. Always
			Did you feel rested with the number of hours slept? 1. Never 2. Occasionally 3. Frequently 4. Always
		Qualitativa nominal	Did you maintain regular sleep schedules? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you use sleep medications? 1. Always 2. Frequently 3. Occasionally 4. Never
Stress management	Dependent	Nominal qualitative	Do you set aside time to relax? 1. Never 2. Occasionally 3. Frequently 4. Always
			Have you used cognitive strategies or psychological support to cope with stress (e.g., meditation, mindfulness, psychotherapy)? 1. Never 2. Occasionally 3. Frequently 4. Always
			Have you practiced a belief, religion, or spirituality? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you feel that your life has meaning? 1. Never 2. Occasionally 3. Frequently 4. Always

Variables	Role	Measurement type	Questions / Survey Items
Stress management	Dependent	Nominal qualitative	Do you feel grateful for your life? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you feel grateful for your life? 1. Never 2. Occasionally 3. Frequently 4. Always
			Did you interact with friends and/or family? 1. Never 2. Occasionally 3. Frequently 4. Always
			Did you feel a sense of belonging or inclusion (e.g., being part of a group of friends, community, or society)? 1. Never 2. Occasionally 3. Frequently 4. Always
Social support	Dependent	Nominal qualitative	Did you have someone you could trust to listen to your problems/concerns? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you have someone to help with daily tasks (e.g., cooking, housework, shopping)? 1. Never 2. Occasionally 3. Frequently 4. Always
			Do you enjoy your leisure time? 1. Never 2. Occasionally 3. Frequently 4. Always
			Were you available to important people in your life? 1. Never 2. Occasionally 3. Frequently 4. Always

Table S2 – Sociodemographic and health history characteristics of Brazilian university students. Unilife-M Cohort – Pilot phase (n = 851), 2022.

Variables	n	%
Sex		
Female	526	56.5
Male	405	43.5
Gender Identity		
Cisgender	908	98.2
Transgender	3	0.3
Non-binary	14	1.5
Sexual orientation		
Heterosexual	694	75.0
Homosexual	72	7.8
Bisexual	135	14.6
Pansexual	15	1.6
Other	9	1.0
Race/ethnicity		
Yellow	5	0.5
Black	136	14.7
Pardo	366	38.9
Indigenous	13	1.4
White	401	43.4
Other	4	0.4
Body mass index		
Underweight	60	6.6
Normal weight	555	61.4
Overweight	289	32.0
Estado civil		
Married	40	4.3
Single	840	90.7
Widowed	0	-
Divorced	8	0.9
Stable union	38	4.1
Number of people in the household		
One	117	12.7
Two	193	20.9
Three	252	27.3
Four	228	24.7
Five or more	134	14.5
Lives in student housing		
Yes	47	5.1
No	879	94.9
Currently employed		
Yes	292	31.6
No	632	68.4
Average monthly household income		
Below R$ 1.254.00	187	20.4
Between R$ 1.255.00 and R$ 2.004.00	251	27.4
Between R$ 2.005.00 and R$ 8.640.00	298	32.6
Between R$ 8.641 and R$ 11.261.00	88	9.6
Above R$ 11.262.00	91	9.9
Mental disorder diagnosis		
Yes	137	14.8
No	790	85.2
Diagnosis of non-communicable diseases and conditions		
Yes	303	32.3
No	636	67.7
Education level		
Undergraduate	847	92.2
Specialization	5	0.5
Master's degree	40	4.4
Doctorate/PhD	27	2.9

Table S3 – Number of missing data points for each lifestyle behavior among Brazilian university students. Unilife-M Cohort – Pilot phase (n = 851), 2022.

Lifestyle behavior (Multidimensional Lifestyle Questionnaire)	Total n	Missing data n (%)
Dietary behavior	888	37 (4.2%)
Substance use	883	32 (3.6%)
Physical activity	891	40 (4.5%)
Stress management	882	31 (3.5%)
Sleep	888	37 (4.2%)
Social support	885	34 (3.8%)
Screen time	891	40 (4.5%)
Valid participants	851	-

Reviewers' assessment

The reviews of this article were originally conducted in Portuguese. This version has been translated using ChatGPT and subsequently reviewed by the Chief Editors.

Reviewer A

Anonymous

Format

- Does the article comply with the manuscript preparation rules for submission to the Revista Brasileira de Atividade Física e Saúde?
  Yes
- Regarding formal aspects, is the manuscript well structured, containing the sections: introduction, methods, results, and discussion (conclusion as part of the discussion)?
  Yes
- Is the language appropriate, and is the text clear, precise, and objective?
  Partly
- Was any evidence of plagiarism observed in the manuscript?
  No
  Suggestions/comments:
- See below

Abstract

- Are the abstract (in Portuguese) and the English abstract appropriate (containing: objective, information about study participants, studied variables, main results, and a conclusion) and do they reflect the content of the manuscript?
  Partly
  Suggestions/comments:
- See below

Introduction

- Was the research problem clearly stated and delimited?
  Yes
- Is the research problem adequately contextualized in relation to the available knowledge, moving from general to specific?
  Yes
- Are the reasons justifying the need for the study (including the authors' assumptions about the problem) well established in the writing?
  Yes
- Are the references used to support the presentation of the research problem current and relevant to the topic?
  Yes
- Was the objective clearly presented?
  Yes
  Suggestions/comments:
- There is a well-developed justification regarding inequalities and intersectionality. However, there is no satisfactory explanation for addressing risk factors in combination (clusters).

Methods

- Are the methodological procedures generally appropriate to study the research problem?
  Yes
- Are the methodological procedures adopted for conducting the study sufficiently detailed?
  Yes
- Was the procedure adopted for selecting or recruiting participants adequate for the studied problem and described in a sufficient, clear, and objective manner?
  Partly
- Were details provided about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, when relevant, the operational definition of the variables?
  Partly
- Is the data analysis plan adequate and adequately described?
  Partly
- Were the inclusion and/or exclusion criteria for the study participants described and adequate for the study?
  Yes
- Did the authors provide clarification on the ethical procedures adopted for conducting the research?
  Yes
  Suggestions/comments:

1. I suggest highlighting more the methods for publicizing the study and recruiting participants.
2. Review the entire text to always present the data in

terms of "race/color," maintaining consistency with the IBGE standard and the accumulated discussions that have led to this approach.
3. Although references have been provided, I think more details about the data collection instrument could be included (recall period, type of questions about PA, about SB/screen time, etc.).
4. Does including social support in this analysis make sense?
5. There is a lack of information on the operational definitions of each variable before mentioning the clusters. For example, what is the definition of "physical inactivity" or "negative sleep management"? This is important to better understand the combination. If the cluster composition does not take this operational definition into account, explain more clearly how it was formed from the variable distribution.
6. I suggest reconsidering the term "risk index" and instead thinking about privilege and/or accumulation of oppressions. I believe the naming of this type of index, which is not consistent in the literature, could be a way to position oneself on the topic, going beyond the risk logic that usually refers to an individual issue.
7. "The project was approved by the Research Ethics Committee (CEP) of XXXX, under opinion number XXXX."
   a. Ensure that the data were omitted to guarantee the blind review process and not because this information was missing.

Results

- Is the use of tables and figures appropriate and does it facilitate proper presentation of the study results?
  Partly
- Is the number of illustrations in the article in accordance with the journal's submission guidelines?
  Partly
- Is the number of participants at each stage of the study, as well as the number and reasons for losses and refusals, presented in the manuscript?
  Yes
- Are the participants' characteristics presented and sufficient?
  Yes
- Are the results presented appropriately, highlighting the main findings and avoiding unnecessary repetition?
  Yes

Suggestions/comments:

1. I suggest first describing the clusters and then showing which ones had a higher or lower proportion of women, economic level X, etc.
2. Standardize whether it is "risk index" or "jeopardy index" (see previous comment).
3. Figure 1 and the lack of association in the analyses with the index suggest that this approach may not be ideal—either due to the lack of sample size in subgroups (information not provided, which would be important) or the absence of distinction between groups with accumulations of oppressions (e.g., groups 4 and 5 may have different combinations). Therefore, I would suggest a complementary descriptive analysis with multiple stratifications, or this aspect should be addressed in the discussion.

Discussion

- Are the main findings of the study presented?
  Yes
- Are the study's limitations and strengths presented and discussed?
  Partly
- Are the results discussed in light of the study's limitations and the available knowledge on the subject?
  Yes
- Are the potential contributions of the main findings to scientific development, innovation, or real-world intervention discussed by the authors?
  Yes

Suggestions/comments:

1. Discuss why these social markers of difference are being analyzed, making clear that they are consequences of racism, sexism, homophobia, etc. I suggest revising the writing when it mentions that variables such as sex, race, and income are determinants of vulnerability (see example below).
   a. "Although no significant associations were observed between lifestyle and the variables sex, race, income, and gender identity in our sample, these determinants of social vulnerability may influence lifestyle behaviors and negatively impact mental health."
2. I believe it is necessary to further discuss the limitation of the sampling process. It is mentioned very superficially and without interpretation of the possible biases of an online survey on this topic (underestimation of risk behaviors, what type of impact

on associations (?), perhaps a lower percentage of people with greater vulnerability in the sample…).
3. Could the small sample size in subgroup analyses also be a limitation?
4. I suggest a final concluding paragraph.

Conclusion

- Was the study conclusion adequately presented and coherent with the study objective?
  Partly
- Is the study conclusion original?
  Partly
  Suggestions/comments:
- See below

References

- Are the references up to date and sufficient?
  Yes
- Is most of the list composed of original research articles?
  Yes
- Do the references comply with the journal's rules (quantity and format)?
  Yes
- Is in-text citation appropriate, meaning that statements in the text cite references that actually support such statements?
  Yes
  Suggestions/comments:
- See below

Comments to the author

- General comments:
- The article addresses an important topic by exploring the clustering of risk factors and examining their association with social and economic variables among university students.
- A broader suggestion is to avoid using in the title and objectives the expression "association in X" and "social determinants." I suggest using "sociodemographic variables," for example. Although the intention is to address social determinants, in the implementation of association analyses, what is being tested are the sociodemographic variables. I understand that social determinants are a model or approach we use in the health field.
- The title and abstract do not provide sufficient information about the study location or the recruitment process.
- In the abstract, some methods-related items are presented in the results section.
- In the abstract, mention also what was not found to be associated.
- In the abstract, the intersectional perspective is not mentioned and needs to be, as it plays an important role in the work.
- I suggest naming the clusters with terms in Portuguese.

Final recommendation (decision)

- Major revisions required

Reviewer B

Anonymous

Format

- Does the article comply with the manuscript preparation rules for submission to the Revista Brasileira de Atividade Física e Saúde?
  Yes
- Regarding formal aspects, is the manuscript well structured, containing the sections: introduction, methods, results, and discussion (conclusion as part of the discussion)?
  Partly
- Is the language appropriate, and is the text clear, precise, and objective?
  Partly
- Was any evidence of plagiarism observed in the manuscript?
  Partly
  Suggestions/comments:
- At certain points, it seems that the text was written by AI; the strongest indication is on line 350, as AI usually produces a summary of what it has written.
- Decide consistently throughout the text which narrative voice will be used to write the paper. Ideally, it should be impersonal; however, in some places (such as lines 189/276), it is written in the third person. Review and correct the entire manuscript.
- No conclusion (final considerations) was identified at the end of the discussion that refers back to the general objective of the study.

Abstract

- Are the abstract (in Portuguese) and the English abstract appropriate (containing: objective, information about study participants, studied variables,

main results, and a conclusion) and do they reflect the content of the manuscript?
Yes
Suggestions/comments:
- No comments

Introduction

- Was the research problem clearly stated and delimited?
  Partly
- Is the research problem adequately contextualized in relation to the available knowledge, moving from general to specific?
  Partly
- Are the reasons justifying the need for the study (including the authors' assumptions about the problem) well established in the writing?
  Partly
- Are the references used to support the presentation of the research problem current and relevant to the topic?
  Yes
- Was the objective clearly presented?
  Yes

Suggestions/comments:
- Improve the writing to make it more robust and academic, avoiding repeated words (highlighted in yellow in the attachment). The research gap, which demonstrates the study's originality, is not clearly presented.

Methods

- Are the methodological procedures generally appropriate to study the research problem?
  Yes
- Are the methodological procedures adopted for conducting the study sufficiently detailed?
  Yes
- Was the procedure adopted for selecting or recruiting participants adequate for the studied problem and described in a sufficient, clear, and objective manner?
  Yes
- Were details provided about the instruments used for data collection, their psychometric properties (e.g., reproducibility, internal consistency, and validity), and, when relevant, the operational definition of the variables?
  Yes
- Is the data analysis plan adequate and adequately described?
  Yes
- Were the inclusion and/or exclusion criteria for the study participants described and adequate for the study?
  Yes
- Did the authors provide clarification on the ethical procedures adopted for conducting the research?
  Yes

Suggestions/comments:
- No sample loss or inclusion/exclusion criteria were identified.

Results

- Is the use of tables and figures appropriate and does it facilitate proper presentation of the study results?
  Yes
- Is the number of illustrations in the article in accordance with the journal's submission guidelines?
  Yes
- Is the number of participants at each stage of the study, as well as the number and reasons for losses and refusals, presented in the manuscript?
  Partly
- Are the participants' characteristics presented and sufficient?
  Partly
- Are the results presented appropriately, highlighting the main findings and avoiding unnecessary repetition?
  Partly

Suggestions/comments:
- The results could be described in more detail.

Discussion

- Are the main findings of the study presented?
  Partly
- Are the study's limitations and strengths presented and discussed?
  Partly
- Are the results discussed in light of the study's limitations and the available knowledge on the subject?
  Partly
- Are the potential contributions of the main findings to scientific development, innovation, or real-world intervention discussed by the authors?
  Partly

Suggestions/comments:

- The study is important, but the discussion was developed in a "shallow" manner, not demonstrating a dialogue between the results, other studies, and possible explanations for this study's findings. The answer to the research objectives was not identified. The language is often not academic, with the same words repeated several times within the same sentence.

Conclusion

- Was the study conclusion adequately presented and coherent with the study objective?
  No
- Is the study conclusion original?
  Partly
  Suggestions/comments:
- No conclusion (final considerations) was identified at the end of the discussion that refers back to the general objective of the study.

References

- Are the references up to date and sufficient?
  Yes
- Is most of the list composed of original research articles?
  Yes
- Do the references comply with the journal's rules (quantity and format)?
  Yes
- Is in-text citation appropriate, meaning that statements in the text cite references that actually support such statements?
  Yes
  Suggestions/comments:
- No comments

Comments to the author

- Important study for the field, but it requires adjustments.

Final recommendation (decision)

- Major revisions required