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Dietary sources and intake of solid fats and added sugars among college students

Fontes alimentares e consumo de gorduras sólidas e açúcares adicionados entre estudantes universitários

Abstract

Objective: To identify the foods that most contributed to energy and solid fats and added sugars (SoFAS) intake in university students' diet and estimate their contribution to total energy consumption. *Methods*: Cross-sectional study with food intake assessed using a 24-hour dietary recall among freshmen university students of 2016, 2017, and 2018, from a public university in the Midwest Region of Brazil. The caloric participation of SoFAS and the food groups contribution to total energy and SoFAS intake were estimated. The analyses were stratified according to gender and economic class. *Results*: The total energy intake from SoFAS was 30% among the 1,063 evaluated students. The intake of saturated fat was higher among students of higher economic classes (12.4%) than those of the lower classes (11.0%). The top source of total energy were beef (12.2%), rice (7.7%), and beans/other legumes (6.9 %); of SoFAS were: sweets/desserts (14.7%), juices (11.6%), beef (9.8%), and soft drinks (9.7%). *Conclusion*: The intake of SoFAS was higher than the recommended limit, with a high contribution of sweetened drinks and ultra-processed foods.

Keywords: Food intake. Students. Universities.

Resumo

Objetivo: Identificar os alimentos que mais contribuíram para a ingestão de energia e de gorduras sólidas e açúcares adicionados (SoFAS) na dieta de estudantes universitários e estimar sua contribuição para o consumo total de energia. *Métodos*: Estudo transversal com avaliação da ingestão alimentar utilizando um recordatório dietético de 24 horas entre estudantes do primeiro ano universitário de 2016, 2017 e 2018, de uma universidade pública da Região Centro-Oeste do Brasil. Estimaram-se a participação calórica das SoFAS e a contribuição dos grupos de alimentos para a ingestão total de energia e SoFAS. As análises foram estratificadas de acordo com o gênero e a classe econômica. *Resultados*: A ingestão total de energia proveniente das SoFAS foi de 30% entre os 1.063 estudantes avaliados. A ingestão de gordura saturada foi maior entre os estudantes de classes econômicas mais altas (12,4%) do que entre aqueles de classes mais baixas (11,0%). As principais fontes de energia total foram carne bovina (12,2%), arroz (7,7%) e

feijão/leguminosas (6,9%); e das SoFAS foram: doces/sobremesas (14,7%), sucos (11,6%), carne bovina (9,8%) e refrigerantes (9,7%). *Conclusão*: A ingestão de SoFAS foi superior ao limite recomendado, com alta contribuição de bebidas adoçadas e alimentos ultraprocessados.

Palavras-chave: Ingestão alimentar. Estudantes. Universidades.

INTRODUCTION

Adolescents and young adults are priority groups for investments in health and well-being since health promotion actions in this phase of life and impact on individuals' current health can determine health in future life stages and affect the future generation of children.[1] The transition from high school to university usually occurs in this phase and can be challenging for many students. It is characterized by the development of routines, habits, and preferences that often persist throughout adulthood.[2]

Admission to higher education is usually marked by a transition from consuming home-made meals with parents to a reality in which university students must plan and prepare their meals.[3] Adopting unhealthy eating practices in this period contributes to weight gain and increases the risk of developing non-communicable diseases.[4,5]

Studies in different countries have shown that university students tend to adopt unfavorable eating habits in the first year of the course, including low consumption of fruits, vegetables, whole grains and vegetables, and the high consumption of ultra-processed foods, sugar, and alcohol.[5-7] The consumption of healthy and unhealthy food groups among university students varies between genders[7] and socioeconomic levels.[8]

Most ultra-processed foods provide energy from solid fats and added sugars (hereafter SoFAS), and are known to be associated with excess energy consumption and unhealthy eating patterns, with high-energy density.[9] Diets with a high SoFAS content are associated with obesity, cardiovascular disease, and type 2 Diabetes Mellitus.[10,11]

The Brazilian Society of Cardiology[12] recommends to adolescents and adults with a normal lipid profile an intake of less than 10% of the total energy consumption from saturated fatty acids and 1% of trans-fatty acids. Concerning added sugars, the World Health Organization recommends a level of less than 10% of total energy consumed for both adolescents and adults, ideally less than 5%.[13]

In Brazil, Pereira et al.[14] found that more than half of the total energy consumption derived from food with high levels of SoFAS, and is higher among adolescents than adults and older adults. However, little is known about the participation and food source of SoFAS among university students. Therefore, this study analyses the primary sources of SoFAS among Brazilian university students and estimates their contribution to total energy consumption.

METHODS

Cross-sectional study of a census nature using data from the "Longitudinal Study on the Lifestyle and Health of University Students" (ELESEU), with university students up to 25 years of age, enrolled in the 21 full-time courses of a public university in the Midwest Region of Brazil. We excluded from the study those who reported having completed another university course previously and who had a physical impairment that limited the performance of anthropometric measures and pregnant and lactating women. These criteria were established since the baseline research aims to evaluate the students included for the first time in the university environment to observe the changes in lifestyle and health indicators, including weight status, that occur in the transition between high school and higher education. More details about the ELESEU study are available in a previous publication.[15]

A self-administered questionnaire containing demographic, socioeconomic, and lifestyle information was used to collect data in the first semesters of 2016, 2017, and 2018.

A convenience sample of approximately 60% of the participants was invited to answer the 24-hour Food Record (R24h) to assess the students' dietary intake. The R24h was applied by trained interviewers in the first academic quarter of each year, including typical and atypical consumption days, such as weekends and holidays. The multiple pass method was used to minimize underreported food consumption[16]. Interviewers relied on a specific photo album for food surveys, containing photographs of food items commonly consumed in the region[17] to estimate portion sizes.

Students were encouraged to identify the foods and preparations during the interview, specifying all the ingredients and quantities of the preparations consumed, with details of the time and place of consumption. The interviewers verified the possibility of omitting some food items commonly overlooked in surveys of this nature, such as sauces, butter/margarine, candies, and other sweets from a list of foods and preparations available in the researcher's manual.

The R24h data was entered into a specific software for recording food consumption data, the ERICA-REC24h.[18] This software contained a list of foods built from the food and beverage acquisition database of the 2008-2009 Household Budget Survey (POF) conducted by the Brazilian Institute of Geography and Statistics.[19]

The 479 reported food items were categorized into 38 groups, considering the nutritional characteristics and reporting frequency,[20] and the final consumption (in grams) of each food group was estimated. Energy intake was estimated from the Table of the Nutritional Composition of Foods Consumed in Brazil.[21] Adolescent intake of supplements or medications has not been evaluated.

The regular consumption of sugar or sweetener by university students was assessed by a question asked before the R24h. When students reported that they habitually consumed sugar, an increase of 10g of sugar was established for each 100ml of fruit juice, coffee, coffee with milk, tea, and mate consumed. On the other hand, when reporting the regular consumption of both (sugar and sweetener), 5g of sugar was added for each 100ml of the drinks mentioned above.[20]

The R24h was used to perform the calculations related to the analysis of the population's mean energy consumption, the caloric participation of saturated fat, trans-fat, and added sugars, and the contribution of each food group to the total energy intake, for the sum of solid fats (saturated and trans-fat) and added sugars. We presented the twenty foods/food groups that most contributed to SoFAS intake, considering the sum of the energy value of solid fats and added sugars.

Gender (male/female) and students' economic class were considered for stratification of the analyses. The Brazilian Economic Classification Criterion of the Brazilian Association of Research Companies[22] was used to assess the economic class. It covers the assessment of consumer durables, the presence of a domestic worker, the family head's education level, and access to public services, such as running water and paved street. The university students were classified into six economic classes (A, B1, B2, C1, C2, D-E), where "Class A" was the highest and D-E, the lowest. Three categories were considered for the analyses: A, B, and C/D/E. The Statistical Analysis System (SAS) software version 9.3 was employed to perform the analyses.

The research project was approved by the Research Ethics Committee. All students who agreed to participate in the study signed the Informed Consent Form before data collection.

RESULTS

A total of 1,063 university students were evaluated, 50.2% of whom were female with a mean age of 18.7 years (79.1% between 16-19 years). As for distribution according to economic class, 16.5% belonged to class A, 48.6% to class B, and 34.9% to classes C/D/E.

The mean daily energy intake was 2,349 Kcal, higher in males (2,706 kcal) than females (1,999 Kcal), with no significant differences regarding economic class (Table 1).

Table 1. Mean and Confidence Interval of 95% (95% CI) of total energy and caloric contribution of saturated fat, trans, and added sugar (%) by gender and economic class, among university students. Cuiabá-MT, 2016, 2017 and 2018.

	Total		Male		Female	
	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)
Total energy (kcal ± DP)	2,349	2,276; 2,423	2,706	2,596; 2,815	1,999	1,910; 2,088
% Saturated fat	11.7	11.4; 12.0	11.6	11.3; 12.0	11.8	11.3; 12.3
% Trans fat	1.1	1.1; 1.2	1.2	1.1; 1.3	1.2	1.1; 1.3
% Added sugar	16.4	15.6; 17.2	15.8	14.8; 16.9	17.1	16.0; 18.3
% SoFAS	29.3	28.5; 30.0	28.7	27.7; 29.6	30.0	28.9; 31.2
	Class A		Class B		Classes C, D and E	
	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)
Total energy (kcal ± DP)	2,319	2,130; 2,509	2,430	2,314; 2,547	2,253	2,146; 2,360
% Saturated fat	12.4	11.6; 13.2	11.9	11.5; 12.4	11.0	10.5; 11.5
% Trans fat	1.1	0.9; 1.4	1.1	1.0; 1.2	1.2	1.1; 1.3
% Added sugar	16.1	13.6; 18.5	16.5	15.6; 17.6	16.4	15.1; 17.7
% SoFAS	29.7	27.4; 30.9	29.7	28.6; 30.7	28.7	27.4; 29.9

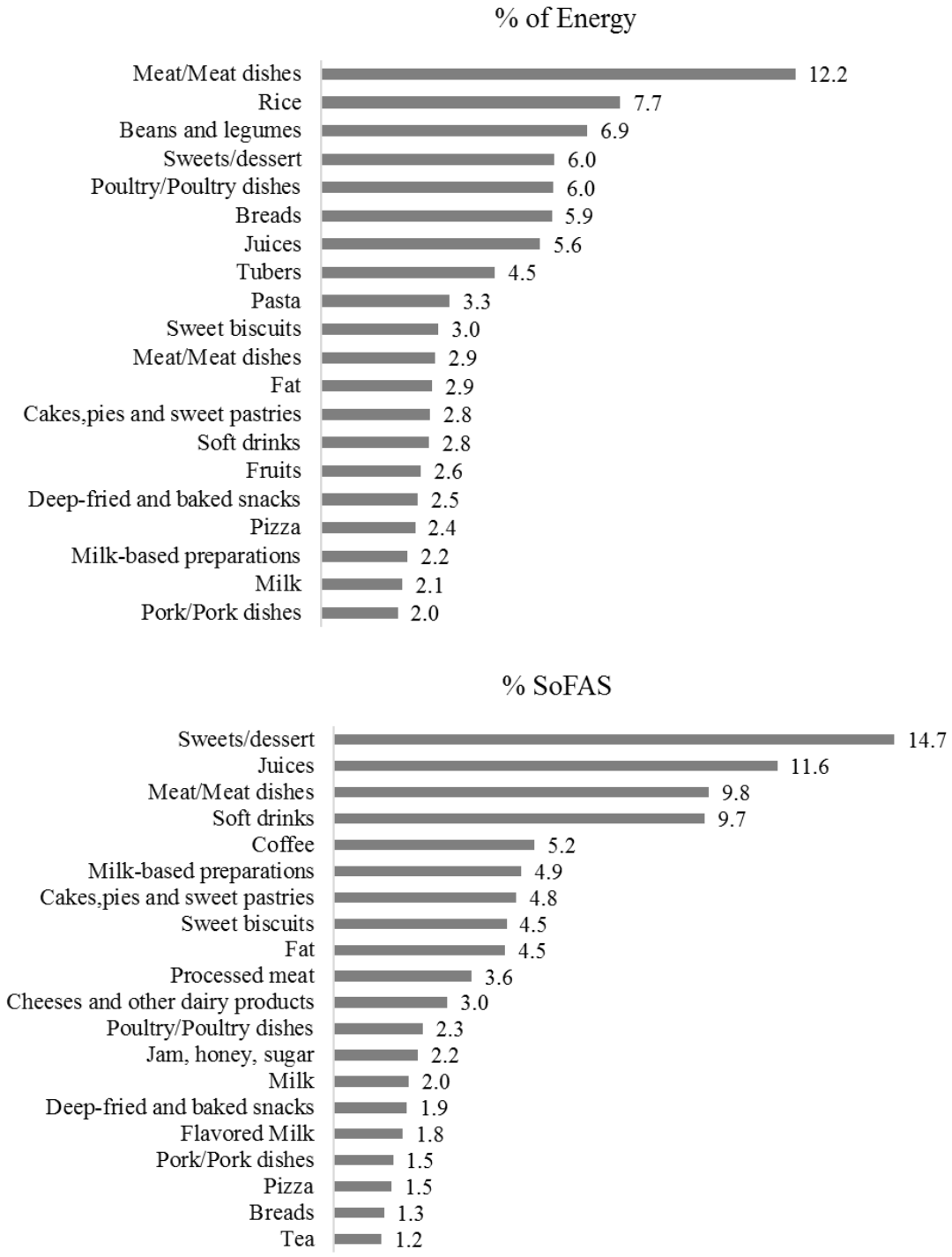
*Economic class by Brazil Criterion of the Brazilian Association of Research Companies (ABEP, 2015).

The caloric contribution of SoFAS to total dietary intake was around 30%, emphasizing the contribution of added sugars (16.4%). Individually, the consumption of saturated fat, trans-fat, and added sugars exceeded the recommended maximum limits (10%, 1%, and 10%, respectively), with no significant difference between genders. Significant difference was found for the intake of saturated fat, according to economic class (Table 1), with greater consumption among class A students (12.4%) than class C/D/E students (11.0 %).

As for the analysis of food groups (Figure 1), in general, the foods that contributed most to total energy consumption were: beef (12.2%), rice (7.7%), beans and other legumes (6.9 %), sweets and desserts (6.0%), and chicken (6.0%). The main food groups that contributed to the consumption of SoFAS were sweets and desserts (14.7%), juices and soft drinks (11.6%), beef (9.8%), soft drinks (9.7%), and coffee (5.2%). Among the top ten foods in the ranking of contribution to the consumption of SoFAS, three groups involve sweetened beverages (juices and soft drinks, soft drinks, and coffee), which together contributed to 26.4% of the total

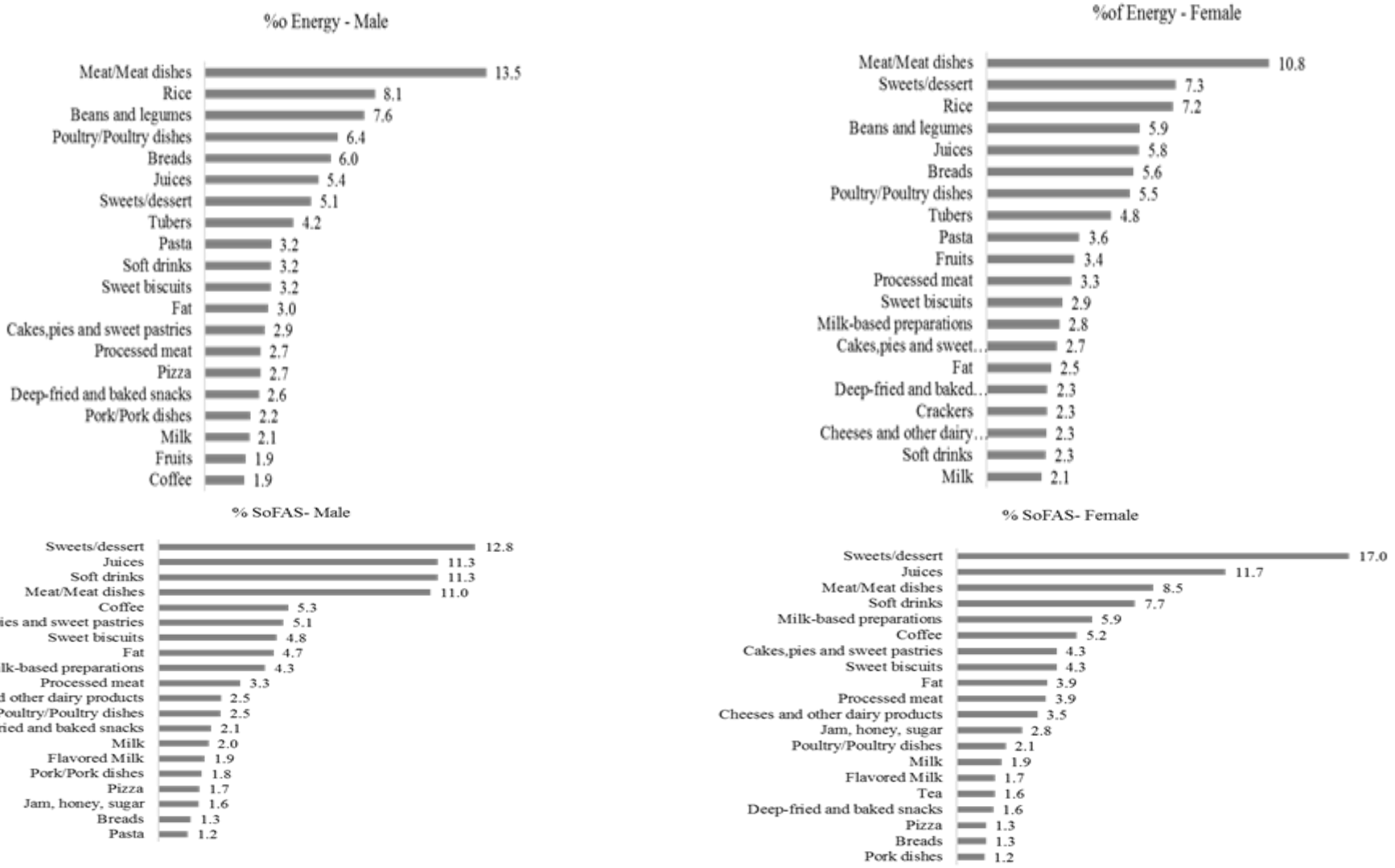
SoFAS consumption. The groups of sweets and desserts; cakes, pies, and sweets; and sweet cookies contributed to 24.0% of SoFAS consumption..

Figure 1. The 20 foods that most contributed to total energy intake and SoFAS (solid fats and free sugar) among university students. Cuiabá-MT, 2016, 2017 and 2018.



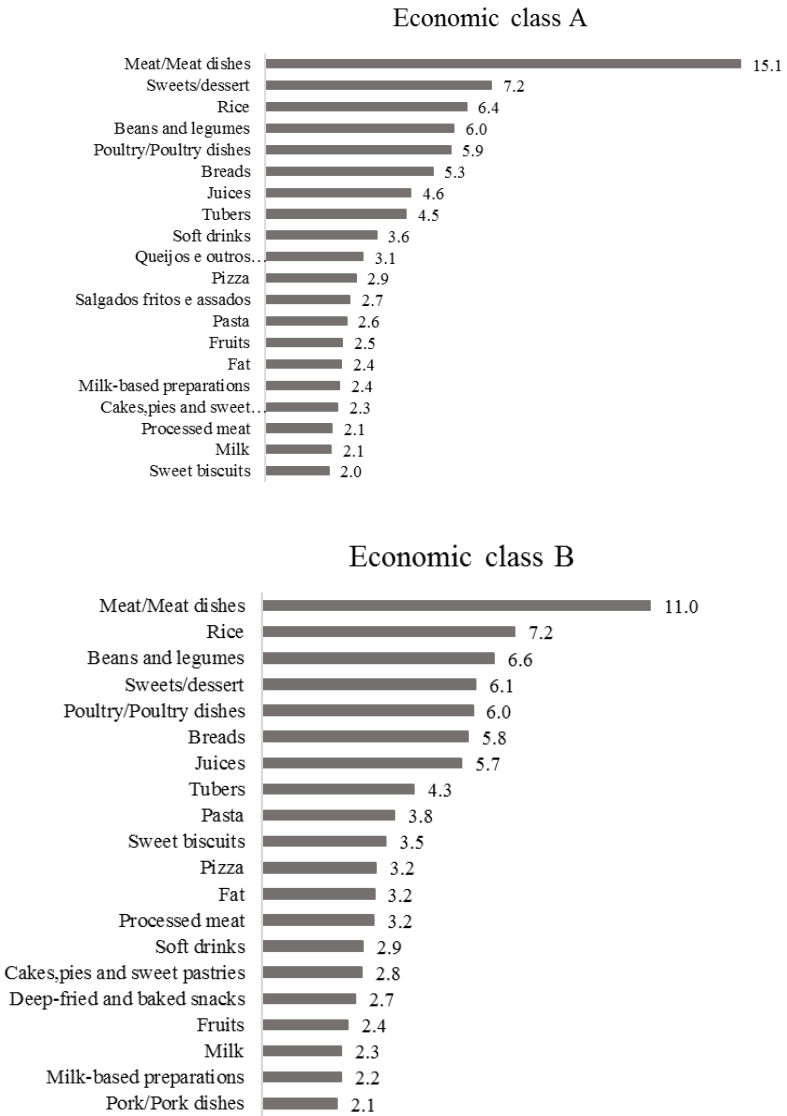
When evaluating food groups according to gender, noteworthy is that sweets and desserts ranked second in the classification of food items with greater participation in the total energy intake among female students, ahead of foods such as rice, beans, and chicken (Figure 2). Sweets, desserts, juices, and soft drinks led the ranking of contribution to SoFAS consumption in both genders. Soft drinks were the third largest source of SoFAS consumption among boys (11.3%) and fourth largest among girls (7.7%).

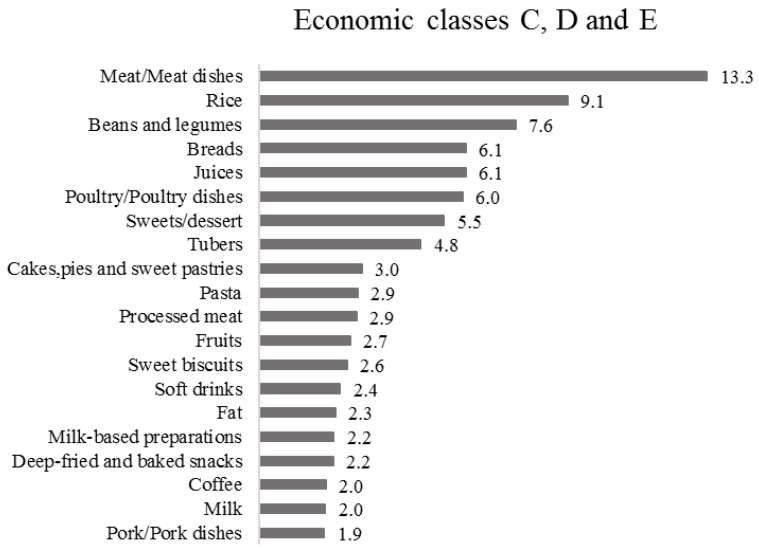
Figure 2. The 20 foods that most contributed to total energy intake and SoFAS among university students, according to sex. Cuiabá-MT, 2016, 2017, and 2018.



As for the largest contributors to energy consumption according to the students' economic class, the participation of beef, rice, and beans together were similar (27.5% in class A, 24.7% in class B, and 30.0% in class C/D/E). However, it should be noted that sweets and desserts ranked second in the list of caloric consumption contributors among students in class A (7.2%). In class B, it ranked fourth (6.1%), and seventh in class C/D/E (5.5%). Cheese and dairy products group was among the 20 main foods only in economic class A (Figure 3).

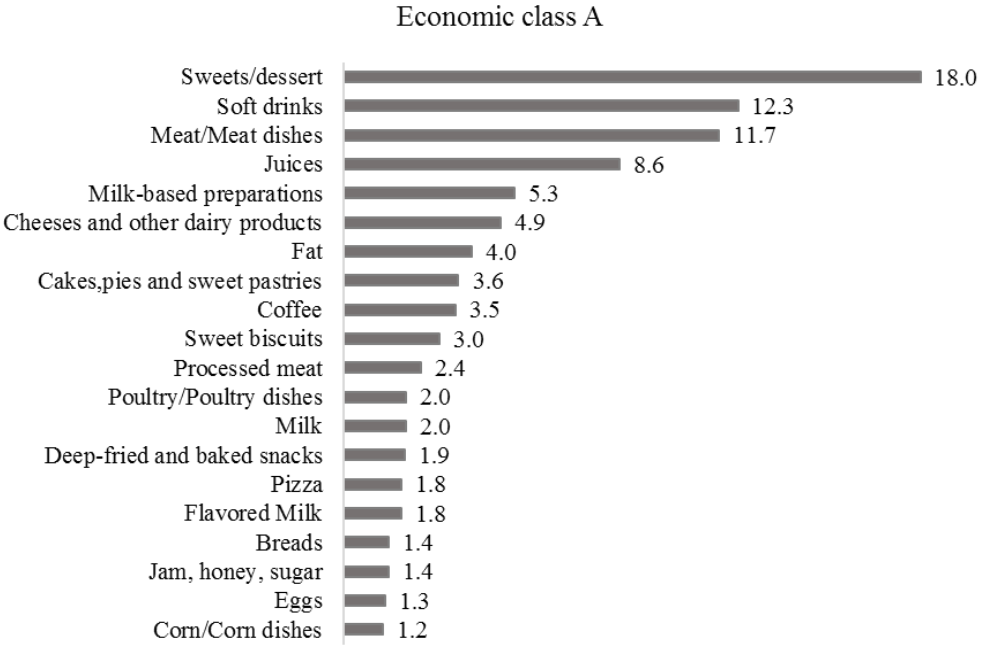
Figure 3. The 20 foods that contributed most to total energy intake among university students, according to economic class. Cuiabá-MT, 2016, 2017, and 2018.

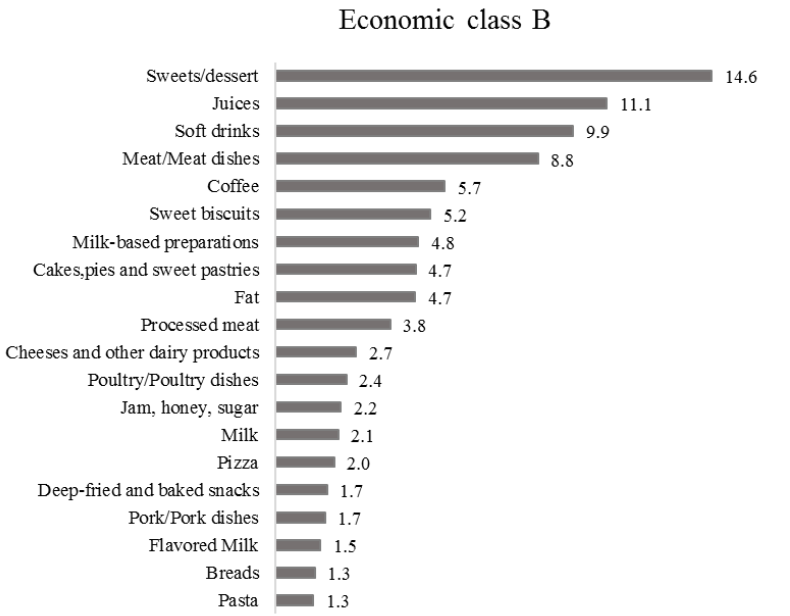


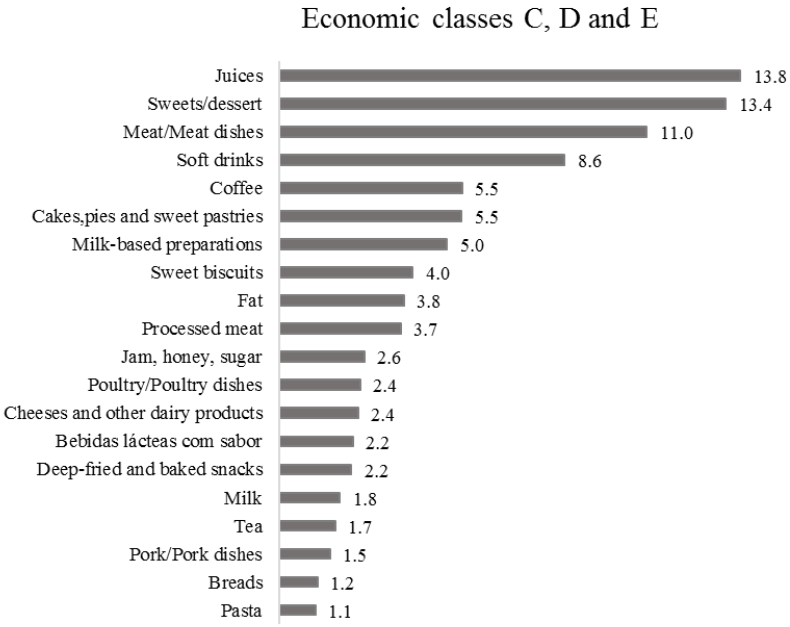


According to economic class, sweets and desserts, juices, and soft drinks were the main contributors to the consumption of SoFAS, with little variation between classes. The greater participation of juices in the economic class C/D/E (13.8%) stands out, ranking fourth in the classification among class A students (8.6%), and second in class B (11.1%). On the other hand, soft drinks had the opposite profile, with lower participation among lower economic class students, with 12.3% in class A, 9.9% in class B, and 8.6% in class C/D/E (Figure 4).

Figure 4. The 20 foods that most contributed to SoFAS among university students, according to sex. Cuiabá-MT, 2016, 2017, and 2018.







DISCUSSION

College students between 16 and 25 years of age had a high consumption of SoFAS, emphasizing the contribution of drinks and sweet foods, such as soft drinks, sweets and desserts, juices and soft drinks, and sweet cookies. The share of SoFAS in total energy intake (29.7%) was more significant than the sum of isolated recommendations for added sugars (10% of total energy intake), saturated fat (10% of total energy intake), and trans-fat (1% total energy intake) of the World Health Organization.[12,13] The main foods that contributed to the students' total energy consumption (rice, beans, and beef) show a persisting traditional dietary pattern.

No studies with this approach have been found among Brazilian university students to date. However, high consumption of refined, energy-dense, and sugar-rich foods has been observed in this population.[23] Considering the scarcity of studies with the evaluation of these groups of nutrients among university students, but considering that most students evaluated are in their adolescence phase, studies in this phase of life are considered below.

In Brazil, according to data from the National Food Survey (INA), carried out in 2008-2009, the consumption of saturated fat observed for adolescents between 14 and 18 years of age was 9.7%, close to that observed in this study, considering that it was also estimated in the survey that 83% of girls and 74% of boys in this age group had total sugar consumption above 10% of total energy consumption.[19] Again, based on INA data, Pereira et al.[14] observed that 52% of the total caloric intake derived from SoFAS, and was higher among women, adolescents, urban dwellers and with higher household income per capita.

In the United States, in a survey using data from adolescents participating in the National Health and Nutrition Examination Survey (1994-2010), Slinnig and Popkin[24] found a decreased intake of SoFAS in the period evaluated, although the energy share of SoFAS spaces remained above the recommendation, reaching 34% of the total energy intake in 2008-2009. According to data from the same study, in 2016, SoFAS still accounted for more than 30% of the total energy intake of adolescents aged 14-18 years.[25]

Added sugars were the dietary component that contributed most to the total SoFAS intake. The caloric participation of sugar in university students' diet was higher than the maximum limit of 10% recommended by WHO, with no significant difference between genders and economic classes. This result was consistent with that verified in a review that assessed sugar consumption by adolescents in 14 countries showed that the proportion of total sugar participation in total energy consumption ranged from 15.4% among boys aged 10-18 years in Italy to 29.6% for girls aged 15-17 years in Germany. As for added sugars, the variation was 12.4% for girls aged 13-17 years in Ireland to 18.6% for Norwegian girls aged 12-14 years.[26] In this study, the contribution of added sugars to total energy was close to that observed in the countries with the highest contribution.

Like added sugars, saturated fat overly contributed to total SoFAS intake. The consumption of fat-rich foods is high[23] among university students, and we observed that the higher intake of saturated fats by university students is associated with low level of knowledge about the nutritional aspects of food and its effects on health.[27] Solid fats were the main contributors to the total SoFAS intake[24] among North American adolescents.

The participation of trans-fats in this study was approximately 1.1% among the students evaluated, higher than recommended,[28] and without significant gender and economic class differences. In a systematic review study, Wanders et al.[29] estimated that the mean contribution of trans-fat intake to the total caloric intake ranged from 0.3 to 4.2% in 29 countries, and only seven of them consuming trans-fat was more significant than the limit recommended by WHO.[28]

The contribution to total energy consumption and SoFAS showed negligible changes according to gender and economic class of the students, emphasizing the high contribution of sweets/desserts to the total energy consumption among girls and the participation profile of juices and soft drinks according to economic class, with a more significant share of soft drinks in the higher classes and juice among students in the lower classes. The food groups that most contributed to SoFAS consumed were similar to those observed in previous studies.[30,31]

Monteiro et al.[30] identified that the foods that contributed most to diets with high SoFAS consumption were sweetened drinks, cookies, cakes, processed meats, sweets and chocolate, sandwiches and snacks, and hamburgers. Similar results were seen among Belgian adolescents, in which the food groups that contributed most to the consumption of ultra-processed foods for men were processed meats, simple cakes and sweet cookies, soft drinks and stuffed cakes, pies, and pastries, and this was different for the females only concerning the first group, which were cakes and cookies, followed by processed meats.[31]

The consumption of soft drinks and other sweetened drinks contributes to this high added sugar intake by the studied population, and an elevated contribution of these drinks were observed mainly among male students and those from higher economic classes. In the 2008-2009 INA, considering the consumption of 171 drinks, categorized into eight groups, Pereira et al.[32] found that these drinks contributed to 17.1% of the total caloric consumption, and groups with the most considerable contribution were caloric coffee drinks (6.4%), fruit/vegetable juices (4.7%), drinks calories from milk/soy milk (2.9%) and sweetened drinks (2.3%). In NHANES (2005-2006), soft drinks were the drinks that most contributed to total energy consumption (9.3%) among adolescents (14-18 years), followed by pizza (8.8%), desserts (6.5%), bread (6.2%), and chicken (5.9%). Soft drinks were also the primary sources of SoFAS (2003-2004), both among girls and boys, providing more than 40% of the total energy.[33]

Among the limitations of this study is the measurement of the amount of sugar added to drinks, standardized based on the previous research,[20] limiting individual variability. Also, food intake was based on daily R24h. However, individual 24-hour recalls knowingly provide good estimates for population means in epidemiological studies,[34] and estimates of energy and nutrient intake were comparable to data obtained in similar studies.[29,30]

However, it is noteworthy that this study contributes to the knowledge of the participation of SoFAS in university students' total energy consumption and the main food groups that contribute to this consumption, considering the scarce literature on this subject in the studied population group. The results presented show the need to promote healthy eating, which can be achieved with an institutional food environment that encourages the consumption of healthy food groups at affordable prices, combined with food and nutrition education actions in the university environment.

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