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Trabajo Original

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Exercise and fruit/vegetable intake, and their associations with body weight status in university students

Ejercicio físico y consumo de frutas/verduras, y sus asociaciones con el estado del peso corporal en estudiantes universitarios

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Abstract

Background: evidence suggests that exposure to risk factors related to excess body weight is more frequent in the second and third decades of life. Thus, one of the most propitious environments for the acquisition of habits that can inhibit overweight is the university.

Objective: to identify the frequency of aerobic and strength exercises and of fruit/vegetable intake in university students, and subsequently establish associations between both health behaviors and excess body weight.

Methods: the sample was comprised of 5,310 university students. An online questionnaire was used to collect the frequency of exercises and fruit/vegetable intake. The body mass index was used to define body weight status. The data were analyzed statistically by employing a bivariate analysis and binary logistic regression.

Results: the practice of aerobic and strength exercises was reported by 80.4 % and 51.6 % of the sample, respectively. Only 13 % of the surveyed university students had an adequate fruit/vegetable intake. The proportion of excess body weight was 39.1 %, the condition being significantly higher in men. The risk for excess body weight identified in the university students who reported not consuming fruits/vegetables daily was two to three times higher than in their peers who reported an adequate intake (women: OR = 2.92 [95 % CI 2.07-4.12]; men: OR = 1.98 [95 % CI 1.41-3.02]). Exposure to the risk for excess body weight was progressively lower as the reported frequency of aerobic exercise became higher.

Conclusion: these findings suggest the need to promote initiatives aimed at the preparation and implementation of health education and promotion programs in the university context, through actions of guidance about exercise and food intake that may help to minimize the risks of onset and development of excess body weight.

Keywords:

Physical activity. Food intake. Overweight. University health. Health promotion.

Resumen

Antecedentes: las evidencias sugieren que la exposición a factores de riesgo relacionados con el exceso de peso se produce con mayor frecuencia en la segunda y tercera décadas de la vida. Por lo tanto, uno de los entornos más propicios para la adquisición de hábitos que puedan inhibir el sobrepeso es la universidad.

Objetivos: identificar la frecuencia de los ejercicios aeróbicos y de fuerza y del consumo de frutas/verduras en estudiantes universitarios, y posteriormente establecer asociaciones entre los dos comportamientos de salud y el exceso de peso.

Métodos: la muestra estaba compuesta de 5310 estudiantes universitarios. Las frecuencias de los ejercicios físicos y del consumo de frutas/verduras se recopilaron mediante la aplicación de un cuestionario *online*. El exceso de peso se estableció a partir del índice de masa corporal. Los datos se analizaron estadísticamente empleando análisis bivariados y de regresión logística binaria.

Resultados: la práctica de ejercicios aeróbicos y de fuerza fue relatada por el 80,4 % y el 51,6 % de la muestra, respectivamente. Solamente el 13 % de los estudiantes universitarios presentaron un consumo adecuado de frutas/verduras. La proporción del exceso de peso fue equivalente al 39,1 %, siendo dicha proporción significativamente más elevada en los hombres. El riesgo de padecer exceso de peso identificado en los estudiantes universitarios que relataron no consumir frutas/verduras diariamente fue de dos a tres veces mayor que el de sus pares que refirieron un consumo adecuado (mujeres: OR = 2,92; IC 95 %, 2,07-4,12; hombres: OR = 1,98; IC 95 %, 1,41-3,02). La exposición al riesgo del exceso de peso fue progresivamente menor conforme mayor era la frecuencia reportada de ejercicios aeróbicos.

Conclusión: los hallazgos sugieren la necesidad de promover iniciativas dirigidas al diseño e implementación de programas de educación y promoción de la salud en el contexto universitario a través de acciones de orientación sobre ejercicio físico y consumo de alimentos que puedan ayudar a minimizar los riesgos de aparición y desarrollo del exceso de peso.

Palabras clave:

Actividad física. Consumo de alimentos. Sobrepeso. Salud universitaria. Promoción de la salud.

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INTRODUCTION

Non-communicable diseases such as cardiovascular diseases, some types of cancers, respiratory diseases, and diabetes cause 71 % of all deaths globally, and over 85 % in low- and middle-income countries (1). Unhealthy lifestyles characterized by physical inactivity and inadequate eating habits are seen as the main risk factors for chronic diseases and premature deaths (2-5). Individually, they account for a significant amount of preventable deaths worldwide, with physical inactivity alone claiming 3.2 million annual deaths, and dietary risks 11.3 million (6). The impact of these individual issues is exacerbated by the interactions with other risk factors, which further endanger the health of the population. For instance, physical inactivity, poor diet, and excess body weight are linked to an increased risk for countless chronic diseases (7).

In this context, overweight and obesity have been an important factor of concern in the area of public health. Estimates indicate that, in keeping with current trends, in 2030 there will be approximately 2.2 billion overweight adults worldwide, and more than 1.1 billion obese people, which should account for 60 % of the world's population (8). Particularly in Brazil, a survey carried out in 2018 reveals that, depending on the region considered, between 32 % and 59 % of the population over 18 years of age are overweight or obese (9). This implies higher rates of morbidity in the population, a significant increase in the need to use medical services, and a great economic impact on the health system (10).

Evidence suggests that the exposure to risk factors related to excess body weight is more frequently emerging in the second and third decades of life (11). Thus, one of the most propitious environments for the acquisition of habits that can inhibit overweight and obesity is the university. University life is where young people undergo various changes in terms of biological, psychological, social, and economic changes. When young people enter university they face numerous challenges, such as being away from home, adjustment to independent living, the need to establish new friendships in addition to coping with higher-level studies and academic stress (12). Moreover, researchers have shown that the academic years lead to major changes in risk behaviors such as decreased levels of physical activity and inadequate eating habits (13). These unhealthy behaviors represent a negative impact not only during the academic cycle but may continue after the university period, becoming highly detrimental in adult age (14).

Thus, investigating physical activity and eating habits in the academic environment can help in detecting the most vulnerable groups to overweight and obesity, and provide interventions aimed at reducing exposure to excess body weight. In Brazil few studies have sought to investigate physical activity, eating habits, and their association with variations of body weight in representative samples of the university population, leaving an important gap in knowledge in the area. The few studies identified so far have focused on exclusive samples of specific courses from a single institution and with participants selected for convenience or another non-probabilistic method (15-17). Most studies on the topic among college students were conducted in developed countries (11,18-21), and tend to show findings and perspectives that are different from those of developing countries.

Therefore, the objective of this study was to identify the frequency of practice of aerobic and strength exercises and of fruit/vegetable intake in university students in the State of Paraná, Southern Brazil, and subsequently establish associations between both health behaviors and excess body weight.

METHODS

This is a cutout of the University Promoting Health Project, a population-based cross-sectional study designed and implemented by the Federal Technological University of Paraná (UTFPR). To illustrate the size of the population universe addressed, the UTFPR attends approximately 30 thousand university students in 105 courses, distributed over 13 campuses located in cities of different geographic regions of the State of Paraná, Brazil.

SAMPLE

The sample size was established assuming a prevalence of unknown success (p = 50 %), 95 % confidence level, and sampling error of three percentage points. However, considering that the sample planning involved a cluster, the design effect was defined to three, adding 20 % to address possible losses during data collection, thus initially foreseeing a minimum sample of five thousand university students. However, the final sample used in the treatment of the collected information comprised 5,310 university students. The composition of the sample was the result of stratified random sampling involving a three-stage cluster: campuses, course, and course year, with probability proportional to size.

DATA COLLECTION

The data were collected between September and November 2018. The information about the frequency of aerobic and strength exercises, and of fruit/vegetable intake were obtained through the online questionnaire known as the National College Health Assessment II (NCHA IIc) as translated, adapted, and validated for use in the Brazilian university population (22), with additional questions about demographic data including gender, age, marital status, housing type, and course year. The reliability and validity of the Brazilian version of the NCHA IIc questionnaire were originally confirmed through psychometric properties equivalent to Cronbach's alpha, indicators of confirmatory factor analysis, factor invariance, and kappa agreement index (23).

The NCHA-IIc involves questions about health-risk and protective behavior, including seven sections: a) health, health education, and safety; b) alcohol, tobacco, and other drug use; c) sex behavior and contraception; d) weight, nutrition, and exercise; e) mental health; f) physical health; and g) impediments to academic performance

(24,25). However, the present study used data made available specifically in the "weight, nutrition, and exercise" section. In this case, our university students reported the frequency with which they practiced aerobic and strength exercises, and consumed fruits/vegetables using the week prior to data collection as their reference.

Based on the frequency of aerobic and strength exercises the following indicators were adopted: no practice; low level of practice for frequencies equivalent to 1-2 days/week; moderate level of practice for frequencies equivalent to 3-4 days/week; and high level of practice for frequencies equivalent to ≥ 5 days/week. Regarding the fruit/vegetable intake reported by university students, according to the recommendations from the World Health Organization (26) the following indicators were taken into consideration: no intake; low intake for frequencies equivalent to 1-2 servings/day; moderate intake for frequencies equivalent to 3-4 servings/day; and adequate intake for frequencies equivalent to ≥ 5 servings/day.

In terms of body weight status, body mass index (BMI) was calculated through the ratio between body mass in kilograms and the square of height in meters (kg/m^2). The measures of body weight and height were self-reported by the university students when answering the questions: a) What is your body weight in kilograms? and b) What is your height in meters? Based on these BMI values, the body weight status of university students was obtained from the cut-off points recommended by the World Health Organization (27), considering the following four strata: low body weight (BMI < 20 kg/m^2), eutrophic (20 kg/m^2 ≤ BMI < 25 kg/m^2), overweight (25 kg/m^2 ≤ BMI < 30 kg/m^2), and obesity (BMI ≥ 30 kg/m^2).

We visited the classrooms selected for the study and explained the objectives of the research and the principles of secrecy, non-identification, and non-influence on academic performance to the university students. We then invited them to participate in the study and those who initially agreed received individual guidelines and a password to access the electronic platform, thus confirming anonymity. We instructed the participants on how to access the platform and self-complete the questionnaire within a deadline of seven days after releasing the individual password. The rights of all participants were guaranteed by a Free and Informed Consent Term signed by an electronic procedure before the initiation of the NCHA IIc self-completion process in the online format.

The exclusion criteria for any university student belonging to the selected classroom included: a) absence from classes on the day scheduled for the invitation to participate in the study and the distribution of the 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 under 18 or over 35 years.

STATISTICAL ANALYSIS

The data were processed using the computerized Statistical Package for the Social Sciences (SPSS®, version 24). The exact proportions and respective confidence intervals (95 % CIs) of indicators associated with the aerobic and strength exercises, and with fruit/vegetable intake, stratified according to demographic data and nutritional status, were identified. Statistical differences between the strata under investigation were analyzed with a table of contingencies and the chi-square non-parametric test (χ^2). Established through binary logistic regression, odds ratios (ORs) were calculated to identify associations between excess body weight and indicators of exercise and fruit/vegetable intake. Models were established separately for each sex, and controlled for age, marital status, housing type, and course year.

RESULTS

Table I provides descriptive data on the sample selected for the study. Approximately one-third of the sample were women (38.2 %) and 39.1 % were aged between 21 and 25 years. At the time of data collection, 78.2 % of the university students were single, 24.2 % lived in students residences, and 52.8 % lived with their families. Regarding the course years, 32.1 of the university students who participated in this study were in the first year of study and 31.5 % in the last year. Moreover, 39.1 % of the sample selected had excessive body weight, with higher proportions of overweight and obesity among men (35.5 % and 12.1 %, respectively), whereas low body weight totaled 15.1 % of the sample, with a higher proportion among women (26.5 %).

The statistical information about the frequency of aerobic and strength exercises is shown in tables II and III. The proportion of university students selected in this study who reported not practicing any type of aerobic exercise during the week prior to the data collection was 19.6 % [95 % CI, 18.2 to 21.1]. In contrast, approximately half (48.4 % [95 % CI, 45.2 to 51.7]) of our university students reported practicing no strength exercises. When the χ^2 values were analyzed, males reported a higher weekly frequency of exercise, especially when this frequency was ≥ 5 times/week (aerobic exercises [$\chi^2 = 19.29$; $p < 0.001$] and strength exercises [$\chi^2 = 18.63$; $p < 0.001$]). With the advance of age, the proportion of university students who did not practice any aerobic exercises ($\chi^2 = 40.41$; $p < 0.001$) or strength exercises ($\chi^2 = 59.48$; $p < 0.001$) tended to increase significantly. In contrast, a significantly higher proportion of university students aged ≤ 20 years reported a frequency ≥ 5 times/week for aerobic exercises ($\chi^2 = 18.74$; $p < 0.001$) and strength exercises ($\chi^2 = 20.04$; $p < 0.001$).

In terms of marital status, a significantly greater proportion of married university students reported performing no aerobic exercises ($\chi^2 = 25.76$; $p < 0.001$) or strength exercises ($\chi^2 = 45.62$; $p < 0.001$), whereas those who said that they lived in a students residence exercised less frequently than those others who reported living with their family. Furthermore, the results revealed a statistically significant trend towards a reduction in the frequency of exercise with the advance of course years, especially for strength exercises.

Body weight status was closely associated with the frequency of exercise among university students. The findings from this

Table I. Demographic data and body weight status of the sample analyzed in the study

	Female n = 2,029 (38.2 %)	Men n = 3,281 (61.8 %)	Both genders n = 5,310 (100 %)
Age			
≤ 20 years	564 (27.8 %)	979 (29.8 %)	1,543 (29.1 %)
21-25 years	854 (42.1 %)	1,224 (37.3 %)	2,078 (39.1 %)
≥ 26 years	611 (30.1 %)	1,078 (32.9 %)	1,689 (31.8 %)
Marital status			
Single	1,494 (73.6 %)	2,658 (81.0 %)	4,152 (78.2 %)
Married/Partnered	535 (26.4 %)	623 (19.0 %)	1,158 (21.8 %)
Housing type			
Student residence	377 (18.6 %)	908 (27.7 %)	1,285 (24.2 %)
Parent's home	1,242 (61.2 %)	1,562 (47.6 %)	2,804 (52.8 %)
Homestay	363 (17.9 %)	731 (22.3 %)	1,094 (20.6 %)
Alone	47 (2.3 %)	80 (2.4 %)	127 (2.4 %)
Course year			
1st	694 (34.2 %)	1010 (30.8 %)	1,704 (32.1 %)
2nd-3rd	753 (37.1 %)	1180 (36.0 %)	1,933 (36.4 %)
4th or more	582 (28.7 %)	1091 (33.2 %)	1,673 (31.5 %)
Body weight status			
Low body weight	538 (26.5 %)	266 (8.1 %)	804 (15.1 %)
Eutrophic	980 (48.3 %)	1,453 (44.3 %)	2,433 (45.8 %)
Overweight	369 (18.2 %)	1,165 (35.5 %)	1,534 (28.9 %)
Obesity	142 (7.0 %)	397 (12.1 %)	539 (10.2 %)

study enable one to infer that the frequency with which university students reported practicing both types of exercise is inversely proportional to their nutritional status. Thus, 31.4 % [95 % CI, 28.9 to 34.0] of eutrophic students reported practicing aerobic exercises ≥ 5 times/week, compared to 5.7 % [95 % CI, 5.2 to 6.4] of those categorized as obese ($\chi^2 = 31.86$; $p < 0.001$). Moreover, 19.4 % [95 % CI, 18.0 to 21.0] of eutrophic students reported practicing strength exercises with the same weekly frequency, while only 2.2 % [95 % CI, 1.9 to 2.7] of obese students reported an identical frequency ($\chi^2 = 22.31$; $p < 0.001$).

Based on the information shown in table IV, 20.7 % [95 % CI, 19.1 to 22.4] of the university students selected for this study reported a moderate frequency, and only 13.0 % [95 % CI, 12.1 to 14.2] mentioned an adequate frequency of fruit/vegetable intake. In contrast, 51.8 % [95 % CI, 48.4 to 55.3] and 14.5 % [95 % CI, 13.4 to 15.8] of students reported a low or nil frequency of fruit/vegetable intake, respectively. The adequate proportion of frequency of fruit/vegetable intake was higher in female ($\chi^2 = 17.98$; $p < 0.001$), and increased with age ($\chi^2 = 6.38$; $p = 0.024$) and in the strata that included married students ($\chi^2 = 14.52$; $p < 0.001$) and those who lived with their family ($\chi^2 = 13.03$; $p < 0.001$). Additionally, the adequate frequency of fruit/vegetable intake was significantly higher with the advance in course year ($\chi^2 = 5.98$; $p = 0.021$). With regard to nutritional status, a significantly lower proportion of students categorized with excess body weight (overweight and obese) reported an adequate frequency of fruit/vegetable intake when compared to those who were eutrophic or had low body weight ($\chi^2 = 14.23$; $p < 0.001$).

Table V shows the associations between exercise, fruit/vegetable intake, and variations in the occurrence of excess body weight found in the sample selected. Through the analysis of odds ratio values, considering that adjustments will be made for the remaining variables in the study, the estimates found in both sexes indicated that the exposure to risk of excess body weight was inversely proportional to the frequencies of aerobic exercises. Compared to individuals who performed exercise ≥ 5 days/week, men who reported not practicing this type of exercise had double the risk of excess body weight (OR = 2.05 [95 % CI, 1.59 to 3.25], whereas the same risk for women was one and a half times (OR = 1.56 [95 % CI, 1.16 to 2.18]).

Regarding strength exercises, significant associations were found for the frequencies of practice of 3-4 days/week. In this case, there was a lower risk for the presence of excess body weight equivalent to 68 % and 62 % among both women and men, respectively (females – OR = 0.68 [95 % CI, 0.44 to 0.98]; males – OR = 0.62 [95 % CI, 0.35 to 0.97]). The remaining situations of frequency of practice of strength exercises did not indicate statistically significant associations with the variations in the presence of excess body weight.

Table II. Proportion (95 % CI) of aerobic exercise practice, with stratification for demographic data and body weight status, among university students

	No practice	1-2 days/week	3-4 days/week	≥ 5 days/week
Overall	19.6 (18.2-21.1)	29.9 (27.5-32.4)	26.4 (24.3-28.6)	24.1 (22.0-26.3)
Gender	$\chi^2 = 18.28$; $p < 0.001$	$\chi^2 = 22.38$; $p < 0.001$	$\chi^2 = 20.87$; $p < 0.001$	$\chi^2 = 19.29$; $p < 0.001$
Female	25.7 (23.6-27.8)	37.8 (34.8-40.9)	19.1 (17.7-20.6)	17.4 (16.2-18.7)
Male	15.8 (14.6-17.1)	25.0 (22.9-27.2)	30.9 (28.4-33.5)	28.3 (26.1-30.6)
Age	$\chi^2 = 40.41$; $p < 0.001$	$\chi^2 = 19.23$; $p < 0.001$	$\chi^2 = 23.48$; $p < 0.001$	$\chi^2 = 18.74$; $p < 0.001$
≤ 20 years	5.7 (5.2-6.4)	33.2 (30.5-36.0)	31.9 (29.3-34.6)	29.2 (26.9-31.6)
21-25 years	18.4 (17.1-19.8)	30.7 (28.2-33.3)	26.1 (23.9-28.4)	24.8 (22.7-27.0)
≥ 26 years	36.5 (33.5-39.6)	23.9 (21.9-26.1)	20.3 (18.8-21.9)	19.3 (17.9-20.8)
Marital status	$\chi^2 = 25.76$; $p < 0.001$	$\chi^2 = 10.78$; $p < 0.001$	$\chi^2 = 4.89$; $p = 0.048$	$\chi^2 = 8.81$; $p < 0.001$
Single	16.3 (15.1-17.6)	31.5 (28.9-34.2)	26.8 (24.6-29.1)	25.4 (23.3-27.6)
Married/Partnered	34.4 (31.6-37.3)	24.2 (22.1-26.4)	21.8 (20.0-23.7)	19.6 (18.1-21.2)
Housing type	$\chi^2 = 27.82$; $p < 0.001$	$\chi^2 = 8.46$; $p < 0.001$	$\chi^2 = 6.09$; $p = 0.024$	$\chi^2 = 5.93$; $p = 0.029$
Students residence	30.9 (28.4-33.5)	26.0 (23.8-28.3)	22.1 (20.3-24.0)	21.0 (19.4-22.7)
Parent's home	11.8 (10.9-12.8)	33.2 (30.5-36.0)	28.2 (26.0-30.5)	26.8 (24.6-29.1)
Homestay	31.7 (29.1-34.4)	25.6 (23.5-27.8)	21.9 (20.1-23.8)	20.8 (19.2-22.5)
Alone	24.3 (22.3-26.4)	28.5 (26.2-30.9)	24.1 (22.1-26.2)	23.1 (21.1-25.2)
Course year	$\chi^2 = 28.59$; $p < 0.001$	$\chi^2 = 5.64$; $p = 0.027$	$\chi^2 = 5.77$; $p = 0.030$	$\chi^2 = 5.61$; $p = 0.034$
1st	11.4 (10.6-12.3)	32.6 (29.9-36.4)	28.7 (26.4-31.1)	27.3 (25.0-29.7)
2nd-3rd	19.7 (18.2-21.3)	29.6 (27.2-32.1)	26.0 (23.9-28.2)	24.7 (22.6-26.9)
4th or more	27.8 (25.6-30.1)	27.2 (25.0-29.3)	23.1 (21.1-25.2)	21.9 (20.1-23.8)
Body weight status	$\chi^2 = 56.38$; $p < 0.001$	$\chi^2 = 6.83$; $p = 0.019$	$\chi^2 = 26.84$; $p < 0.001$	$\chi^2 = 31.86$; $p < 0.001$
Low body weight	10.1 (9.7-11.0)	32.1 (29.5-34.8)	29.6 (27.2-32.1)	28.2 (26.0-30.5)
Eutrophic	8.7 (7.9-9.6)	27.4 (25.2-29.8)	32.5 (29.8-35.3)	31.4 (28.9-34.0)
Overweight	28.9 (26.6-31.3)	32.8 (30.1-35.6)	20.7 (19.1-22.4)	17.6 (16.3-19.0)
Obesity	56.2 (52.5-60.1)	25.9 (23.7-28.2)	12.2 (11.3-13.2)	5.7 (5.2-6.4)

The risk of excess body weight, regardless of the simultaneous contribution of age, marital status, housing type, course year, and exercise, was increasingly higher in parallel with the reduction in the frequency of fruit/vegetable intake. Compared to those who mentioned an intake of ≥ 5 servings/day, the women who reported not consuming fruits/vegetables were approximately three times more likely to have excess body weight (OR = 2.92 [95 % CI, 2.07 to 4.12]). Among males, this proportion was nearly two times higher (OR = 1.98 [95 % CI, 1.41 to 3.02]). Moreover, the exposure to the risk of excess body weight among the university students who reported a frequency of fruit/vegetable intake equivalent to 1-2 portions/day remained significant in both sexes (females – OR = 1.97 [95 % CI, 1.31 to 2.96]; males – OR = 1.54 [95 % CI, 1.07 to 2.43]).

DISCUSSION

Initially, the present study aimed to identify specific information about the frequency of practice of aerobic and strength exercises, and of fruit/vegetable intake in a representative sample of Brazilian university students. Subsequently, it sought to establish possible associations between both health behaviors and the occurrence of excess body weight (overweight + obesity), adjusted for control variables.

The specialized literature includes few cases of population-based studies that deal with the frequency of exercise and food intake. Furthermore, there is no consensus regarding the measurement instruments to be used to estimate these types of health behavior among these studies. Differences in sample

Table III. Proportion (95 % CI) of strength exercise practice, with stratification for demographic data and body weight status, among university students

	No practice	1-2 days/week	3-4 days/week	≥ 5 days/week
Overall	48.4 (45.2-51.7)	20.3 (18.8-21.9)	16.8 (15.6-18.2)	14.5 (13.5-15.7)
Gender	$\chi^2 = 32.68$; $p < 0.001$	$\chi^2 = 3.98$; $p = 0.109$	$\chi^2 = 16.73$; $p < 0.001$	$\chi^2 = 18.63$; $p < 0.001$
Female	60.8 (56.6-65.1)	22.1 (20.3-24.0)	11.2 (10.4-12.2)	5.9 (5.4-6.7)
Male	40.7 (37.6-43.9)	19.2 (17.8-20.7)	20.3 (18.8-22.0)	19.8 (18.3-21.5)
Age	$\chi^2 = 59.48$; $p < 0.001$	$\chi^2 = 25.89$; $p < 0.001$	$\chi^2 = 22.79$; $p < 0.001$	$\chi^2 = 20.04$; $p < 0.001$
≤ 20 years	28.1 (25.9-40.4)	28.3 (26.1-30.6)	23.4 (21.4-25.6)	20.2 (18.7-21.9)
21-25 years	38.4 (35.4-41.5)	24.2 (22.1-26.4)	20.1 (18.6-21.8)	17.3 (16.1-18.7)
≥ 26 years	79.3 (74.7-84.1)	8.2 (7.5-9.1)	6.7 (6.1-7.6)	5.8 (5.3-6.6)
Marital status	$\chi^2 = 45.62$; $p < 0.001$	$\chi^2 = 19.82$; $p < 0.001$	$\chi^2 = 17.05$; $p < 0.001$	$\chi^2 = 14.89$; $p < 0.001$
Single	40.5 (37.4-43.7)	23.8 (21.7-26.0)	19.2 (17.8-20.8)	16.5 (15.3-17.9)
Married/Partnered	72.7 (68.2-77.3)	10.3 (9.5-11.3)	9.7 (8.9-10.7)	7.3 (6.7-8.2)
Housing type	$\chi^2 = 12.48$; $p < 0.001$	$\chi^2 = 5.61$; $p = 0.034$	$\chi^2 = 3.83$; $p = 0.121$	$\chi^2 = 4.10$; $p = 0.084$
Students residence	55.3 (51.8-58.9)	17.4 (16.2-18.7)	14.6 (13.5-15.9)	12.7 (11.8-13.9)
Parent's home	41.9 (38.8-45.1)	22.9 (20.9-25.0)	18.9 (17.5-20.5)	16.3 (15.1-17.7)
Homestay	54.3 (50.7-58.0)	18.1 (16.8-19.5)	15.1 (14.0-16.4)	12.5 (11.6-13.6)
Alone	50.6 (47.3-54.0)	19.5 (18.0-21.1)	16.0 (14.8-17.4)	13.9 (12.9-15.1)
Course year	$\chi^2 = 48.38$; $p < 0.001$	$\chi^2 = 22.42$; $p < 0.001$	$\chi^2 = 17.54$; $p < 0.001$	$\chi^2 = 14.78$; $p < 0.001$
1st	33.4 (30.7-36.2)	26.2 (24.1-28.4)	21.7 (19.9-23.6)	18.7 (17.3-20.3)
2nd-3rd	42.7 (39.6-45.9)	22.7 (20.7-24.8)	18.2 (16.9-19.7)	16.4 (15.2-17.8)
4th or more	68.9 (64.5-73.4)	11.7 (10.8-12.8)	10.2 (9.4-11.2)	8.1 (7.4-9.1)
Body weight status	$\chi^2 = 50.69$; $p < 0.001$	$\chi^2 = 6.34$; $p = 0.015$	$\chi^2 = 21.98$; $p < 0.001$	$\chi^2 = 22.31$; $p < 0.001$
Low body weight	47.5 (44.3-50.8)	22.1 (20.3-24.0)	16.4 (15.2-17.8)	14.1 (13.1-15.3)
Eutrophic	38.9 (35.9-42.0)	19.2 (17.8-20.7)	22.5 (20.5-24.7)	19.4 (18.0-21.0)
Overweight	57.3 (53.5-60.2)	18.5 (17.1-20.1)	13.0 (12.1-14.1)	11.2 (10.4-12.3)
Obesity	76.9 (72.3-81.7)	15.4 (14.3-16.6)	5.5 (5.0-6.3)	2.2 (1.9-2.7)

composition and selection procedures must also be taken into consideration as factors that hinder comparative analyses.

When the information about the frequency of exercise reported by university students was analyzed, the results showed a trend towards a reduction with age and towards men being more committed to their practice, as compared to women. Although certain differences in type of exercise can be found, the studies available in the literature agree that this practice tends to be negatively associated with age, especially beginning in the last years of adolescence (28,29). Although several studies have sought to identify the reasons for such decrease, the proportion of the contribution of biological and environmental factors and their interaction to the reduction in exercise with age remains unclear.

Previous studies showed that adult males exercise more frequently than females (30), corroborating the results found in the present study. However, if, on the one hand, the practice of aerobic and strength exercises predominated in women and men, on the other hand, there were important differences in the distribution of frequency of aerobic and strength exercises between sexes. Among young adults, the ratios to identify differences in physical activity between women and men are not clear. However, some studies have revealed the existence of a combination of socio-cultural and biological factors with the potential to encourage both sexes to practice exercise. The greater involvement with exercise shown by men can be partly explained by the fact that males are encouraged to practice highly physical activities since an early age, whereas women are directed towards activities that are more

Table IV. Proportion (95 % CI) of fruit/vegetable intake, with stratification for demographic data and body weight status, among university students

	No intake	Low intake[1]	Moderate intake[2]	Adequate intake[3]
Overall	14.5 (13.4-15.8)	51.8 (48.4-55.3)	20.7 (19.1-22.4)	13.0 (12.1-14.2)
Gender	*$\chi^2 = 19.06$; $p < 0.001$*	*$\chi^2 = 49.87$; $p < 0.001$*	*$\chi^2 = 48.27$; $p < 0.001$*	*$\chi^2 = 17.98$; $p < 0.001$*
Female	6.2 (5.7-7.0)	38.9 (35.8-42.1)	33.7 (30.9-36.6)	21.2 (19.6-23.0)
Male	19.6 (18.1-21.3)	59.8 (55.6-64.1)	12.7 (11.8-13.9)	7.9 (7.2-9.0)
Age	*$\chi^2 = 23.87$; $p < 0.001$*	*$\chi^2 = 5.49$; $p = 0.038$*	*$\chi^2 = 14.79$; $p < 0.001$*	*$\chi^2 = 6.38$; $p = 0.024$*
≤ 20 years	23.5 (21.4-25.7)	48.4 (45.2-51.7)	16.2 (15.0-17.6)	11.9 (11.0-13.1)
21-25 years	16.9 (15.7-18.3)	52.6 (49.1-56.2)	19.9 (18.4-21.6)	10.6 (9.8-11.8)
≥ 26 years	4.7 (4.2-5.6)	53.8 (50.2-57.5)	25.0 (22.9-27.3)	16.5 (15.3-18.0)
Marital status	*$\chi^2 = 13.52$; $p < 0.001$*	*$\chi^2 = 22.32$; $p < 0.001$*	*$\chi^2 = 21.84$; $p < 0.001$*	*$\chi^2 = 14.52$; $p < 0.001$*
Single	16.6 (15.4-18.0)	55.1 (51.6-58.8)	17.5 (16.2-19.0)	10.8 (10.0-11.9)
Married/Partnered	7.1 (6.5-7.9)	39.8 (36.7-43.0)	32.3 (29.7-35.1)	20.8 (19.2-22.6)
Housing type	*$\chi^2 = 15.73$; $p < 0.001$*	*$\chi^2 = 41.08$; $p < 0.001$*	*$\chi^2 = 39.81$; $p < 0.001$*	*$\chi^2 = 13.03$; $p < 0.001$*
Students residence	21.0 (19.4-22.8)	58.7 (54.6-62.9)	12.4 (11.5-13.6)	7.9 (7.2-9.0)
Parent's home	9.2 (8.4-10.2)	43.8 (40.7-47.0)	29.1 (26.8-31.6)	17.9 (16.6-19.5)
Homestay	19.4 (18.0-21.0)	62.3 (58.0-66.7)	10.2 (9.4-11.3)	8.1 (7.4-9.2)
Alone	20.3 (18.8-22.0)	54.5 (50.9-58.2)	15.5 (14.3-16.9)	9.7 (8.9-10.9)
Course year	*$\chi^2 = 6.43$; $p = 0.014$*	*$\chi^2 = 16.42$; $p < 0.001$*	*$\chi^2 = 13.49$; $p < 0.001$*	*$\chi^2 = 5.98$; $p = 0.021$*
1st	10.4 (9.6-11.5)	45.6 (42.4-48.9)	26.7 (24.5-29.1)	17.3 (16.1-18.8)
2nd-3rd	17.2 (16.0-18.6)	53.3 (49.8-56.9)	18.1 (16.8-19.7)	11.4 (10.6-12.6)
4th or more	16.4 (15.2-17.7)	55.5 (51.8-59.3)	17.6 (16.3-19.2)	10.5 (9.7-11.7)
Body weight status	*$\chi^2 = 22.54$; $p < 0.001$*	*$\chi^2 = 39.78$; $p < 0.001$*	*$\chi^2 = 18.41$; $p < 0.001$*	*$\chi^2 = 14.23$; $p < 0.001$*
Low body weight	10.1 (9.3-11.2)	50.6 (47.3-54.0)	24.2 (22.1-26.5)	15.1 (14.0-16.5)
Eutrophic	10.7 (9.9-11.8)	44.1 (41.0-47.3)	27.3 (25.1-29.7)	17.9 (16.6-19.5)
Overweight	18.1 (16.8-19.7)	63.9 (59.6-68.3)	11.1 (10.2-12.4)	6.9 (6.3-7.9)
Obesity	29.7 (27.5-32.2)	55.3 (51.4-59.0)	9.2 (8.4-10.4)	5.8 (5.3-6.7)

[1]Frequency of intake equivalent to 1-2 servings/day. [2]Frequency of intake equivalent to 3-4 servings/day. [3]Frequency of intake equivalent to ≥ 5 servings/day.

physically passive. Likewise, the more effective participation of men in the practice of exercise can be the result of the greater positive reinforcement and promotion of such practice received by them since childhood (28).

Another possible explanation for the lower participation of women in exercise is the different concept of body, capacity, and attitude required to make more intense physical efforts. From a socio-cultural perspective, the concept of body which is usually associated with physical activity is not adjusted to current female models of corporeality. Effectively, in modern times, the ideal female body is characterized by grace, elegance, beauty, and relative fragility, which does not seem to adjust to the image of a body involved with physical efforts. This factor can cause women to show some reservations concerning the possibility of practicing exercise, as this may affect their femininity (31).

In addition to socio-cultural factors, differences in the practice of exercise between sexes can be equally due to biological factors. Lower muscle resistance and strength, higher level of body fat, greater diameter and depth of the pelvic area, and discomfort during menstruation could be good reasons for women's lower involvement with exercise (32). The presence of sexual dimorphism should be seriously considered by managers of intervention programs in public health, especially aiming to eliminate social prejudices against the participation of women in the practice of exercise, which are culturally emphasized and valued from an individual perspective.

Table V. Odds ratios and respective confidence intervals (95 % CI) for the association between excess body weight (overweight + obesity) and frequency of exercise and fruit/vegetable intake among university students

	Female		Male	
	OR Adjusted (95 % CI)	p-value	OR Adjusted (95 % CI)	p-value
Aerobic exercise				
≥ 5 days/week	Reference	0.019	Reference	0.001
3-4 days/week	1.23 (0.94-1.65)		1.31 (0.97-1.93)	
1-2 days/week	1.36 (1.01-1.87)		1.47 (1.08-2.28)	
No practice	1.56 (1.16-2.18)		2.05 (1.59-3.25)	
Strength exercise				
≥ 5 days/week	Reference	0.037	Reference	0,041
3-4 days/week	0.68 (0.44-0.98)		0.62 (0.35-0.97)	
1-2 days/week	0.92 (0.64-1.37)		0.84 (0.51-1.44)	
No practice	1.18 (0.85-1.72)		1.17 (0.69-1.98)	
Fruit/vegetable intake				
≥ 5 servings/day	Reference	< 0.001	Reference	0.001
3-4 servings/day	1.43 (0.94-2.18)		1.26 (0.91-2.11)	
1-2 servings/day	1.97 (1.31-2.96)		1.54 (1.07-2.43)	
No intake	2.92 (2.07-4.12)		1.98 (1.41-3.02)	

Values adjusted for age, marital status, housing type, course year, and/or frequency of fruit/vegetable intake and exercise.

The high proportions of university students who reported not performing aerobic and strength exercises were one of the alarming findings. Previous studies showed that, apart from being an important factor that predisposes young adults to organic and psychological disorders, the risk of insufficient and inadequate physical activity tends to increase with age. This suggests a higher possibility that such behavior, harmful to health, will remain during more advanced adult stages of life (28).

Regarding the frequency of fruit/vegetable intake, the results found showed that only 13 % of the study sample met the recommendations for adequate intake (≥ 5 portions/day). Although possible methodological differences and influences resulting from cultural characteristics, climate, and food production and commercialization conditions can be found, this result corroborates previous estimates found in studies involving the Brazilian population in general and, more specifically, the population of university students (15-17). However, this was significantly lower than the findings of studies performed in developed countries (18,19). In this sense, assuming that the eating habit is one of the priority actions in the thematic agenda of public health, in view of the results found, there is the great challenge of education and health promotion in our reality.

Consistent with the results found in Brazilian studies (9,15-17) and different regions worldwide (18,19,21), the frequency of fruit/vegetable intake was higher among women and older university students. In fact, culturally speaking, a greater interest in questions related to diet, health, and beauty generates more concern about the consumption of low-calorie foods, which can have a positive influence on women's eating habits (33), thus justifying the differences in fruit/vegetable intake between genders. The higher fruit/vegetable intake found in older university students may be analyzed as a result of differences in the formation of eating habits in younger generations. In theory, this should consider the fact that they are more exposed to the eating pattern that predominates in modern society, which includes a larger amount of processed foods and high levels of fat and sugar, to the detriment of vegetable foods. Healthier eating habits at more advanced ages can also be associated with greater concern and health care and, consequently, older subjects may follow the instructions provided by health professionals in a more effective way.

The association between frequency of fruit/vegetable intake and marital status, housing type, and university course year found in the present study is in agreement with some findings from the literature (9,15-21). In this sense, possible causal mechanisms must be taken into consideration when seeking an explanation for this association, as is the case of knowledge about nutrition and motivation to adopt a healthy diet. In fact, marketing and educational nutrition interventions are actions that have proven highly effective in the search for a healthier diet (34).

Regarding excess body weight, in general, it could be observed that its occurrence was higher than identified in university students from middle income and emerging economy countries (11); however, lower than found in the United States (35) and similar to the rates reported in some European countries (19,20). The results indicate that excess body weight was more prevalent in men, coinciding with the findings from certain studies (19,20,35);

however, this diverges from other studies that show similarities between both sexes (11). In this case, the differences found among studies can probably be attributed to the variousl criteria used to define excess body weight, since there is no consensus regarding the use of only one criterion.

Another finding from the present study was the statistically significant and inverse association between frequency of exercise and fruit/vegetable intake, and excess body weight as identified in both sexes. It should be emphasized that both outcomes remained significantly associated, even after adjustments were made for control variables. In this case, the lower risk of exposure for the occurrence of excess body weight among those university students who most frequently perform exercise and consume fruits/vegetables is consistent with the evidence shown by other studies involving different experimental designs and statistical treatments (19).

Fruit/vegetable intake with an adequate frequency influences the occurrence of excess body weight through a specific effect on the greater proportion of complex carbohydrates and insoluble fibers found in plant foods, causing an increase in satiety and a reduction in the caloric support of food intake. Contrary to diets in which manufactured products and high levels of fat and sugar predominate, diets with a more frequent fruit/vegetable intake tend to show lower amounts of simple carbohydrates and fats, which is inversely associated with greater calorie intake, a known component of excess body weight (36).

Among the limitations of the study, it is noteworthy that the investigation method employed involves self-reported responses, thus allowing for possible memory biases or even biased statements towards the desirable. However, self-reporting is the current procedure in studies such as this one, as it is the most viable way to gather data in population-based surveys. Normally, certain procedures minimize this limitation, which are also adopted here: anonymous questionnaire, voluntary participation, filling out the questionnaire without the presence of the researchers, and the guarantee of the confidential nature of the information provided. Besides, the larger sample size allows for minimizing any inaccuracy of the calculated estimates in some way. Additionally, the cross-sectional approach to data does not allow inferences of causality in the associations due to the outcomes and the independent variables that can be modified having been identified simultaneously, increasing the risk of a reverse causality bias. Therefore, the identified associations should not be considered conclusive, and further longitudinal studies are needed to address this limitation, which are currently being conducted by the authors of this manuscript. Another limitation refers to the adequate fruit/vegetable intake being ≥ 5 servings/day, instead of being expressed in grams or size of portions consumed. Nonetheless, the measure of the frequency of food intake, without considering the size of portions, is very common in the international (18,21) and national literature (15-17).

The main strengths of the study relate to the concept, design, and conduct of the University Health Promoter project. The project meets a comprehensive cultural and geographic diversity, and provides robust and up-to-date data on exercise, fruit/vegetable intake, and weight status of university students from a representative state in southern Brazil, which allows for the generalization of its results to a larger population universe. Its findings may add new evidence to the scarce body of knowledge about the association of exercise and fruit/vegetable intake with weight status, considering that studies involving Brazilian university students and those from other regions in the world are rare. Since this population is composed of young adults, it is important to identify these associations and to invest heavily in the prevention and control of excess body weight. Regarding the methodology used, possible seasonal interferences in the reports of university students were minimized as data collection was carried out over a short period (three months) and within the same season of the year (spring), which, along with a minimum refusal rate to participate in the study, ensures more reliability to the findings.

CONCLUSIONS

The results found in this study mainly point to habits of exercise and fruit/vegetable intake that do not meet current recommendations. Approximately one third of the university students included in the sample showed excess body weight. Variations in the occurrence of excess body weight was inversely and significantly associated with a higher frequency of aerobic exercise and fruit/vegetable intake. In the case of strength exercises, lower chances of university students being categorized with excessive body weight occurred with a frequency of practice equivalent to 3-4 days/week. These findings indicate there is a need to promote initiatives aimed at the preparation and implementation of health education and promotion programs in the university context, through actions of guidance on exercise and food intake that can help to minimize the risks of onset and development of excess body weight.

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