Prevalence and correlates of excess body weight in university students

Prevalência e correlatos do excesso de peso corporal em estudantes universitários

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Abstract – This study aimed to identify the prevalence of excess body weight in university students from a representative state in Brazil's southern region and establish associations with the demographic, university environment, and health behavior correlates. A random sample of 5,310 university students answered an online questionnaire with demographic, university environment, and eight health behavior data. Excess body weight was identified using the body mass index (BMI ≥ 25 kg/m²). The data were processed using bivariate analysis and hierarchical multiple regression. The overall prevalence of excess body weight exposure was equivalent to 39.1% [35.7-42.6], with significantly different rates between gender, age, and marital status. Likewise, housing type and study year showed significant associations with excess body weight. Among health behavior indicators, with control of all other variables involved in the model, depressive symptoms (p = 0.031), high stress (p = 0.045), sleep duration < 6 hours/night (p < 0.001), moderate-vigorous physical activity < 150 min/week (p = 0.022) and fruit/vegetable consumption < 5 servings per day (p < 0.001) were independently associated with the outcome. However, tobacco use, binge drinking, and prescription drug misuse did not remain in the adjusted multivariate model. In conclusion, the findings emphasize the importance of proposing and implementing multifaceted preventive intervention actions to prevent health outcomes related to excess body weight, once since significant associations with modifiable factors have been identified.

Key words: Lifestyle; Public health; Health promotion; Student health; Student health services.

Resumo – *O objetivo do estudo foi identificar a prevalência do excesso de peso corporal em estudantes universitários de um estado representativo da região sul do Brasil e estabelecer associações com correlatos demográficos, do ambiente universitário e de condutas de saúde. Amostra aleatória de 5310 estudantes universitários respondeu questionário online com dados demográficos, do ambiente universitário e de oito condutas de saúde. O excesso de peso corporal foi identificado mediante o índice de massa corporal (IMC ≥ 25 Kg/m²). Os dados foram tratados através de análise bivariada e regressão múltipla hierarquizada. Prevalência global de exposição ao excesso de peso corporal foi equivalente a 39,1% [35,7–42,6], com taxas significativamente diferentes entre sexo, idade e situação conjugal. Da mesma forma, tipo de habitação e ano de estudo apresentaram associações significativas com o excesso de peso corporal. Entre os indicadores de conduta de saúde, com controle de todas as demais variáveis envolvidas no modelo, sintomas de depressão (p = 0,031), estresse elevado (p = 0,045), duração de sono < 6 horas/noite (p < 0,001), atividade física moderada–vigorosa < 150 min/semana (p = 0,022) e consumo de frutas/hortaliças < 5 porções/dias (p < 0,001) mostraram-se independentemente associados ao desfecho. Contudo, tabagismo, consumo nocivo de álcool e uso indevido de medicamentos controlados não permaneceram no modelo multivariado ajustado. Concluindo, os achados enfatizam a importância de propor e implementar ações de intervenção preventivas multifacetadas a fim de prevenir agravos relacionados ao excesso de peso corporal, uma vez identificada associações significativas com fatores modificáveis.*

Palavras-chave: *Estilo de vida; Saúde pública; Promoção da saúde; Saúde do estudante; Serviços de saúde para universitários.*

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INTRODUCTION

The larger accumulation of body weight in the university population is one of the main challenges for public health worldwide. National surveys conducted in countries with emerging economies identified that approximately 22% of university students were overweight or obese[1], while the prevalence rates equivalent to excess body weight have reached rates between 30% and 45%[2-4] in developed countries. Specifically, in Brazil, data suggest that one in three university students is overweight[5-7].

The excess body weight is recognized as a risk factor imposing immediate adverse health effects, such as high blood pressure, modified plasma lipids, altered blood glucose, insulin resistance, compromised inflammatory markers, and atherosclerosis[8]. Furthermore, its long-term persistence increases the risk of diagnosing comorbidities, including cardiovascular and respiratory diseases, diabetes, some types of cancer, musculoskeletal, neurodegenerative, and mental disorders[9], which causes a significant increase in the need to use medical services accompanied by a high social and economic burden to society[10].

Data available in the literature indicate that overweight is among the first five attributable burdens of premature death and is responsible for 10% of deaths occurring annually worldwide[11]. In this context, while the outcomes associated with excess body weight are typically identified after the second half of life, they are progressive and can settle in childhood or adolescence, escalating their early adulthood deterioration[12].

Therefore, university students must have a particular special consideration, since the university environment can contribute decisively to a greater susceptibility of young adults to increased body weight. The transition from high school to university education is a critical period in which the achievement of autonomy for entering adult life, the feeling of freedom in decision-making, the relative distance from family surveillance, new friendships, relationships, and experiences contribute to higher exposure to obesogenic behaviors[13]. However, despite the World Health Organization recognizing universities as places where prevention and control efforts should be promoted[14], the identification of excess body weight and the proposed intervention actions at the university level have been underestimated.

Thereby, this study aimed to identify the prevalence of excess body weight in university students from a representative state in Brazil's southern region and establish associations with the demographic, university environment and selected health behaviors' correlates. Findings should contribute to the design and implementation of more effective interventionist actions aimed at groups with greater exposure to excess body weight and institutional policies to promote healthy lifestyles.

METHODS

This is a selection from the Health Promoting University Project, a cross-sectional population-based study, idealized and implemented by the Federal Technological University of Paraná (UTFPR). To illustrate the size of the addressed population universe, the UTFPR serves approximately 30 thousand university students in 105 courses spread over 13 campuses located in cities in

different geographical regions of the state of Paraná, Brazil. The University's Ethics Committee approved the study under Opinion N° 2.533.783/2018.

Sample

The sample size was established assuming an unknown prevalence of success (p = 50%), a 95% confidence level, and a sampling error of three percentage points. However, considering that the sampling planning involved a cluster, an effect of design equivalent to three was defined, and 20% was added to cater for data collection losses, resulting in 5,500 university students in the initial sample. However, the final sample was composed of 5,310 university students. The sample was achieved by random draw with a three-stage cluster, namely, campuses, course, and study year, with probability proportional to the size

Data collection

Data were collected from September to November 2018 through the online questionnaire of the Brazilian version of the National College Health Assessment II (NCHA IIc), using an electronic platform via the web, accessed through desktops, notebooks, tablets, or smartphones, at any time and place of convenience and preference of university students. Currently, NCHA IIc is widely used in international studies[15] whose printed format was translated and cross-culturally adapted, and its online format validated for use by Brazilian university students[16].

In addition to demographic data (gender, age, skin color, marital status, and paid work) and the university environment (housing type, size of campuses, year and shift of study), items stratified into eight health practices were selected: depressive symptoms, stress, sleep, physical activity, fruit/vegetable consumption, tobacco use, misuse of controlled medications and alcohol abuse. The NCHA IIc questions included in the study and the answer options are shown in Table 1.

Table 1. Questions and answer options for health behaviors used in the study.

Questions	Answer options
Depressive Symptoms	
Have you ever felt so depressed that it was difficult to function?	"No, never", "No, not in last 12 months", Yes, in the last 2 weeks", Yes, in the last 30 days", "Yes, in the last 12 months".
Stress	
In the last 12 months, how would you rate the overall level of stress you have experienced?	"No stress", "Less than average stress", "Average stress", "More than average stress", "Tremendous stress".
Sleep	
On how many of the past seven nights did you get enough sleep so that you felt rested when you woke up in the morning?	"None", "1 night", "2 nights", "3 nights", "4 nights", "5 nights", "6 nights" and "7 nights".
Physical activity	
On how many of the past 7 days did you do moderate-vigorous-intensity cardio or aerobic exercise (caused a noticeable or large increase in breathing or heart rate, such as a brisk walk or jogging) for at least 30 minutes?	"None", "1 day", "2 days", "3 days", "4 days", "5 days", "6 days" and "daily".
Fruit/vegetable consumption	

Table 1. Continued...

Questions	Answer options
How many servings of fruits and vegetables do you usually have per day? (1 serving = medium piece of fruit; ½ cup fresh, frozen, or canned fruits/vegetables; ¾ cup fruit/vegetable juice; 1 cup salad greens; or ¼ cup dried fruit).	"None", "1-2 servings per day", "3-4 servings per day, "≥ 5 servings per day".
Tobacco use	
In the last 30 days, on how many days did you use tobacco and tobacco products (for example, cigarettes, e-cigarettes, hookah, cigarillo, little cigars, clove cigarettes, or smokeless tobacco)?	"None", "1-2 days", "3-5 days", "6-9 days", "10-19 days", "20-29 days" and "Used daily".
Binge drinking	
Over the last two weeks, how many times have you had five or more drinks of alcohol at a sitting?	"None", "1 time", "2 times", "3 times", "4 times", "5 times", and "6 or more times".
Prescription drug misuse	
In the last 12 months, have you taken any of the following prescription drugs that were not prescribed to you (antidepressants, erectile dysfunction drugs, pain killers, sedatives, or stimulants)?	"No" and "Yes".

Concerning nutritional status, body mass index (BMI) was calculated using the ratio between body mass measurements expressed in kilograms and height expressed in meters squared (kg/m^2), self-reported by university students. With BMI values, excess body weight was identified from the cut-off point suggested by the World Health Organization (BMI ≥ 25 kg/m^2)[17].

The classroom chosen for the study was visited, and the research objectives and the principles of secrecy, non-identification in the study, and non-influence on academic performance were explained to university students in order to complete the questionnaires. Subsequently, university students were invited to participate in the study and those who initially agreed to receive guidance and an individual password to access the electronic platform, thus confirming their anonymity. Participants were instructed to access the platform and self-complete the questionnaire within seven days after the personal password was released. All participants' rights were safeguarded by an Informed Consent Term signed electronically before the beginning of NCHA IIc online self-completion.

The criteria adopted for the exclusion of any university student belonging to the classroom selected for the study were: (a) absence from classes on the day scheduled to effect the invitation to participate in the study and distribution of an individual password to access the electronic platform; (b) refusal to participate in the study; (c) being subjected to any specific medical treatment or diet; (d) pregnancy; (e) failure to complete the questionnaire on the electronic platform within seven days; and (f) age below 18 years or above 35 years.

Statistical analysis

The data were processed with the computerized Statistical Package for the Social Sciences (SPSS®, version 24). The prevalence estimates equivalent to excess body weight and demographic data, the university environment, and health behaviors were shown in specific proportions (%), accompanied by the respective 95% confidence intervals (95% CI). To analyze the linearity of the associations between excess body weight and potential correlates the prevalence

ratio calculations were used. Statistical differences between the strata under investigation were processed by the chi-square test (χ^2). Subsequently, correlates with at least marginally significant associations ($p \leq 0.20$) in the bivariate analysis were included in the hierarchical multiple regression procedures. In this case, the correlates were included in blocks, and demographic data (block 1) were the first to enter the model, followed by those related to the university environment (block 2) and, finally, data equivalent to health behavior (block 3), which were of primary interest in the study. Variables with statistical significance in block 1 setting were maintained in the block model 2, and the variables with statistical significance in blocks 1 and 2 were maintained in the model adjustment of the last block. The threshold of statistical significance was equivalent to $p < 0.05$.

RESULTS

Of the 5,500 participants initially selected for the study, 95 refused to participate or were absence from classes on the day scheduled to carry out the invitation to participate in the study, 27 were undergoing specific medical treatment or diet, and 68 did not properly complete the questionnaire on the platform electronics. Descriptive information about the sample selected in the study is available in Table 2.

Approximately one-third of the sample consisted of women (38.2%), 39.1% were aged between 21 and 25 years, 61.5% self-reported white, and 78.2% were single. Besides the studies, 23.1% of the university students analyzed reported part-time paid work and 39.6% full-time paid work. Regarding data from the academic environment, 24.2% lived in student residence, and 52.8% with their families, 21% of university students were from smaller campuses (< 1500 students) and 37.7% from larger campuses size ($\geq$ 3,000 students), 63.3% attended daytime classes, while the study years were distributed similarly, that is, 32.1% in the first study year and 31.5% in the last years.

Concerning health behavior, one-fourth of university students (25.1%) reported depressive symptoms, and 38.6% reported above average or high stress. Most (56.4%) showed insufficient sleep, while 75.9% and 87% of university students reported physical inactivity and inadequate fruit/vegetable consumption. Concerning substance use, 15.1% admitted having used tobacco in the last 30 days and 13.5% controlled drugs without a prescription in the last year. One in each group of three university students (35.4%) had alcohol abuse in the last two weeks (Table 2).

Table 2. Descriptive information of the selected study sample (n = 5,310).

Indicators	n (%)	Indicators	n (%)
Demographic data		**University environment data**	
Gender		**Housing type**	
Female	2,029 (38.2%)	Students' residence	1,285 (24.2%)
Male	3,281 (61.8%)	Parents' home	2,804 (52.8%)
Age		Homestay	1,094 (20.6%)
≤ 20 years	1,543 (29.1%)	Alone	127 (2.4%)
21-25 years	2,078 (39.1%)	Campus size	
≥ 26 years	1,689 (31.8%)	< 1,500 students	1,113 (21,0%)
Skin color		1,500 – 3,000 students	2,195 (41.3%)
White	3,266 (61.5%)	> 3,000 students	2,002 (37.7%)
Black	2,044 (38.5%)	Year of study	

Table 2. Continued...

Indicators	n (%)	Indicators	n (%)
Marital status		1st	1,714 (32.1%)
Single	4,152 (78.2%)	2nd-3rd	1,933 (36.4%)
Married/Common law marriage	1,158 (21.8%)	4th or more	1,673 (31.5%)
Paid work		Study shift	
No work	1,980 (37.3%)	Day	3,362 (63.3%)
Part time	1,227 (23.1%)	Night	1,948 (36.7%)
Full time	2,103 (39.6%)		
Health behavior data			
Depression (last 12 months)		Fruit and vegetable consumption	
Never or not in the last 12 months	3,978 (74.9%)	≥ 5 servings per day	690 (13.0%)
Yes	1,332 (25.1%)	0–4 servings per day	4,620 (87.0%)
Stress (last 12 months)		Tobacco use	
None, less than average, or average	3,260 (61.4%)	Never used or not used in the last 30 days	4,508 (84.9%)
More than average or tremendous	2,050 (38.6%)	Used 1-2 times/day to used daily	802 (15.1%)
Enough sleep (past 7 nights)		Prescription drug misuse (last 12 months)	
≥ 4 nights	2,315 (43.6%)	No	4,593 (86.5%)
0–3 nights	2,995 (56.4%)	Yes	717 (13.5%)
Physical activity		Binge drinking (last 2 weeks)	
≥ 5 days/week	1,280 (24,1%)	No	3,430 (64.6%)
0–4 days/week	4,030 (75,9%)	Yes	1,880 (35.4%)

Overall, 39.1% [35.7 – 42.6] of university students were excess body weight. Estimates of the prevalence of excess body weight with stratification for each demographic, university environment, and health behavior correlate are described in Table 3. The bivariate analysis evidenced that prevalence varied substantially between strata. The list of potential demographic and university environment correlates, skin color, campus size, and study shift were not statistically identified. The eight health behaviors considered in the study were individually associated with the prevalence of excess body weight among university students (p < 0.20).

Table 3. Prevalence (95% CI) of excess body weight with stratification for demographic, university environment, and health behavior correlates of university students.

Indicators	% (95% CI)	Indicators	% (95% CI)
Demographic data		**University environment data**	
Gender	χ^2 = 23.726; p < 0.001	Housing type	χ^2 = 10.158; p < 0.001
Female	25.2 (22.4 – 28.1)	Students' residence	45.3 (41.4 – 49.3)
Male	47.6 (43.5 – 51.8)	Parents' home	34.9 (31.8 – 38.0)
Age	χ^2 = 10.827; p < 0.001	Homestay	42.2 (38.5 – 46.1)
≤ 20 years	34.7 (31.6 – 37.9)	Alone	42.9 (39.1 – 46.9)
21-25 years	37.5 (34.2 – 40.8)	Campus size	χ^2 = 2.083; p = 0.217
≥ 26 years	45.1 (41.2 – 49.1)	< 1,500 students	37.1 (33.9 – 40.4)
Skin color	χ^2 = 1.924; p = 0.235	1,500 – 3,000 students	38.9 (35.5 – 42.4)
White	38.2 (34.9 – 41.6)	> 3,000 students	40.5 (36.9 – 44.2)
Black	40.5 (36.9 – 44.2)	Year of study	χ^2 = 11.429; p < 0.001
Marital status	χ^2 = 11.682; p < 0.001	1st	34.2 (31.2 – 37.3)
Single	36.8 (33.6 – 40.1)	2nd-3rd	38.7 (35.3 – 42.2)

Table 3. Continued...

Indicators	% (95% CI)	Indicators	% (95% CI)
Married/Common law marriage	47.3 (43.3 – 51.5)	4th or more	44.4 (40.6 – 48.3)
Work for pay	$\chi^2 = 8.836$; p = 0.025	Study shift	$\chi^2 = 2.395$; p = 0.209
No work	35.0 (31.9 – 38.2)	Day	37.7 (34.4 – 41.1)
Part time	39.4 (36.0 – 42.9)	Night	41.6 (37.9 – 45.4)
Full time	42.8 (39.0 – 46.7)		
Health behavior data			
Depression	$\chi^2 = 9.262$; p = 0.024	Fruit and vegetable consumption	$\chi^2 = 11.047$; p < 0.001
Never or not in last 12 months	37.1 (33.9 – 40.4)	≥ 5 servings per day	30.5 (27.6 – 33.6)
Yes	45.2 (41.3 – 49.3)	0–4 servings per day	40.4 (36.9 – 44.1)
Stress	$\chi^2 = 6.873$; p = 0.049	Tobacco use	$\chi^2 = 5,174$; p = 0.071
None, less than average	36.5 (33.3 – 39.80)	Not used in last 30 days	38.4 (35.1 – 41.8)
More than average	43.2 (39.4 – 47.2)	Used 1-2 times/day to used daily	43.1 (39.3 – 47.0)
Enough sleep	$\chi^2 = 11.836$; p < 0.001	Prescription drug misuse	$\chi^2 = 5.672$; p = 0.064
≥ 4 nights	33.8 (30.8 – 36.9)	No	39.0 (35.6 – 42.5)
0–3 nights	44.1 (40.3 – 48.1)	Yes	43.8 (40.0 – 47.8)
Physical activity	$\chi^2 = 8.493$; p = 0.031	Binge drinking	$\chi^2 = 3.638$; p = 0.128
≥ 5 days/week	33.4 (30.4 – 36.6)	No	37.8 (34.5 – 41.2)
0–4 days/week	40.9 (37.3 – 44.7)	Yes	41.5 (37.8 – 45.4)

Results of the hierarchical multiple regression are available in Table 4. In the case of demographic correlates, after adjusting for the other variables included in the model, the final model showed significant associations between excess body weight and gender, age, and marital status. Data stratified by the university environment's correlates showed that university students who live far from their families and have studied for four or more years at the university showed a significantly higher probability of excess body weight. By controlling all other independent variables involved in the model, we identified that the only health behavior considered in the study not significantly associated with excess body weight were tobacco use, prescription drug misuse, and binge drinking.

Table 4. Summary of hierarchical multiple logistic regression for demographic (block 1), university environment (block 2) and health behavior (block 3) correlates associated with university students' excess body weight.

Correlates	OR $_{Adjusted}$ (CI$_{95\%}$) [a]	p-value
Block 1 - Demographic data		
Gender		
Female	Reference	
Male	2.19 (1.52 – 3.68)	< 0.001
Age		
≤ 20 years	Reference	
21-25 years	1.24 (0.86 – 2.12)	0.106
≥ 26 years	1.81 (1.28 – 2.93)	0.003
Marital status		
Single	Reference	
Married/Common law marriage	1.87 (1.33 – 3.07)	0.001
Block 2 - University environment data		
Housing type		
Students' residence	1.74 (1.22 – 2.91)	0.009

a Odds ratio adjusted for the other variables included in the model.

Table 4. Continued...

Correlates	OR $_{Adjusted}$ (CI$_{95\%}$) [a]	p-value
Parents' home	Reference	
Homestay	1.58 (1.08 – 2.69)	0.025
Alone	1.52 (1.03 – 2.84)	0.038
Year of study		
1st	Reference	
2nd-3rd	1.23 (0.86 – 2.11)	0.110
4th or more	1.64 (1.13 – 2.79)	0.019
Block 3 - Health behavior data		
Depression		
Never or not in last 12 months	Reference	
Yes	1.53 (1.06 – 2.71)	0.031
Stress		
None, less than average	Reference	
More than average	1.48 (1.02 – 2.64)	0.045
Enough sleep		
≥ 4 nights	Reference	
0–3 nights	1.94 (1.35 – 3.27)	< 0.001
Physical activity		
≥ 5 days/week	Reference	
0–4 days/week	1.59 (1.11 – 2.71)	0.022
Fruit and vegetable consumption		
≥ 5 servings per day	Reference	
0–4 servings per day	2.08 (1.46 – 3.57)	< 0.001

a Odds ratio adjusted for the other variables included in the model.

DISCUSSION

The study showed excess body weight trends in a regionally representative sample of Brazilian university students. Also, we examined associations between the outcome and demographic, university environment, and selected health behavior correlates. Although other Brazilian studies have already investigated the excess body weight of university students in particular[5-7], to the best of our knowledge, this is the first study examining the correlates through hierarchical multiple regression procedures, which allows minimizing the influence of confounding factors. Internationally, the study is also one of the few to consider variations in associations' nature in a specific context.

Based on values equivalent to BMI, the findings showed that 39.1% of university students were excess body weight. According to the most recent National Health Survey, 33.7% of the Brazilian population between 18 and 24 was reportedly overweight[18]. The prevalence rate identified in university students higher than observed in the general population of the same age is consistent with previous studies[2-4]. Compared to data collected in other countries, it appears that the prevalence identified in the current study was approximately four times higher than that found in university students in China (9.5%)[19]; however, it was similar to that reported in the U.S.[2], Australia[4] and some European countries[3]. A multicenter study showed an overall prevalence of 22%[1] in Latin American and African university students. Specifically, in Brazil, available data have shown prevalence rates close to 28%[5-7].

In this context, finding that more than one-third of the university students selected in the study were overweight is a significant concern with notable public health implications. As previous studies suggest[3], monitoring body

weight in the university environment is essential to containing the obesity epidemic in current society, considering that overweight in early adulthood is a significant predictor of progression to more severe degrees of overweight or obesity in more advanced life stages[12]. Evidence has shown that girls and boys with overweight in their late teens are 70% to 80% more likely to become obese in later adulthood[20].

Regarding the associations between excess body weight and demographic correlates, similar to what was found in previous studies[1-7], the prevalence rates of excess body weight were higher in men and older university students, especially in those aged ≥ 26 years. University students who reported being married also showed a greater propensity to excess body weight, which confirms the hypothesis that men and women tend to be more exposed to environmental factors and social support that favor more significant body weight accumulation after marriage[21]. Initially, paid work was a possible correlate of excess body weight (bivariate analysis); however, the association did not remain significant when processed in the multivariate model by adjusting for confounding variables. The lack of association with skin color is not an unexpected finding. Previous studies have also observed similar prevalence rates of excess body weight in white and black university students[2].

Data stratified by the university environment's correlates showed that housing type and study year were also important mediators for excess body weight. University students who reported living with their families showed less risk of exposure to overweight than their peers who lived far from the family. In this sense, a previous study on the impact of the perceived family style on obesogenic habits revealed that few university students maintained the same habits before entering university and started to live far from the family. Most of them reported that they started to adopt more compromising habits[22] to face the new routine and study environment. The highest prevalence rates with advancing study years are consistent with previous studies[2-3]. They may result from the progressive adaptation and integration of students to the university context that does not favor policies and actions to maintain healthy body weight.

Regardless of the simultaneous participation of demographic correlates and the university environment, several health behaviors considered in the study were associated with excess body weight. However, it is noteworthy that, while tobacco use, binge drinking, and prescription drug misuse were associated with excess body weight in the bivariate analysis, these health behaviors did not remain in the adjusted multivariate model. The finding that tobacco use and binge drinking did not affect excess body weight predisposition is consistent with previous findings[23,24]. However, as far as is known, an eventual attempt at an association between prescription drug misuse and excess body weight in university students has not yet been identified in the literature.

On the other hand, it was identified that reports of depressive symptoms and a higher perception of stress enhanced university students' exposure to overweight, which coincides with previous findings[25]. In this regard, there are potential behavioral and physiological mechanisms by which excess body weight can contribute to compromised mental health. The social stigma associated with accumulated weight gain can harm body image, self-esteem, and social interactions, supporting the onset of depressive symptoms. Also, there may be physiological factors common to depression and excess body weight, including higher serotonin levels in the central nervous system and biochemical changes

in the pituitary-adrenal axis, which increase the risk of developing both conditions[25]. Furthermore, higher levels of chronic stress can alter the adrenal hypothalamic-pituitary axis activity, increasing cortisol secretion, which, in turn, stimulates the consumption of high-energy-density, sugar- and fat-rich foods, governed by neuroendocrine adaptations predisposing for body weight gain[26].

Our findings are in line with evidence that suggests a higher risk of excess body weight for a habitual sleep time of fewer than six hours a night. Sleep is an important neuroendocrine function modulator, including decreased glucose tolerance and insulin sensitivity, increased nighttime concentrations of ghrelin levels, and reduced leptin levels, which increases the perception of hunger and, consequently, food intake[27]. Concerning physical activity, the multivariate model showed that the likelihood of university students who reported being less active to be excess body weight was significantly higher than their more active peers. This finding corroborates previous studies' results and points to physical activity as an essential component to control body weight[28].

Another health behavior associated with excess body weight was the fruits/vegetables consumption. In this case, university students who reported lower consumption had higher exposure to excess body weight. The fruits/vegetables consumption at an appropriate frequency influences excess body weight prevention through a specific effect on the higher proportion of complex carbohydrates and insoluble fibers found in plant-derived foods, causing an increase in satiety and a reduced caloric intake of food consumption[29].

While this study provides a broad view of the demographic, university environment, and health behavior correlates associated with university students' excess body weight exposure, some limitations require consideration. Immediately, the cross-sectional approach of the data increases the risk of reverse causality bias in the association between correlates and excess body weight. Also, although several potential confounding factors have been controlled, other factors not considered can affect associations. Artificial groups may have arisen due to the dichotomization of health behaviors. Still, although at first the use of self-reported measures of height and body weight to calculate BMI can be seen as a possible limitation, the evidence available in previous studies has shown the possibility of using this procedure with acceptable validity in epidemiological survey with university students[30].

Despite its limitations, the study has important strengths. The main ones are related to the conception, design, and conduction of the Health Promoting University project. The project serves a vast cultural and geographic diversity. It provides robust and updated data on the epidemiology of university students' exposure to excess body weight in a state representative of Brazil's southern region, which allows the generalization of its results to a larger population universe. Its findings may add new evidence to the scarce body of knowledge, considering that studies on the subject involving Brazilian university students and other world regions are rare. As this population consists of young adults, it is essential to identify excess body weight early and invest in preventing its progression.

In conclusion, the prevalence rate of excess body weight identified in the study was similar to the higher rates found in university populations in other world regions. Specific correlates related to demographic, university environment, and health behavior characteristics were associated with excess body weight. The findings emphasize the importance of proposing and implementing

preventive intervention actions in order to prevent harm related to excess body weight, since associations between modifiable factors and the prevalence of the outcome have been identified. In this scenario, it is believe that interventionist actions should be guided in a multifaceted perspective for health promotion and education in the university context.

COMPLIANCE WITH ETHICAL STANDARDS

Funding

This research received no external funding. D.P.G is a Research Productivity Fellow at Brazilian National Board for Scientific and Technological Development – CNPq.

Ethical approval

The project was approved by the Ethics Committee of the Federal Technological University of Parana (Protocol number 2.533.783/2018). The research was written in accordance with the standards set by the Declaration of Helsinki.

Conflict of interest statement

The authors declare that they have no competing interests.

Author Contributions

D.P.G. and A.L.S.S conceptualized the study and were involved in methodology, data collection and analysis. Both authors were involved in the writing-original draft preparation and writing-review and editing. All authors have read and agreed to the published version of the manuscript.

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