FOOD AND NUTRITION IN COLLECTIVE HEALTH
DOI: 10.12957/demetra.2025.84395

DEMETRA
Alimentação, Nutrição & Saúde

e-ISSN:2238-913X

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This article originated from the dissertation entitled "Associação de padrões alimentares do jantar com o índice de massa corporal em estudantes universitários", authored by Kimberlly Lauraine Dias Soares Silva and supervised by Márcia Gonçalves Ferreira, presented to Federal University of Mato Grosso (Universidade Federal de Mato Grosso), year of publication, 2023, Cuiabá, MT, Brazil.

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Assistant Editor
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Dinner meal pattern is associated with lower body mass index in university students

O padrão do jantar está associado ao IMC em estudantes universitários

Abstract

Introduction: Entering university is a period marked by changes in lifestyle behaviors, including eating habits and weight status. *Objective*: This study aimed to analyze the association between dietary patterns for dinner and body mass index among university students. *Methods*: A cross-sectional study was carried out with 685 male and female university students. Demographic, socioeconomic, and lifestyle data were collected using a self-administered questionnaire. Food intake was assessed by 24-hour dietary recall. Three dietary patterns for dinner were identified in a previous study, using factor analysis with extraction by the principal component method. Dinner was defined as the meal consumed between 5 and 8 p.m. Weight and height were assessed in all students. A generalized linear model with the Gamma family and log link was used to estimate the association of dietary patterns for dinner with BMI, according to socioeconomic status. *Results*: Among the respondents, 50.1% were males, 78.8% were aged between 16 and 19 years old, and 33.4% had the lowest socioeconomic statuses (C-D-E). The analyses showed an inverse association of the traditional Brazilian dietary pattern for dinner with BMI for the lowest socioeconomic statuses (β_{adj}= 0.93; 95% CI: 0.86;0.99). *Conclusions*: The dietary pattern for dinner which represented a traditional Brazilian meal, consisting of rice and beans, was associated with a lower BMI among students with lower socioeconomic statuses.

Keywords: Dietary patterns. Meals. Body Mass Index. University Students.

Resumo

Introdução: A entrada na universidade é um período marcado por mudanças nos comportamentos relacionados ao estilo de vida, incluindo os hábitos alimentares e o estado nutricional. *Objetivo*: Analisar a associação de padrões alimentares do jantar com o índice de massa corporal em estudantes universitários. *Métodos*: Estudo transversal com 685 estudantes universitários de ambos os sexos. Dados demográficos, socioeconômicos e de estilo de vida foram coletados por questionário autoaplicado. O consumo alimentar foi avaliado por meio de recordatório alimentar de 24 horas. Três padrões alimentares para o jantar foram identificados previamente, utilizando análise fatorial com extração pelo método dos componentes principais. O jantar foi

definido como a refeição consumida entre 17h e 20h. Os estudantes foram submetidos à avaliação antropométrica da massa corporal e estatura. Modelo linear generalizado com ligação logarítmica e família gama foi usado para estimar a associação dos padrões alimentares do jantar com o IMC, segundo a classe econômica. *Resultados*: Do total de participantes 50,1% eram do sexo masculino e 33,4% pertenciam às classes econômicas mais baixas (C, D e E). As análises mostraram associação inversa do padrão alimentar brasileiro tradicional no jantar com o IMC nas classes socioeconômicas mais baixas (βaj = 0,93; IC 95%: 0,86; 0,99). *Conclusões*: O padrão alimentar no jantar representando uma refeição brasileira tradicional, composta por arroz e feijão, foi associado a menor IMC entre estudantes de menor nível socioeconômico.

Palavras-chave: Padrões alimentares. Refeições. Índice de Massa Corporal. Estudantes universitários.

INTRODUCTION

During the transition from adolescence to adulthood, many young people enter university, and this period of life is marked by important and unhealthy changes in lifestyle-relatedbehaviors,[1-3] including eating habits.[4,5] These changes in lifestyle may lead to weight gain, especially in the first year.[6]

Changes in students' eating habits are also influenced by the food environment that students find on campus, as reported by a study conducted with students who participated in the present study and that identified the dietary patterns of the three main meals (breakfast, lunch, and dinner) of Brazilian university students.[7]

The assessment of dietary patterns for meals has been used for analysis of food consumption and has the advantage of considering the effect of combinations between nutrients during food intake, which enables the design of more targeted nutritional interventions.[8] Furthermore, according to Schwedhelm et al.,[9] the dietary patterns of one single meal appear to be representative of global dietary patterns.

The Dietary Guidelines for the Brazilian Population consider dinner one of the main meals of the day, and the intake of unprocessed or minimally processed foods is encouraged in this meal as a strategy to promote adequate and healthy eating.[10] Among university students, however, this meal is often skipped, which is a habit associated with weight gain. Data from a longitudinal study of Japanese university students showed that skipping dinner is associated with body weight gain. The incidence of increased body adiposity was 1.42 (CI95%: 1.02-1.98) for women and 1.67 (CI95%: 1.33-2.09) for men.[11]

Studies have been carried out in different countries to assess the increase in body adiposity among university students.[4,12] University students have unhealthy eating habits, with specific characteristics that reflect the university environment, where there is a predominance of ultra-processed foods, such as snacks, sweets, soft drinks, and alcoholic beverages,[5,13] and this context contributes to weight gain.[4] Furthermore, the habit of skipping main meals has been associated with excess weight in this population.[11,14]

In this sense, university canteens in Brazil play a role in promoting healthy eating and preventing unwanted weight gain among students, especially among low-income ones, since they offer nutritionally-balanced meals for free or at a very low cost.[15]

Thus, the present study aimed to analyze the association of dietary patterns for dinner with body mass index among students participating in the Longitudinal Study on the Lifestyle and Health of University Students (ELESEU).

METHODS

Population and study design

This is a cross-sectional study with baseline data from the Longitudinal Study on the Lifestyle and Health of University Students (ELESEU), a dynamic cohort of male and female university students aged up to 25 years old, starting full-time degree programs at a government-funded university between 2015 and 2018.[16]

The students starting university in 2016 and 2017 participated in the present study. There was a total of 1,228 eligible students, of whom 4.6% (n=57) refused to participate and 4.7% (n=58) did not answer the questionnaire. Therefore, there was a total of 1,113 students. Food intake was assessed in a convenience subsample of 685 students (61.5%) represented proportionally among the 21 courses

evaluated. The sample size was estimated to evaluate food consumption, considering a significance level of 5 and power of 80%, with proportions of 0.50, allowing for the analysis of different outcomes.[7]

Data collection and covariates

A semi-structured and self-administered questionnaire was used to collect information on sociodemographic and economic conditions and lifestyle behaviors. Age was recorded in complete years and analyzed in age groups of 16-19 years (adolescents) and 20-25 years (young adults). Socioeconomic status was evaluated according to the criteria of the Brazilian Association of Research Companies (ABEP) whose categories range from A (highest) to E (lowest). In the analysis, the C-D-E categories were grouped, representing the lowest socioeconomic statuses.[17]

Assessment of alcoholic beverage consumption was based on the intake of at least one glass or one dose of alcoholic beverages in the last 30 days.[18] Smoking was assessed using the question "on average, how many cigarettes do you smoke in a day?". Any student who had smoked at least one cigarette in the last 30 days was considered to be a smoker.[19]

Sedentary behavior was assessed through the question "In general, how many hours a day do you spend watching television/playing computer games/video games/mobile games?". Answers were categorized for analysis into 'up to 2 hours' and 'more than 2 hours' of screen time.[20]

Short sleep duration was detected by the question "Over the last month, how many hours did you sleep per night?". For students aged 18 years and over, short sleep duration was considered to occur when they reported 6 hours of sleep or less per night, while for those under 18 years of age, when the total number of hours of sleep was less than or equal to 7 hours.[21]

Perceived stress was assessed using the 10-item version of the Perceived Stress Scale - PSS, previously validated for the Brazilian population.[22] The instrument is answered on a 5-item Likert scale, ranging from 0 (never) to 4 (very often), totaling 40 points. Answers were categorized as mild (≤ 13 points), moderate (between 14 and 19 points), and high (≥ 20 points).[23]

Independent variables

The independent variables of the present study were university students' dietary patterns for dinner, determined in a previous study,[7] namely "Beans, rice and processed juice", "White bread and butter/margarine" and "White meat, eggs, and natural juice" (Table 1). They were based on food intake assessed among 596 participants, using a 24-hour Food Recall that was applied by trained interviewers and included weekdays, weekends, and holidays. Dinner was defined as the meal eaten between 5 and 8 p.m. Dinner time was set based on the opening hours of the university canteen. This definition took into account that the time coincides with the breaks between classes for full-time courses and also with the time at which the Brazilian population usually eats this meal.[7] When a student mentioned more than one meal at this time interval, the eating occasion with the highest intake of energy was considered as dinner.[24]

Table 1.Rotated Factor Matrix and estimated factor loadings and communalities (h^2), for dinner dietary patterns (n=596). Cuiabá-MT, 2016-2017.

Food group	Beans, rice and artificial juice	White bread, butter and margarine	White meat, eggs and natural juice	h^2
Beans	**0.747**	-0.224	0.099	0.618
Rice	**0.682**	-0.222	0.238	0.571
Artificial juice	**0.519**	-0.084	-0.233	0.331
Red meat	**0.494**	0.050	-0.076	0.253
Vegetables	**0.447**	-0.046	-0.003	0.202
Cakes and cookies	**-0.349**	-0.113	-0.158	0.159
Savory snacks	**-0.299**	-0.120	-0.086	0.111
White bread	-0.045	**0.786**	-0.041	0.621
Butter and margarine	-0.050	**0.682**	0.024	0.468
Sausages	-0.033	**0.595**	-0.045	0.357
Cheese	0.069	**0.350**	-0.020	0.128
Soft drinks	-0.248	**0.295**	0.122	0.164
White meat	0.017	-0.072	**0.703**	0.500
Eggs	-0.073	0.075	**0.599**	0.370
Natural juice	0.113	0.024	**0.299**	0.102
Desserts	0.097	0.025	**-0.379**	0.154
Milk and yogurt	-0.157	0.040	**-0.366**	0.160
% of explained variance	14.2	8.8	8.0	
% of accumulated variance	14.2	23.0	31.0	
KMO	0.624			

KMO, Kaiser-Meyer-Olkin

Food items recorded in the 24hR were grouped based on their nutritional similarity. Frequently reported foods, such as rice and beans, were not grouped. Food items or food groups eaten by less than 5% of students were excluded or regrouped. In total, 318 items were recorded for dinner, and organized into 17 groups.[7] Exploratory factor analysis with extraction by the principal component method[25] was used to determine eating patterns for dinner.[7]

Dependent variable and measurements

Body mass was measured using a TANITA UM-080 body composition analyzer with a capacity for 150 kg and variation of 0.1 Kg. Height was measured in duplicate using a portable Sanny ES 2040 stadiometer, with a maximum length of 210 centimeters and a variation of 1 mm. The mean of the two height measurements was considered the final height. Body mass and height were measured using standardized techniques.[26] BMI (body mass/height^2) was the dependent variable of the study, and it was used for the classification of weight status.

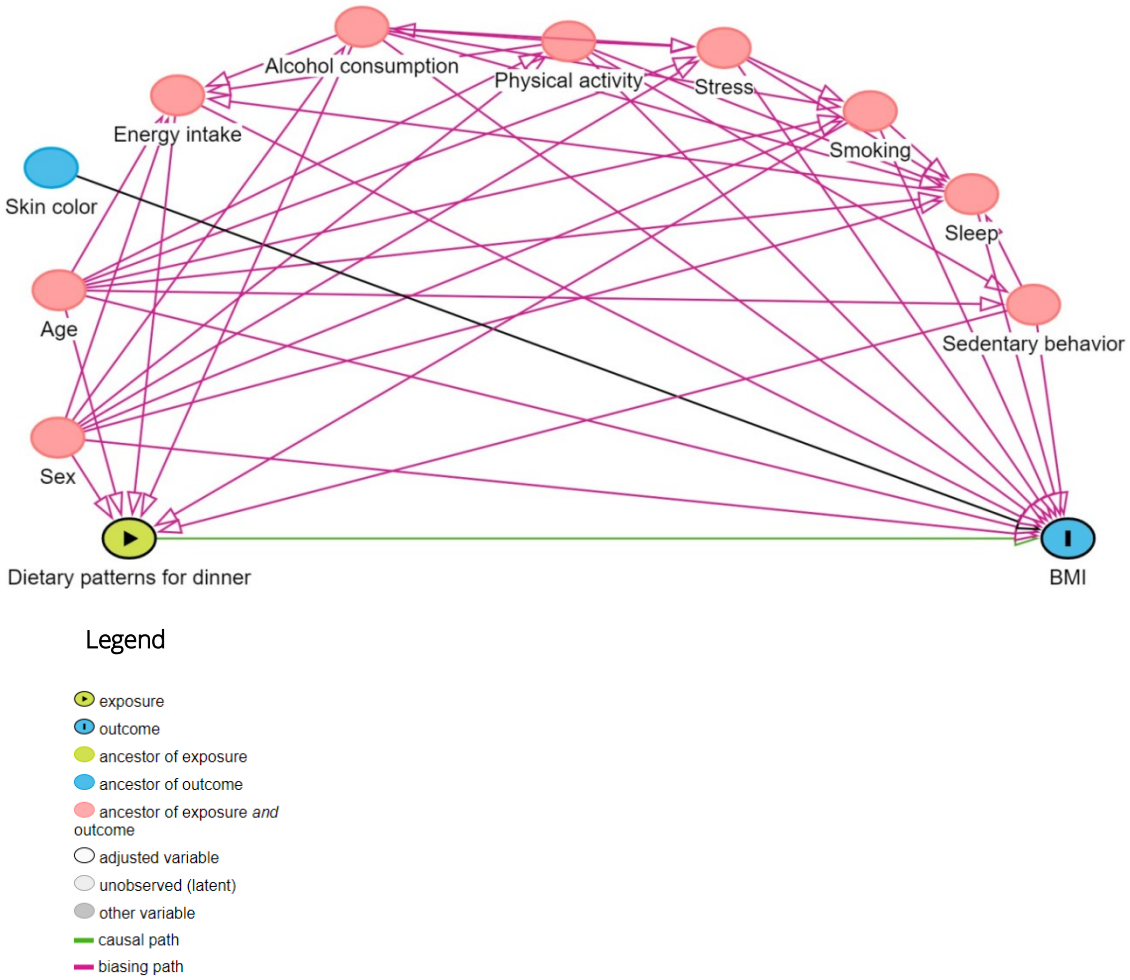
For adolescents (16-19 yo), the BMI cut-off points expressed as z-score were: underweight (< -2); normal weight (≥ -2 and ≤ +1); overweight (>+1 and ≤ +2); and obesity (> +2).[27] For adults, the BMI cut-off points were: < 18.5 kg/m^2 (underweight); ≥ 18.5 and < 25.0 kg/m^2 (normal weight); ≥ 25.0 and < 30.0 kg/m^2 (overweight); and ≥ 30.0 kg/m^2 (obesity), as recommended by WHO.[28]

Statistical analysis

Statistical analyses were stratified by socioeconomic status. The associations of dietary patterns for dinner and body mass index were estimated by using the regression coefficient of the adjusted generalized linear model with log link and gamma family and their respective 95% confidence intervals (95%CI). For the statistical analyses, the Stata program version 11 was used.

Considering the conceptual theoretical model that explains the association between exposure (Dietary patterns for dinner) and outcome (BMI) analyzed in this study, the Directed Acyclic Graphs (DAG) wereconstructed to identify the confounding variables, as shown in Figure 1. Variables identified as confounding variables were used to adjust the final models. To build the DAG, the DAGitty® version 3.0 program was used, a browser-based virtual environment to create, edit, and analyze causal models.[29]

Figure 1. Directed Acyclic Graphs (DAG) for the association between dietary patterns for dinner and Body Mass Index.



Ethical aspects

The research project was approved by the Research Ethics Committee of the Júlio Muller University Hospital of the Federal University of Mato Grosso - technical report no. 1,006,048, of 03/31/2015. Participants were informed about the purpose of the study, and data collection began after they had signed a Free and Informed Consent Form.

RESULTS

A total of 685 university students participated in the study. Of the total number of participants, 78.8% were aged between 16 and 19 years old, 50.1% were male, and 48.7% belonged to socioeconomic status "B". The majority reported having non-white skin color.

Alcoholic beverage consumption was reported by 50.8% of students while 12.4% reported smoking over the last 30 days. About 57% of the students reported doing less physical activity after entering university and 24.1% were classified as having sedentary behavior. The proportion of excess weight was 22.4% (Table 2).

Table 2. Distribution of the university students according to sociodemographic, economic, lifestyle variables and weight status (n=685). Cuiabá-MT, 2016-2017.

Variables	n	%
Sex		
Female	342	49.9
Male	343	50.1
Age group (years)		
20-25	145	21.2
16-19	540	78.8
Economic class[1]		
A	121	17.9
B	328	48.7
C, D and E	225	33.4
Skin color		
White	267	39.2
Non-white	414	60.8
Alcohol consumption[2]		
No	288	42.0
Yes	397	58.0
Smoking status[3]		
No	587	87.6
Yes	83	12.4
Perception of change in physical activity		
Decreased	391	57.1
Increased	156	22.8
Maintained	138	20.1
Sedentary behavior[4]		
No	519	75.9
Yes	165	24.1
Weight status[5]		
Underweight/normal weight	531	77.6
Overweight/obesity (Excess weight)	153	22.4

[1]ABEP, 2015; [2]Moura e Malta, 2011; [3]WHO, 1998; [4]WHO, 2010; [5]WHO, 1995, 2007. Missing values: Economic class: 11; Skin color: 4; Smoking status: 15; Sedentary behavior: 1.

When the association of adherence to dietary patterns for dinner with BMI was assessed, it was found that, among students with lower socioeconomic statuses, those in the third tertile of the "Beans, rice and processed juice" pattern had a lower body mass index. (β_{aj} =0.93; 95% CI: 0.86- 0.99). The other dietary patterns identified for dinner were not associated with BMI (Table 3).

Table 3. Crude (β_c) and adjusted (β_{adj}) regression coefficient for the association of dinner dietary pattern scores and BMI, stratified by economic class. Cuiabá-MT, 2016-2017.

	Economic class A				Economic class B				Economic class C, D and E			
Dinner Dietary Pattern	β_c	CI (95%)	β_{adj}	CI (95%)	β_c	CI (95%)	β_{adj}	CI (95%)	β_c	CI (95%)	β_{adj}	CI (95%)
Beans, rice and artificial juice [A]												
1st tertile	1		1		1		1		1		1	
2nd te rtile	1.01	0.93-1.09	1.01	0.93-1.09	1.01	0.95-1.06	1.01	0.96-1.06	0.98	0.90-1.06	0.96	0.89-1.04
3rd tertile	1.01	0.93-1.09	1.01	0.93-1.10	0.99	0.94-1.05	0.98	0.93-1.04	0.93	0.86-0.99	**0.91**	**0.84-0.98**
White bread, butter and margarine [B]												
1st tertile	1		1		1		1		1		1	
2nd tertile	0.94	0.87-1.02	0.96	0.89-1.04	1.02	0.97-1.07	1.04	0.99-1.10	0.99	0.93-1.07	1.01	0.94-1.09
3rd tertile	0.94	0.87-1.02	0.99	0.91-1.09	1.02	0.97-1.08	1.04	0.98-1.10	1.06	0.98-1.13	1.06	0.99-1.14
White meat, eggs and natural juice [C]												
1st tertile	1		1		1		1		1		1	
2nd tertile	0.99	0.92-1.08	1.01	0.93-1.10	1.04	0.99-1.10	1.04	0.98-1.10	1.01	0.94-1.09	0.99	0.93-1.08
3rd tertile	0.97	0.89-1.05	1.01	0.92-1.11	0.98	0.93-1.03	0.97	0.92-1.02	1.06	0.99-1.14	1.05	0.97-1.13

Dinner Dietary Pattern A-B-C: Final models adjusted for sex, age group, perception of change in physical activity, alcohol consumption, smoking status, sedentary behavior, short sleep duration, perceived stress and energy consumption.

DISCUSSION

In this study, students from socioeconomic statuses C, D and E in the third tertile of the dietary pattern for dinner, namely "Beans, rice and processed juice", had lower BMI values when compared to students in the first tertile. This dietary pattern was composed of rice, beans, beef, vegetables and processed juice; it showed negative loads for cakes and cookies and for snacks, and it explained 15% of the variability of food eaten by the students at dinner. The other dietary patterns for dinner were not associated with BMI.

The nutritional profile of this dietary pattern for dinner can be considered more adequate in comparison to the other dietary patterns identified in this study because it was composed mainly of unprocessed or minimally processed foods, which is consistent with Brazilian recommendations for a healthy dinner.[10,30] In addition, it contains foods from different food groups, thus striking a balance between providing nutrients in the meal and meeting people's daily dietary fiber needs. These characteristics may explain the inverse association found in this study between this dietary pattern and BMI.

Corroborating these findings, the global dietary pattern, characteristic of a traditional Brazilian diet, is protective against obesity in the general population.[31-34] As was also evidenced by the study by Santos et al.[35] with young adults, the results showed that the traditional Brazilian lunch pattern, also consisting of rice and beans, was inversely associated with BMI among insufficiently active individuals.

The balance in dietary macronutrient intake is associated with body weight, and dietary fibers act on satiety mechanisms, reducing food intake and preventing weight gain.[36] Upon entering university, students often replace a traditional meal at dinner with snacks or ready-to-eat foods,[5,37] most of which have poor nutritional quality and high levels of energy, fat and/or sugars.[30] This behavior has been associated with overweight and obesity,[38] which reinforces the importance of having a nutritionally balanced dinner. Studies have detailed the mechanism of association between skipping dinner and weight gain, including excessive calorie consumption due to positive appetite regulation after skipping dinner, leading to a high total energy intake[11] and the consumption of foods of low nutritional quality.[39]

University canteen can help students achieve this nutritional balance and, consequently, prevent weight gain. Having meals at university canteens was associated with a higher frequency of regular intake of beans, vegetables, raw vegetables, cooked vegetables and fruits, and a lower frequency of regular intake of French fries and/or fried snacks among students from a Brazilian government-funded university in the city of Rio de Janeiro.[40] In the present study, all food items that made up the dietary pattern "Beans, rice and processed juice" are served daily for dinner at the university canteen, with vegetables included.

In this study, 46.3% of university students ate dinner at the university canteen, and this proportion is greater than the onefound in a cross-sectional study carried out in Minas Gerais.[41] It is worth noting that a considerable proportion(57.6%) of students with lower socioeconomic status (classes C, D, E) in the present study have dinner at the university canteen, which allows us to consider that the foods consumed at dinnerin the university canteen may contribute, at least partially, to the dietary patterns for dinnerof low-income students. Perez et al.[40] showed that the proportion of students who replaced dinner with a snack was lower among regular users of the university canteen compared to non-users and occasional users at a university in Rio de Janeiro.[40] The provision of healthy meals at affordable prices is a fundamental element for low-income students to remain in higher education; in this way, the university canteen contributes to the promotion of healthy eating and also to food and nutritional security.

In this study, the protective effect of adherence to the third tertile of the "Beans, rice and processed juice" dietary pattern for dinner on BMI was found to occur only among students with lower socioeconomic

status. This result can be explained by the fact that, in addition to offering balanced and healthy meals, university canteens have the role of offering low-cost meals to university students.[15] Therefore, among economically disadvantaged students, university canteens can be their only opportunity to have full meals and avoid skipping or replacing large meals (lunch and dinner) with unhealthy snacks. In fact, in the study by Fonseca et al.,[7] which identified the dietary patterns for dinner used in the present study, students with lower socioeconomic statuses showed greater adherence to the dietary pattern "Beans, rice and processed juice" than those of the upper classes.

A study carried out at a university in the United States, where there was no university canteen, showed that first-year students with a low socioeconomic level consumed more unhealthy foods compared to those with a higher socioeconomic level.[42] The high cost of healthy food in snack bars was mentioned as one of the main barriers to healthy eating among university students in Germany.[43] These findings highlight the fact that the university canteen plays an important role in maintaining healthy eating habits among students with lower socioeconomic levels, as they offer healthy and balanced meals at a low cost. According to the Social Indicators Summary (SIS) of the Brazilian Institute of Geography and Statistics,[44] in 2019, 26.7% of students in government-funded universities were among the two-fifths of those with the lowest monthly income per capita, a proportion that was 17.0% in private universities. Therefore, access to university canteen may be a decisive factor to avoid student dropout in Brazilian government-funded universities.

Previous research has shown the importance of access to healthy food at universities. The study by Hartmann[45] with Brazilian university students showed that among low-income university students, intake of fruits and vegetables was higher during the week, when they had access to the university canteen when compared to students with higher socioeconomic status. However, on weekends, when there was no access to the university canteen, there was no difference in the intake of such foods between the groups. This finding suggests that the university canteen plays a role in encouraging healthy food consumption. The influence of socioeconomic status on food consumption was also shown in a study carried out with university students from Côte d'Ivoire, in which 33.3% of the participants reported financial difficulties as the reason for skipping meals.

In addition to access to low-cost meals, students can feel encouraged to have adequate eating practices by means of commensality when they eat meals together at dining halls in the university canteen. The study by Alves& Boog[46] showed that eating together with others positively changed the diet of university students; thus, the food environment at university canteens can be seen as an important tool to encourage healthy eating habits among students.

This study has some limitations, such as the convenience sample selection to answer the 24hR. However, further analysis showed that there were no differential losses between students who participated and those who did not participate in the food intake assessment (data not shown), regarding sociodemographic and economic characteristics and weight status.

Memory bias and under-reporting of consumption are significant challenges when assessing food consumption using 24hR, especially in overweight individuals. To minimize under-reporting of food consumption, the multiple-pass technique was adopted.[47] In addition, a photographic albumwith emphasis on the diet of the local population was used to ensure higher accuracy in the report about the type and amount of food consumed.[48]On the other hand, the use of the 24hR allows for the collection of detailed information on food consumption and is less influenced by systematic errors,[25] which is a strength of this study.

Finally, the findings of this study should be interpreted with caution, since the social, cultural, economic, and dietary context of students can vary between different universities, which limits the generalization of the results found in the study.

The study is innovative because it investigates the association between the dietary patterns of a single meal and BMI. The contribution of this study, which evaluated food intake from the perspective of meals, is the possibility of providing dietary information that can more objectively support the planning of interventions in food and nutrition education among university students. Given the scarcity of data in the literature, further studies should be carried out to better understand the relationship between dietary patterns of meals and body weight.

CONCLUSION

University students with lower socioeconomic statuses who showed greater adherence to the dietary pattern for dinner that is characteristic of a traditional Brazilian dinner, consisting of rice and beans, had a lower body mass index.

Considering the socioeconomic context, it is important tomaintain university canteens, which are spaces for the promotion of food and nutritional security.University canteens contribute to improving eating habits and keeping students at university.

The results of this study reinforce the need to implement food and nutritional education programs that encourage healthy eating at university, as well as university policies that promote healthy and accessible options of foods at the university campus.

ACKNOWLEDGMENTS

The authors appreciate the collaboration from the students who kindly agreed to participate in the study.

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Contributors

Silva KLDS contributed to the data collection, literature review, concept of the manuscript, writing, and critical revision of the manuscript for important intellectual content; Fonseca LB contributed to the manuscript concept, statistical analysis,writingof the manuscript, and critical revision for important intellectual content; de Souza APA, contributed to the interpretation of the results, writing of the manuscript and critical revision for important intellectual content; Ferreira MG contributed tothe concept and writing of the manuscript, critical revision of the manuscript for important intellectual content, and was responsible for designing the cohort study (ELESEU).All authors contributed to the interpretation of the results and approved the final version of the manuscript.

Conflict of Interest: The authors declare no conflict of interest.

Received: May 16, 2024
Accepted: April 13, 2024