Saúde e Pesquisa
DOI: 10.17765/2176-9206.2024v17n1.e12345

Dietary patterns of Brazilian university students in Belo Horizonte, Minas Gerais, Brazil

Padrão alimentar em universitários brasileiros em Belo Horizonte, Minas Gerais, Brasil

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ABSTRACT
This descriptive, cross-sectional study evaluated the dietary patterns of university students of both sexes. An online questionnaire, and a validated food frequency questionnaire were used to assess the dietary intake. Dietary patterns were identified using the principal components factor analysis method. A total of 397 university students from 10 undergraduate courses were included (82.6% women). Two distinct dietary patterns were identified (Western and Healthy), and 53.9% of university students were categorized into the Western dietary pattern, with no significant differences between men and women (P=0.631). When comparing courses, only the nutrition and pharmacy courses had a higher prevalence of healthy dietary patterns. Thus, this study demonstrated a high prevalence of university students with unhealthy dietary patterns, demonstrating the importance of carrying out institutional actions or campaigns to reinforce the importance of healthy eating for the health of these students.

Keywords: College students. Dietary pattern. Food intake. Nutrition status.

RESUMO
Esse estudo descritivo e transversal avaliou o padrão alimentar em acadêmicos adultos de uma instituição de ensino superior de ambos os sexos. Esta pesquisa foi realizada através de um questionário online e, na alimentação, foi utilizado um questionário de frequência alimentar validado. Os padrões alimentares foram identificados através do método de análise fatorial por componentes principais. Foram incluídos 397 universitários de 10 cursos de graduação (82,6% mulheres). Foram identificados dois padrões alimentares distintos (ocidental e saudável) e 53,9% dos universitários foram categorizados no padrão alimentar ocidental, sem diferenças entre homens e mulheres (P=0,631). Na comparação entre os cursos, apenas nutrição e farmácia apresentaram maior prevalência do padrão alimentar saudável. Assim, esta pesquisa demonstrou uma grande prevalência de universitários com um padrão alimentar não-saudável, demonstrando a importância de realizar ações ou campanhas institucionais reforçando a importância da alimentação saudável na saúde destes discentes.

Palavras-chave: Estado nutricional. Ingestão alimentar. Padrão alimentar. Universitário.

INTRODUCTION

The health of university students has received attention in several scientific publications, and the authors have demonstrated that the lifestyle of this population presents important aspects related to unhealthy eating habits, a sedentary lifestyle, excess weight, and consumption of alcoholic beverages[1,2,3].

This has also been observed in other countries. A multicenter study[4] carried out with 4809 university students from 10 Latin American countries demonstrated unhealthy habits in a large part of this population and that the quality of the diet was better in students who had a dietary pattern based on the consumption of fruits and vegetables, including vegetarians and vegans. A British study[5] carried out with 1448 students from five universities identified that students who followed a healthy eating pattern had a favorable micronutrient intake profile, while those who had less healthy eating patterns were more associated with smoking, a sedentary lifestyle, and greater consumption of fast food. Another study[6] analyzed 37 articles on food consumption by university students, including only 8 Brazilian studies, and demonstrated that most university students had unhealthy eating behaviors, such as high consumption of fast food, quick snacks, sweets, soft drinks, and alcoholic drinks, as well as low consumption of fruits, vegetables, fish, whole grains, and legumes.

In recent decades, Brazil has undergone a nutritional transition characterized by a reduction in malnutrition and an increase in the prevalence of obesity. Among the components that may be associated with this transition, a sedentary lifestyle and changes in the Brazilian dietary pattern stand out, which has changed from a dietary pattern characterized by greater consumption of fiber and low-fat content to a pattern rich in saturated fats and simple carbohydrates. This current dietary pattern is commonly associated with an increase in obesity and other chronic non-communicable diseases such as diabetes, hypertension, metabolic syndrome, among others[7].

Studies have shown that young people's entry into higher education can change their daily lives and affect their eating habits and nutritional status. When entering college/university, this population no longer has their previous family routine, and many begin to have their own responsibilities in relation to financial management, transportation, and food. Many leave their family home and live-in student residences, while others need to balance their studies and work schedules. These changes can affect health and contribute to weight gain, and the causal factors (stress, excessive academic tasks, fad diets, and inadequate time management) require attention[1,8].

Eating patterns can be characterized through the application of dietary surveys in a given population and their evolution over time. From these surveys, associations can be established between health and nutrition conditions and the diets of specific populations. These surveys, despite being indirect indicators of nutritional status, are a fundamental part of nutritional diagnosis and contribute to the perception of potential subclinical risk for the development of a problem[9].

The dietary pattern of Brazilian university students is normally characterized by a high consumption of "fast food," a diet rich in saturated fat, sugar, and sodium and poor in natural foods such as fruits, vegetables, and whole grains. This poor diet among university students is often associated with a lack of time due to their study and work routine, moving to another city, and adapting their diet to new friendships and regional habits, which leads them to frequent cafeterias and restaurants[10].

Previous studies conducted among university students demonstrate an inadequate dietary profile, even in a population that studies the importance of changing dietary patterns, such as students in the health fields, including

nutrition[1,10,11]. A study[12] of nutrition students at a higher education institution observed low consumption of fruits and vegetables, although the majority stated that they never consumed snacks such as chips and that they ate fried foods only 1 to 3 times a month. According to the authors, it is important to pay attention to the dietary patterns of these students to ensure a better quality of life and health.

By understanding the dietary profiles of university students, it is possible to define and create health promotion strategies and programs in educational institutions, seeking to improve the health and quality of life of the student population. Therefore, this study aimed to evaluate the dietary patterns of university students at a higher education institution in the city of Belo Horizonte, Minas Gerais, Brazil.

METHODOLOGY

STUDY DESIGN

This descriptive, observational, cross-sectional study was conducted between August and October 2023 on university students from different undergraduate courses at a higher education institution located in the city of Belo Horizonte, Brazil.

ETHICAL ASPECTS

This study was approved by the Institutional Research Ethics Committee (CAAE: 67004423.7.0000.5105). All academics who agreed to participate signed a Free and Informed Consent Form (TCLE), after receiving the necessary explanations about the study.

SAMPLE CALCULATION

For the sample calculation, all students regularly enrolled at this higher education institution in the first semester of 2023 were considered (a total of 3,608 enrolled university students). Considering a standard error of 5% and confidence level of 95%, the minimum number of students required was 348.

PARTICIPANTS

Students of both sexes from all undergraduate courses at the institution who agreed to participate and met the inclusion criteria were included in this study. The inclusion criteria were age between 18 and 60 years, who were regularly enrolled in an undergraduate course at this institution in Belo Horizonte, and who agreed to participate in the study by signing the TCLE. Students who did not complete the questionnaire completely and correctly were excluded. These academics were recruited in person by researchers at the institution or through invitati, ons via social networks, emails, or chat applications such as WhatsApp . Teachers, coordinators, and class representatives also contributed to student recruitment.

PROCEDURES

The study was conducted using an online questionnaire created on the Google Forms platform and shared with all students at the institution. The questionnaire was developed based on scientific research on dietary patterns, and covered sociodemographic questions, nutritional status, physical activity, and questions regarding food and sleep. Regarding the practice of physical activity, university students were asked about their weekly frequency of at least 30 minutes of exercise per day.

In the survey, volunteers were asked about their current weight and height, and based on these data, their body mass index (BMI) was calculated, as proposed by the World Health Organization (WHO)[13]. In this study, BMI was categorized as underweight, normal

weight (eutrophic), and overweight (including overweight and obese) to classify nutritional status[13].

ASSESSMENT OF THE DIETARY PATTERN

In this study, dietary patterns were assessed using a food frequency questionnaire (FFQ) comprising 88 questions (items) covering more than 100 foods. The FFQ was developed and validated by Ribeiro and Cardoso[14] by adapting a validated questionnaire applied to a Japanese community in Brazil, excluding foods of Japanese origin[15]. As an adaptation, foods commonly consumed in the research region, such as cheese bread and starch biscuits, were added. The FFQ made it possible to evaluate the foods consumed and the dietary patterns across food groups[14].

This FFQ is semi-quantitative, which also allows an assessment of the quantities ingested; however, this was not the focus of the present research. Therefore, only the list of foods from this questionnaire was used with adaptations for the online survey. The frequency of consumption needed to be categorized by the researchers because, in the original questionnaire, the interviews were face-to-face. Therefore, this FFQ, when included in Google Forms, caused foods to be categorized on a Likert scale: never or almost never, 2–3x/day, 1x/day, 5–6x/week, 2–4x/week, 1x/week, and 1–3x/month.

The foods in the FFQ were divided into 24 groups based on their similarities in nutritional content and culinary use (Table 1). The consumption frequencies of these foods were transformed into a daily consumption score: 2 to 3x/day (= 2.5); 1x/day (= 1); 5 to 6x/week (= 0.79); 2 to 4x/week (= 0.43); 1x/week (= 0.14); 1 to 3x/month (= 0.07); and never or almost never (= 0). Next, the coded frequencies corresponding to the foods actually consumed by individuals in each food group were added, which constituted the numerator of the summary measure. The denominator corresponded to the maximum number of foods that the individual could consume in each food group multiplied by 2.5 (the highest value in the daily consumption score). For example, for an individual, the sum of the frequencies coded for the red meat group was 2.79. In this group, the maximum would be 7.5 (there are 3 foods in the group, and the maximum would be 2.5 in each). Therefore, the red meat consumption score for this individual was 2.79 / 7.5 = 0.372 (summary measure). These summary measurements were obtained for each individual in the sample in each food group and were used in the multivariate analysis to identify the dietary patterns, as described in the Statistical Analysis section[16,17,18].

Table 1. Grouping of foods used in the dietary patterns analysis. Belo Horizonte, Brazil, 2023.

Food or food group	Foods in the food frequency questionnaire
Dairy products	whole milk; skimmed milk; semi-skimmed milk; full-fat natural yogurt; low-fat natural yogurt; yogurt with fruit; Danoninho ; fresh cheese and ricotta; yellow cheeses; cream cheese.
Red meat	beef; pork; sun-dried meat, dried meat, jerky.
White meat and seafood	chicken or other poultry meat; fish; canned fish (tuna, sardines); shrimp, seafood.
Viscera	viscera, tripe, liver, heart.
Sausages	ham, mortadella, salami; Turkey breast; sausage; chicken or fish nuggets.
Eggs	boiled eggs, omelet, scrambled eggs; fried eggs.
Fats of animal origin	butter; bacon, cracklings.
Margarines and mayonnaise	margarine; light margarine; mayonnaise.
Olive oil	olive oil (regardless of the type of olive oil).
Nuts	nuts, oilseeds, peanuts.
Savory breads, biscuits, and breakfast cereals	bread, sliced bread and others; whole grain bread, rye; oats, flaxseed, granola, chia seeds; breakfast cereals; tapioca flour biscuit; savory crackers or toast.
Sweet breads, biscuits, and breakfast cereals	sweet bread, croissant; sweet biscuits (filled or not); breakfast cereal with sugar, like corn-flakes; industrialized cakes.
Pastas	pasta, lasagna, gnocchi; noodle.
Tubers and cereals	rice; potatoes, cassava, polenta (fried); potatoes, cassava, polenta (not fried); sweet corn; canned sweet green corn; sweet potato; farofa, corn flour.
Fruits	orange, tangerine, lemon, pineapple; banana; apple, pear; papaya; watermelon melon; grape; guava in season; avocado in season; mango, persimmon in season; dried or dehydrated fruits; other fruits.
Fresh fruit juices	fresh orange juice; fresh juice from other fruits.
Legumes	beans (regardless of the type); peas, lentils, chickpeas, or others.
Leafy vegetables	lettuce, endive, watercress, arugula; cabbage, chard, kale, spinach.
Non-leafy vegetables	cauliflower, broccoli; carrots, zucchini; pumpkin; tomato; eggplant; beetroot; green beans, chayote, zucchini; pickled vegetables; vegetable or vegetable soups.
Pastry and fried foods	snacks and pies; pizza; cheese bread; snacks like chips and others.
Sweets and desserts	cakes, pies; chocolates; honey or jam; ice cream, milk shake; pudding, sweets with milk; fruit sweets, fruit syrups; candy, gum, chewing gum.
Coffee and tea	coffee; coffee with sugar; coffee with sweetener; black or mate tea; herbs tea.
Artificial beverages	artificial juices; diet, light, zero soda; regular soda; energetics.
Alcoholic beverages	Beer; cachaça, distillates beverages; wine.

STATISTICAL ANALYSIS

The database was created using the Microsoft Excel program (Office 2013®, Redmond, WA, USA) and analyzed using the Statistical Package for Social Sciences (SPSS®), version 19.0 for Windows (SPSS Inc., Chicago, IL, USA). The Kolmogorov-Smirnov test was used to assess normality. Qualitative (categorical) variables are described using absolute and relative frequencies (percentages). Quantitative variables with a normal distribution are presented as means and standard deviations. Quantitative variables with normal distribution were compared using Student's t-test for independent samples. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test. Principal component factor analysis (PCA) was performed to identify the dietary patterns. All criteria that must be established for the application of such an analysis were adequate, as proposed by Neumann and collaborators[16]. The first step of PCA is the evaluation of the applicability of this method in the sample; for this, two tests are used: the Kaiser-Meyer-Olkin (KMO) coefficient, which is desirable at ≥0.50, and the test of sphericity of the Bartlett (BTS), which must be $p<0.05$. If both conditions are guaranteed, PCA is suitable for analyzing this sample. The number of factors (patterns) retained was then defined based on the following criteria: components with eigenvalues greater than 1.5, Cattel graph (screen plot), and the conceptual meaning of the identified patterns. Subsequently, Varimax orthogonal rotation was performed to simplify the factorial matrix, facilitate data interpretation, and identify dietary patterns. The objective of the rotation was to ensure that each variable presented high loadings on only one factor (standard) and low loadings on the other factors, facilitating interpretation without changing the correlation between the variables. Subsequently, factor scores were generated for the main components of each individual in the sample. Each main component was analyzed based on foods with rotated factor loadings ≥ 0.3 or ≤ -0.3. Loads ≥ 0.3 contribute directly to the pattern, while loads ≤ -0.3 correlate negatively with the dietary pattern. Finally, the denomination of the identified dietary patterns was carried out according to the composition of their food groups, prioritizing the nomenclature used in other scientific studies[16,17,18]. To categorize individuals in each pattern, individual factor scores were used for each identified pattern, and the individual was categorized according to the pattern where their contribution was the greatest (highest factor loading). Pearson's correlation analysis was also performed to verify the associations of weight, BMI, age, and sex with the identified dietary patterns. In this study, results with a significance level of 95% (P value ≤0.05) were considered statistically significant.

RESULTS

Initially, this research received 406 responses to the questionnaire. After applying the exclusion criteria and excluding duplicates, 397 university students were included in the analyses: 328 women (82.6%) and 69 men (17.4%). These 397 participants belonged to the institution's 10 undergraduate courses, as described in Table 2, and were distributed across all periods (from the first to the last period of each course). The average age was 24.6 ± 7.0 years, with no significant difference between men and women ($P=0.954$). Of the 397 university students, 53 (13.4%) already had another degree course in addition to the current one they were studying. Table 2 shows the general and anthropometric characteristics of the participants. There were no differences between the sexes regarding marital status, per capita income, alcohol consumption,

smoking, and BMI categorization. The differences observed in weight, height, and BMI were expected when comparing men and women. Physical activity practice was different between men and women (P=0.001) (Table 2).

Table 2. General characteristics of the university students. Belo Horizonte, Brazil, 2023.

(Continued)

Characteristics	Total (n=397)	Men (n=69)	Women (n=328)	*P-value*[#]
Age (years)				
Mean ± SD	24.6 ± 7.0	24.6 ± 6.4	24.6 ± 7.1	0.954
Marital status – n (%)				0.100
Single	330 (83.1%)	62 (89.9%)	268 (81.7%)	
Married or in a stable union	67 (16.9%)	7 (10.1%)	60 (18.3%)	
Per capita income* – R$				0.873
Up to 1 minimum wage	126 (31.7%)	22 (31.9%)	104 (31.7%)	
Between 1 and 3 minimum wages	193 (48.7%)	32 (46.4%)	161 (49.1%)	
More than 3 minimum wages	78 (19.6%)	15 (21.7%)	63 (19.2%)	
Height (m)				
Mean ± SD	1.65 ± 0.08	1.76 ± 0.07	1.63 ± 0.06	**<0.001**
Weight (kg)				
Mean ± SD	65.8 ± 14.1	77.9 ± 14.8	63.3 ± 12.6	**<0.001**
BMI (kg/m^2)				
Mean ± SD	24.1 ± 4.4	25.2 ± 4.8	23.9 ± 4.3	**0.024**
BMI categorization – n (%)				0.629
Low weight (BMI < 18.5 kg/m^2)	23 (5.8%)	3 (4.3%)	20 (6.1%)	
Normal weight (18.5 ≤ BMI < 25.0 kg/m^2)	235 (59.2%)	38 (55.1%)	197 (60.1%)	
Overweight (25.0 ≤ BMI < 30.0 kg/m^2)	101 (25.4%)	19 (27.5%)	82 (25.0%)	
Obesity (BMI ≥ 30.0 kg/m^2)	38 (9.6%)	9 (13.1%)	29 (8.8%)	
Consumption of alcoholic beverages – n (%)				0.530
Yes	205 (51.6%)	38 (55.1%)	167 (50.9%)	
No	192 (48.4%)	31 (44.9%)	161 (49.1%)	
Smoker – n (%)				0.093
Yes	23 (5.8%)	7 (10.1%)	16 (4.9%)	
No	352 (88.7%)	56 (81.2%)	296 (90.2%)	
Previously smoked, but not currently	22 (5.5%)	6 (8.7%)	16 (4.9%)	

(Conclusion)

Physical activity (minimum 30 minutes) – n (%)				**0.001**
Sedentary	158 (39.8%)	21 (30.4%)	137 (41.8%)	
Once or twice a week	78 (19.6%)	12 (17.4%)	66 (20.1%)	
Three to five times a week	113 (28.5%)	18 (26.1%)	95 (29.0%)	
More than five times a week	48 (12.1%)	18 (26.1%)	30 (9.1%)	
Undergraduate course currently enrolled – n%				**0.003**
Nutrition	62 (15.6%)	6 (8.7%)	56 (17.1%)	
Medicine	78 (19.6%)	21 (30.4%)	57 (17.4%)	
Pharmacy	31 (7.8%)	3 (4.3%)	28 (8.5%)	
Biomedicine	35 (8.8%)	4 (5.8%)	31 (9.5%)	
Psychology	48 (12.1%)	5 (7.3%)	43 (13.1%)	
Dentistry	31 (7.8%)	4 (5.8%)	27 (8.2%)	
Nursing	44 (11.1%)	5 (7.3%)	39 (11.9%)	
Administration	16 (4.0%)	4 (5.8%)	12 (3.7%)	
Accounting	15 (3.8%)	7 (10.1%)	8 (2.4%)	
Law school	37 (9.4%)	10 (14.5%)	27 (8.2%)	

Note: BMI: body mass index; SD: standard deviation; kg: kilogram; m: meter; #: Student's t-test for independent samples with normal distribution and Pearson's Chi-square test or Fisher's exact test for categorical variables. *: the Brazilian minimum wage of 2023 was considered in the amount of R$1320.00.

When asked how these university students considered their health in general, 21 (5.3%) said they classified it as bad or terrible, 321 (80.9%) as fair, and only 55 (13.9%) as excellent. There was a significant difference between men and women (P<0.001). The percentages of responses to this question among men and women were as follows: 8.7% and 4.6% classified their health as bad or very poor, 62.3% and 84.8% as regular, and 29% and 10.6% as excellent (P<0.001), respectively. Regarding sleep, 259 university students (65.2%) reported sleeping well, 98 (24.7%) reported difficulty falling asleep, and 40 (10.1%) reported poor sleep quality. There were no significant differences between men and women (P=0.453). The average number of hours of sleep per night was 6.7 ± 1.2 hours, with no significant differences between men and women (6.5 ± 1.2; 6.8 ± 1.2 hours, respectively, P=0.080). University students were also asked about waking up tired, with the feeling that their sleep was not restful, and 263 (66.2%) said they had this feeling. There were no significant differences between men and women (P=0.448).

The assessment of the applicability of the data to factor analysis using the KMO coefficient (0.891) and Bartlett's sphericity test (P<0.001) demonstrated efficient confidence in the analysis of dietary patterns using this method. All criteria necessary for the use of factor analysis, as described in the methodology, were met.

When identifying dietary patterns through PCA, 2 distinct dietary patterns were identified, which were subsequently named Western and healthy dietary patterns, using common definitions in other studies. Together,

these two dietary patterns explained 41.3% of the variance in the data, which was acceptable for dietary profile identification studies. The food groups that contributed to its composition by obtaining values greater than 0.300 and presenting a predominance of factorial loading in a specific pattern are listed in Table 3.

Western dietary pattern pastries and fried foods; breads, cookies, and sweet breakfast cereals; sausages; sweets and desserts; artificial drinks; alcoholic beverages; pastas; viscera; margarine and mayonnaise; fats of animal origin.
Healthy eating pattern non-leafy vegetables; leafy vegetables; fruits; white meat and seafood; eggs; red meat; legumes; natural juices; oil; breads, crackers, and savory breakfast cereals; tubers and cereals; oilseeds; milk and dairy products.

Table 3. Distribution of factor loadings[#] of dietary patterns among university students. Belo Horizonte, Brazil, 2023. (Continued)

Food or food group	Western dietary pattern (n=214)	Healthy dietary pattern (n=183)
Pastry and fried foods	**0.794**	0.153
Sweet breads, biscuits, and breakfast cereals	**0.764**	0.044
Sausages	**0.760**	0.259
Sweets and desserts	**0.707**	0.224
Artificial beverages	**0.681**	0.001
Alcoholic beverages	**0.668**	0.143
Pastas	**0.591**	0.230
Viscera	**0.479**	0.162
Margarines and mayonnaise	**0.463**	0.175
Fats of animal origin	**0.426**	0.334
Coffee and tea	0.237	0.214
Non-leafy vegetables	0.100	**0.816**
Leafy vegetables	0.029	**0.794**
Fruits	0.232	**0.696**
White meats and seafood	0.228	**0.674**
Eggs	0.138	**0.625**
Red meat	0.328	**0.514**
Legumes	0.187	**0.491**
Fresh fruit juices	0.363	**0.485**
Olive oil	- 0.246	**0.479**
Savory breads, biscuits, and breakfast cereals	0.385	**0.473**

(Conclusion)

Food or food group	Western dietary pattern (n=214)	Healthy dietary pattern (n=183)
Tubers and cereals	0.450	**0.466**
Nuts	0.247	**0.388**
Dairy products	0.209	**0.360**
% Variance	31.0%	10.3%
% Accumulated variance	31.0%	41.3%

Note: [#]: Factor loadings ≥0.3 are significant for the pattern. When a food group is significant for both standards, it was considered in the standard where it contributes the most (highest value). The groups that contributed to each pattern are bolded.

Based on their predominant dietary pattern, 214 (53.9%) were categorized into the Western dietary pattern and 183 (46.1%) were categorized into the healthy dietary pattern, with no differences in distribution between men and women (P= 0.631) (Figure 1).

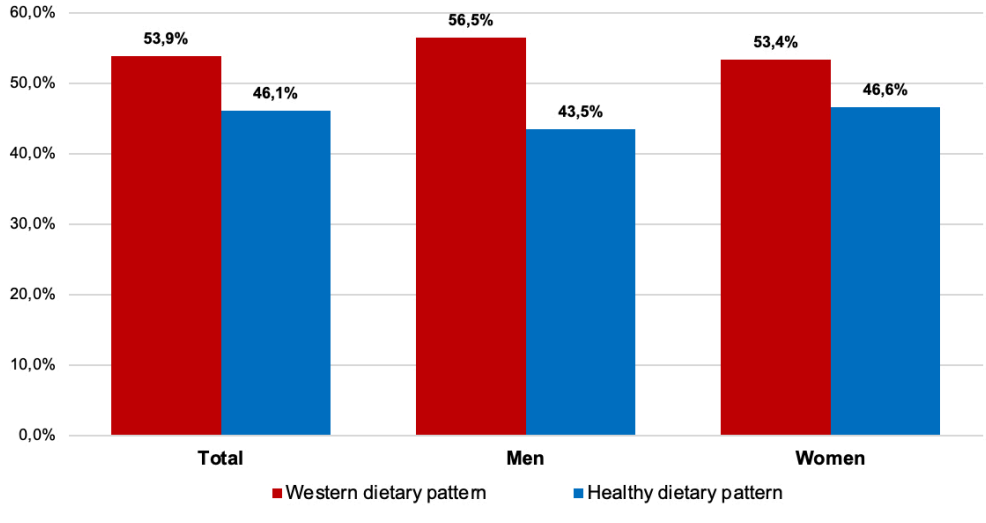

Figure 1. Total and gender distribution of university students regarding the predominance of contribution to dietary patterns. Belo Horizonte (MG), Brazil, 2023.

Legend: There was no difference between men and women (P=0.631).

Regarding the distribution of students between the institution's undergraduate courses regarding the predominance of contribution to dietary patterns, there was a statistical difference between the courses (P<0.001), in which a greater prevalence of the healthy pattern as a percentage was observed only in the undergraduate courses. nutrition and pharmacy. Figure 2 shows a comparison of the courses in terms of dietary patterns.

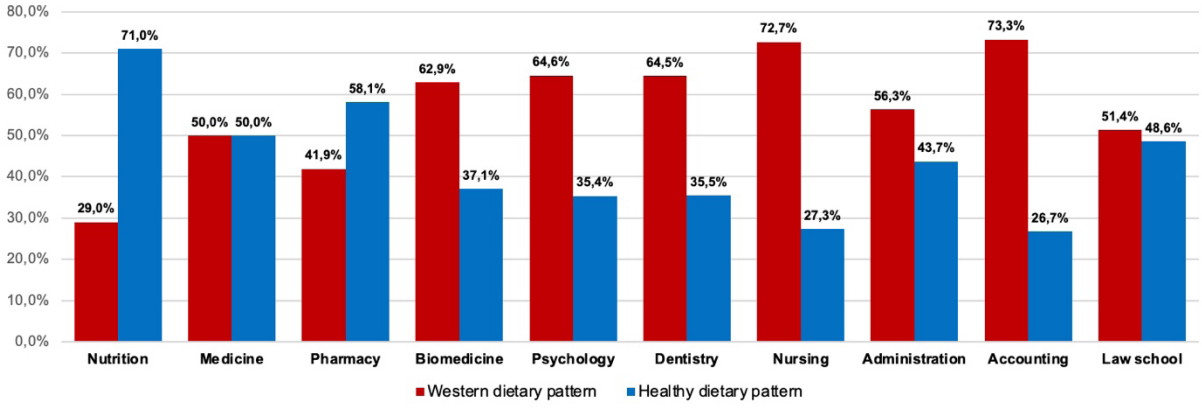

Figure 2. Distribution of university students regarding the predominance of contributions to dietary patterns by undergraduate course. Belo Horizonte (MG), Brazil, 2023.

Legend: There was a difference between the courses (P<0.001).

All variables from the sample characterization research were also tested to compare Western and healthy eating patterns to verify possible differences. There were no differences regarding age (P=0.897), sex (P=0.631), marital status (P=0.570), per capita income (P=0.963), weight (P=0.519), height (P=0.354), BMI (P=0.931), BMI categories (P=0.265), alcohol consumption (P=0.056), smoking (P=0.485) and hours of sleep per night (P=0.679). However, there were differences in health, eating, and sleep characteristics (Table 4). This finding demonstrates and reinforces the importance of adherence to healthy eating patterns. From these results, it was observed that the majority (>50%) of those who followed the Western dietary pattern were sedentary, while the majority of those who had a healthy eating pattern exercised three or more times a week (P<0.001). Likewise, those who had a healthy eating pattern had a higher self-perceived health rating (excellent, sleeping better, and waking up less tired) (Table 4).

Table 4. General and anthropometric characteristics of university students comparing the two dietary patterns identified. Belo Horizonte, Brazil, 2023.

Characteristics	Western dietary pattern (n=214)	Healthy dietary pattern (n=183)	*P-value*[#]
Age (years)			
Mean ± DP	24.6 ± 6.7	24.5 ± 7.3	0.897
Gender – n (%)			0.631
Men	39 (18.2%)	30 (16.4%)	
Women	175 (81.8%)	153 (83.6%)	
Height (m)			
Mean ± DP	1.65 ± 0.08	1.64 ± 0.08	0.354
Weight (kg)			
Mean ± DP	66.3 ± 14.1	65.3 ± 14.2	0.519
BMI (kg/m²)			
Mean ± DP	24.1 ± 4.1	24.1 ± 4.7	0.931
BMI categorization – n (%)			0.265
Low weight (BMI < 18.5 kg/m²)	14 (6.5%)	9 (4.9%)	
Normal weight (18.5 ≤ BMI < 25.0 kg/m²)	119 (55.6%)	116 (63.4%)	
Overweight (25.0 ≤ BMI < 30.0 kg/m²)	62 (29.0%)	39 (21.3%)	
Obesity (BMI ≥ 30.0 kg/m²)	19 (8.9%)	19 (10.4%)	
Physical activity (minimum 30 minutes) – n (%)			**<0.001**
Sedentary	113 (52.8%)	45 (24.6%)	
Once or twice a week	48 (22.4%)	30 (16.4%)	
Three to five times a week	44 (20.6%)	69 (37.7%)	
More than five times a week	9 (4.2%)	39 (21.3%)	
How do you consider your health? – n (%)			**0.003**
Bad or terrible	15 (7.0%)	6 (3.3%)	
Fair	180 (84.1%)	141 (77.0%)	
Excellent	19 (8.9%)	36 (19.7%)	
How do you classify your sleep? – n (%)			**0.049**
Sleeping well	128 (59.8%)	131 (71.6%)	
Difficulty falling asleep	61 (28.5%)	37 (20.2%)	
Poor sleep quality	25 (11.7%)	15 (8.2%)	
Do you wake up tired? – n (%)			**0.009**
Yes	154 (72.0%)	109 (59.6%)	
No	60 (28.0%)	74 (40.4%)	
Hours of sleep per night (hours)			
Mean ± DP	6.7 ± 1.1	6.8 ± 1.2	0.679

Note: BMI: body mass index; SD: standard deviation; kg: kilogram; m: meter; #: Student's t-test for independent samples with normal distribution and Pearson's Chi-square test or Fisher's exact test for categorical variables.

In the correlation analysis, no associations were observed between the two dietary patterns identified in this study and age (r= -0.007, P=0.897), sex (r=0.024; P=0.632), weight (r= -0.032; P=0.519), height (r= -0.047; P=0.354), or BMI (r= -0.004; P=0.931). A positive association was found between age and body weight (r=0.172; P=0.001) and BMI (r=0.189; P<0.001), and a negative association between age and the number of hours asleep per night (r= -0.143; P=0.005).

DISCUSSION

This study demonstrated a high prevalence of university students with Western (unhealthy) eating patterns. Furthermore, students who had a healthy eating pattern had a higher rating; health perception were excellent, sleeping better, waking up less tired, and practicing more physical exercise.

In dietary pattern research, it is common to observe differences in the number of patterns identified. As the analysis is "a posteriori," that is, the statistical treatment identifies possible patterns of association, it is common to observe differences in number and even in the classification of the pattern name. In the present study, two eating patterns were identified, which were classified as healthy and western (unhealthy). These two classifications have also been reported in some studies[19,20]. However, other studies have identified three or more patterns that, in most cases, are called healthy patterns, mixed patterns, diet patterns, traditional patterns, and unsatisfactory patterns based on the characteristics of the foods present in each them[21,22,23, 24,25,26,27].

However, regardless of the number of patterns identified, it would be interesting to evaluate the extent to which these patterns explain the variance in the data. In the present study, the two identified patterns accounted for 41.3% variance. This value is even higher than those observed in other studies. Antunes and collaborators[23] identified three patterns that explained 32% of the variance. Two other studies reported a value of 27.67% for the three identified patterns[26,27].

The unhealthy pattern was also more prevalent among university students in a study by Oliveira and collaborators[25]. In this study[25], the authors demonstrated a high frequency of the standard, which they called unsatisfactory, among university students as well as physical inactivity (below recommended) in 57% of students. In the present survey, almost 40% of university students, especially women, were classified as sedentary.

The present study included the following foods as contributors to the health standard: non-leafy and leafy vegetables, eggs, red and white meat, fruits, olive oil, natural juices, breads, biscuits, savory breakfast cereals, oilseeds, tubers, milk and dairy products, and cereals. These foods are different, in part, from the healthy standard in two other studies[26,27], which considered them healthy: fruits and juices, negative charges for coffee and tea, bread and pasta, red meat, cereals, legumes, vegetables, roots and tubers, and typical regional foods.

It is interesting to note that some foods made a significant contribution to both patterns, that is, factor loading > 0.3 in both identified patterns. This occurs, for example, in the case of red meat. It was included in the healthy pattern as its factor loading was higher in this group, but it also had a significant value in the Western (unhealthy) group. There is evidence that high consumption of red meat and processed meat may be associated with an increase in total mortality, mortality from cardiovascular diseases, and even some types of cancer (breast cancer and gastric tumors)[28,29]. However, it is important to highlight that the present study did not evaluate the amount ingested, nor did it evaluate whether the red meat consumed was made up of leaner or fattier cuts; therefore, it may have been present in both groups.

Regarding the contribution of students from each course to the study, we observed that nutrition and pharmacy students had a higher prevalence of students in the healthy dietary pattern, while medicine and law students obtained similar percentage results for both dietary patterns. In contrast, students from other courses demonstrated a higher prevalence of a Western diet, especially the accounting sciences course, which had a percentage of 73.3%. This suggests that, perhaps, in some courses, such as nutrition, medicine, and pharmacy, individuals are a little more concerned about their food choices, since the training process in the health area causes people to have different perceptions of what is beneficial, but other health courses are still observed with different results.

Despite all this, many students in these courses still have predominantly unhealthy eating patterns, which reinforces the need to discuss the impact and importance of a healthy diet on their health and academic performance. Reuter, Forster, and Brister[30] demonstrated that healthy eating habits have positive effects on the academic performance of university students, while a fast-food diet has negative effects. Another study[31] demonstrated that adherence to a healthy eating pattern, such as the Mediterranean diet, by university students promoted better academic performance and quality of life, in addition to physical and mental health. Furthermore, the authors demonstrated that most university students, even nutrition and medical students, have limited knowledge of healthy eating habits[31].

A study[32] carried out with 407 university students in the city of Belo Horizonte, MG, Brazil, showed that 40.3% were classified as overweight, and 25.6% said they had an unhealthy diet. Furthermore, the authors observed that 35.6% had risk behaviors for eating disorders, and 39.1% had severe concerns about body image. These data reinforce the importance of investigating and seeking alternatives to ensure better health and quality of life in this population, which are closely associated with changes in mental health.

In addition to being risk factors for the development of clinical conditions that affect health, Western dietary patterns are also associated with sleep. In the present study, the healthy eating pattern group had a higher percentage of volunteers who slept better than those with unhealthy eating patterns. According to Gonçalves and Hass[33], sleeping 7 to 8 hours a night improves quality of life because sleep is considered a very important modulator of metabolism and is directly related to the regulation of glucose and appetite. Furthermore, having an unregulated sleep routine is associated with unregulated and inadequate food consumption[33].

In a study[34] of 253 university students, the authors highlighted the need to pay attention to the health habits of university students with a high prevalence of alcohol consumption, illicit drugs, in addition to inadequate eating habits. These habits need to be changed with disease prevention in mind, as there is also an increase in obesity, overweight, and chronic noncommunicable diseases in this population of university students[34].

As practical implications of this study, by understanding the situation of students, it is possible to seek ways to help them, making the academic journey a safe process that adds to this interpersonal transition and brings autonomy safely, both in terms of nutrition and in general. in health conditions. The inclusion of preventive actions in the academic environment, such as institutional health promotion campaigns, is essential because of the poor habits of this population[35]. The institution, in partnership with the Nutrition Department, can create scientific events, lectures, and actions with the academic community that demonstrate the importance of a healthy diet for preventing diseases and improving academic performance. In this way, it is possible to encourage better eating and health habits to prevent chronic non-communicable diseases, such as diabetes, hypertension, and dyslipidemia,

since there is an association between unhealthy eating patterns and the development of these diseases[24].

This study had some limitations. It is important to highlight that this study was performed using an online questionnaire created on the Google Forms platform and made available to students who were willing to participate in this study as volunteers. In this way, it is known that some results observed are the result of self-perception of the items covered in the form, making some responses subjective. Another limitation is the non-randomized sample, which comprised all students who agreed to participate in the study. However, although this is a limitation, this study used a sample size calculation, and the number of respondents was higher than the minimum necessary. All students at the institution received the questionnaire and were invited to participate in the survey via email. Another possible limitation is the use of the FFQ as an instrument. The limitation in this case is associated with the method, since the FFQ, although widely used, has limitations, such as the respondent's dependence on memory. However, despite these limitations, this study has the value of having carried out a representative sample calculation of the institution's students and of using statistical methodology to identify the dietary pattern that is most accepted and used in scientific studies.

CONCLUSION

This study demonstrated a high prevalence of unhealthy Western eating patterns among university students. Courses in health areas, such as nutrition and pharmacy, showed a higher prevalence of students with healthy eating patterns, although individuals from these courses still had Western eating patterns. These results highlight the importance of performing institutional actions or campaigns to reinforce the impact and importance of a healthy diet on the health, quality of life, and academic performance of university students.

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Received: 18 dec. 2023
Accepted: 16 mar. 2024