

Food intake of university students

Consumo alimentar de estudantes universitários

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ABSTRACT

This narrative literature review aimed to analyze the results of studies on the food intake of university students. A literature search was conducted in July 2014 and updated in July 2016 in the Scopus, MedLine/PubMed, and SciELO databases, using descriptors related to university students and food intake in English and Portuguese. Overall, 37 studies that analyzed university students' food intake were included in this review, eight of which were conducted in Brazil. The results demonstrated that most university students have unhealthy eating behaviors, such as high intake of fast foods, snacks, sweets, soft drinks, and alcoholic beverages, and low intake of fruits, vegetables, fish, whole grains, and legumes. Undergraduate students of health sciences, such as nursing, nutrition, and medicine, did not have healthier diets. University students' food intake was characterized as unhealthy, regardless of undergraduate program or sex, especially among students who left the parents' home and became responsible for their own food. Therefore, there is a need of developing public policies that promote healthy eating habits among students, such as interventions to change their eating habits and increase their access to healthy foods at the university environment.

Keywords: Eating. Healthy diet. Public policies. Students. Universities.

RESUMO

O estudo teve o objetivo de realizar revisão narrativa de literatura para analisar os resultados de estudos sobre o consumo alimentar de estudantes universitários. Realizou-se busca bibliográfica, em julho de 2014, atualizada em julho de 2016, nas bases de dados Scopus, MedLine/PubMed e SciELO, utilizando unitermos relacionados a estudantes universitários e a consumo alimentar, em língua inglesa e portuguesa. No total, 37 artigos sobre o consumo alimentar de universitários foram analisados e discutidos nesta revisão. Dentre os estudos incluídos, 8 foram realizados no Brasil. Os resultados dos estudos demonstram que a maioria dos estudantes universitários

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apresenta comportamentos alimentares pouco saudáveis, como o elevado consumo de fast food, snacks, doces, refrigerantes e bebidas alcoólicas, bem como baixo consumo de frutas, legumes, verduras, peixes, cereais integrais e leguminosas. Cursar graduação na área da saúde, como enfermagem, nutrição e medicina não foi indicativo de ter uma alimentação mais saudável. O consumo alimentar de estudantes universitários foi caracterizado como pouco saudável, independentemente de curso de graduação e sexo, destacando-se aqueles estudantes que saíram da casa dos pais e passaram a ser responsáveis pela própria alimentação. Sugere-se a elaboração de políticas públicas que estimulem a promoção da alimentação saudável dos estudantes, a exemplo de intervenções para mudanças nas práticas alimentares e para aumento do acesso a alimentos saudáveis no ambiente universitário.

Palavras-chave: *Ingestão de alimentos. Dieta saudável. Políticas públicas. Estudantes. Universidades.*

INTRODUCTION

University education may be considered a transition period between adolescence and adulthood, one in which students become independent from their parents and acquire new health behaviors [1].

Given the time adolescents and young adults spend at universities and nearby areas, said sites may influence the eating habits of these students in adulthood [2]. Moreover, international studies show that attending university may increase the prevalence of overweight and obesity, weight gain, and unhealthy lifestyles, which have been associated with a higher risk of chronic diseases [1,3].

University life and its dietary context are often associated with inappropriate eating habits in students. At foreign studies, university students' food intake is characterized by a higher intake of snacks, fast foods, French fries, cakes, pies, and carbonated beverages, and a lower intake of fruits and vegetables [4-6]. Hence, the time spent at university is recognized as an important phase to promote students' health and prevent diseases [1].

Some studies have discussed the possible barriers to and facilitators of healthier eating habits among young adults [7-10].

Current food intake studies are concerned with healthful eating in this group. Nonetheless, reviews that discuss the results of studies on university students' food intake and establish a common profile for those students have not

been found. According to Alves & Boog [11], understanding the eating behavior of these young adults is important because it allows the development of health-promoting interventions.

In this context, the objective of this article was to make a narrative literature review to analyze the results of Brazilian and foreign studies that investigate university students' food intake. This review attempted to answer the following question: How does characterize the food intake of university students?

METHODS

This narrative literature review included information from exploratory studies, available in the scientific literature, on the food intake of university students.

A literature search was conducted in July 2014 and updated in July 2016 in the following databases: Scopus, MedLine/PubMed, and Scientific Electronic Library Online (SciELO). An additional search using the snowball method was performed, selecting the references in the review studies obtained from the initial search.

The terms used for the literature search were defined by the Medical Subject Headings of United States National Library of Medicine, and the Health Sciences Descriptors (SHDe) and the keywords of studies found in the previous search. The search was conducted by combining the descriptors in English and Portuguese as follows: "feeding practic\$", "food practic\$", "eat\$ habit\$", "eat\$ practic\$", "eat\$ behavior",

"diet\$ habits", "food habits", "food behavior", "food consumption", "food intake", "health\$ behavior", "nutritio\$ habits", "university students", "college students", "undergraduate students", "freshman", "sophomore", "young adults". Date-related restrictions or other search filters were not used. The combinations were adapted to use more general or more specific terms based on the limitations of each database.

This review investigated exploratory studies that analyzed the food intake of university students and papers with repeated data from similar sources were excluded, prioritizing inclusion of the original sources. The studies, which analyzed the intake of food or food groups, or the dietary patterns of university students, were read and judiciously analyzed in full text. Thus, the studies were characterized by author, year of publication, location, type of study, sample, food intake assessment instruments, dietary outcomes, and main results. The common results were grouped and presented separately in Brazilian and foreign studies.

Analysis of the results of studies on the food intake of university students emerged in a discussion about the possible barriers to and facilitators of healthful eating among university students, and the barriers and facilitators were presented in a specific section as a secondary issue of the present review. For this purpose, the main characteristics of healthful eating considered by this review refer to the respect for and appreciation of cultural practices, access to fairly priced foods, and appreciation of variety, flavor, color, safety, proper amount, and proper quality [12].

University students' food intake: Brazilian and foreign studies

This review included 37 studies, eight of which were conducted in Brazil. Of the foreign studies (n=29), 58.6% were conducted in Europe (41.0% in Spain), 17.2% in North America, 13.8% in the Middle East (all of them

in Saudi Arabia), 6.9% in South America, and 3.5% in Africa (South Africa).

Chart 1 [13-41] synthesizes the foreign studies that analyzed the food intake of university students.

The most investigated inadequacies found in the results of foreign studies were the high intake of fast foods, snacks, deep-fried foods, and sweets [15,18,20,33,34,36,39,41], carbonated and other sugar-sweetened beverages [13,17,23,25,29,34,40], energy drinks [17,29,38], refined grains and sugars [18,26,27,30,33], and alcoholic beverages, especially beers [15,28,34].

The main outcome investigated by most foreign studies was the frequency of students' fruit and vegetable intake according to international recommendations, and said intake was low in all analyzed studies [13,15,17,18, 20,23,26,27,29,30-36,38,41]. Additionally, some studies have also found a low intake of dietary fibers [26,30,32,33].

Seafood was another food group investigated by foreign studies, and the studies found that seafood was not or little consumed by students [15,17,26,27,29,33,34,41]. On the other hand, students had high intakes of milk and dairy products [18,26,27,30], refined grains, and sugars [18,26,27,30,33].

Regarding main meal intake, breakfast was the most skipped main meal by university students at foreign studies [13,29,34,36,38-41], followed by lunch [18,27,36] or dinner/supper [34,36]. In addition results of foreign studies reported the university students' habit of snacking throughout the day, between main meals, often consuming low-nutrient-dense foods, such as snacks or sandwiches, sold at university cafeterias [13,29,40].

In contrast, three Spanish studies [26,27,30] and one Canadian study [17] found that most of students investigated had the habit to eat breakfast daily. Even though few foreign studies assessed the impact of breakfast on the

Chart 1. Foreign studies that analyzed the food intake of university students.

1 of 6

Authors (year) Country	Study design	Sample	Assessment instruments	Food-related outcomes	Main results
Huang <i>et al.</i> (1994) [13] United States	Cross-sectional	1,912 university students (68% F); aged 22 to 24 years.	Food recall	Intake frequency of food groups and beverages.	22% skipped breakfast and 80% habitually snacked at least once a day. The most and least frequent snacks were carbonated beverages and fruits and vegetables, respectively. Females consumed more salads and fewer high-fat and fast foods than males.
Papadaki <i>et al.</i> (2007) [14] Greece	Cross-sectional	84 university students (62% F); aged 20 to 24 years.	FFQ	Food intake frequency (by students living with and without parents).	73% of the students did not live with their parents. Students who did not live with their parents had lower intake of fruits, vegetables, seafood, legumes, and olive oil; they prepared home meals less frequently; and they had higher intake of sugar, alcoholic beverages, and fast foods than students who lived with their parents.
Kremmyda <i>et al.</i> (2008) [15] Scotland	Pre-test/Pos-test	43 (Greeks living with parents); 65% F; mean age 23 years; 37 (Greeks not living with parents, in Greece); 59% F; mean age 22 years; 55 (Greeks not living with parents, in Scotland); 49% F; mean 26 years.	FFQ	Food intake frequency Pre-test/Pos-test analysis of entering university (living with and without parents).	Students living with or without parents in Greece or those who moved to Scotland made worse food choices. Students who lived in Glasgow had made significant dietary changes, reducing their intake of fruits, vegetables, meats, and cheeses, and increasing their intake of snacks. Greeks who living away from parent home but remained in Greece reduced their intake of legumes, fish, breads/grains, and vegetables, and increased their intake of alcoholic beverages. Students who stayed with their parents did not make significant dietary changes.
Laska <i>et al.</i> (2009) [16] United States	Cross section of a longitudinal study	1,687 young adults (56% F); aged 18 to 23 years.	FFQ Intake frequency of meals and snacks Score for home food availability of healthy food.	Food intake. Dietary patterns in the last week. Home food availability.	69% were university students and 47% did not live with their parents. Students who lived with their parents or rented a place had lower intake frequency of breakfast and higher intake of fast foods, higher home availability of junk foods, carbonated beverages, and chocolate at home than those who lived in the university campus.
Péresse-Lachance <i>et al.</i> (2010) [17] Canada	Cross-sectional	3,143 members of the university community, 80% are students, (76% F); mean age 24 years.	Online questionnaires about eating habits.	Intake frequency of fruits, vegetables, fish, and breakfast.	Males consumed more carbonated beverages and energy drinks and skipped breakfast more frequently than females. Most did not consume the recommended amount of fruits and vegetables daily (87% F and 81% M) or the recommended amount of fish weekly (61% F and 57% M). 89% frequently had breakfast.

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Nola <i>et al.</i> (2010) [18] Croatia	Cross-sectional	441 university students (medicine program, first or sixth year of the undergraduate program); (70% F); aged 19 to 26 years.	FFQ	Intake frequency of food groups.	22.5% had breakfast daily. 41.9% used dietary supplements. >80.0% consumed milk, dairy products, fruits, grains, sweets, coffees, and teas daily. First-year students consumed more meat, and sixth-year students consumed more coffee and tea.
Cefai & Camilleri (2011) [19] Malta	Cross-sectional	494 university students (69% F); <25 years (96% of the sample).	FFQ	Intake frequency of food groups.	Half of the students consumed 1–2 servings of fruits per day. 24% had breakfast daily. Preferred snacks at the <i>campus</i> : cafeteria: sweets, chocolates, and white bread/sandwiches.
Ansari <i>et al.</i> (2012) [20] Germany, Denmark, Poland, and Bulgaria	Cross-sectional	2,402 university students; aged 20 to 23 years (70–80% of the sample).	FFQ	Food intake frequency by German, Danish, Polish, and Bulgarian students.	In all countries less than 50% of the students consumed fruits frequently (many times a day). Males consumed more snacks and fast foods, and females consumed more vegetables and sweets. Students who lived with their parents consumed more fruits, vegetables, and meats. Bulgaria: highest intake frequency of sweets, pies, and snacks (French fries and fast food). Poland: lowest intake frequency of fruits and vegetables.
Ortiz-Moncada <i>et al.</i> (2012) [21] Spain	Cross-sectional	380 university students (64% F); mean age 22 years (F) and 24 years (M).	FFQ	Percentage of adherence to the Mediterranean diet.	Not a single student had proper intake of all study food groups. High intake of red meats, sausages, cured meats, and sweets; low intake of grains, fruits, vegetables, and fish.
Moreno-Gómez <i>et al.</i> (2012) [22] Spain	Cross-sectional	987 university students (55% F); mean age 21 years.	Semi-quantitative FFQ	Diet quality assessment by four indices.	Low intake of grains, tubers, fruits, vegetables, legumes, nuts, seeds, and olive oil. High intake of processed meats, sweets, snacks, sugar-sweetened beverages, and bakery items. Females consumed significantly more fruits, vegetables, nuts, and seeds than males, while males consumed more foods high in fats and proteins.

Chart 1. Foreign studies that analyzed the food intake of university students.

3 of 6

Authors (year) Country	Study design	Sample	Assessment instruments	Food-related outcomes	Main results
Small <i>et al.</i> (2013) [23] United States	Longitudinal	608 university students (51% F); mean age 18 years (first semester).	Fourteen consecutive 24-hours recalls (conducted during a follow-up period of seven semesters).	Mean daily intake of fruits, vegetables, and carbonated beverages throughout the semesters.	Few students consumed fruits and vegetables, and the intake of these items decreased significantly over the semesters. Carbonated beverage intake also decreased over the semesters. Students who did not live in the campus (1.9%) had even lower intake of fruits and vegetables over the semesters.
Strawson <i>et al.</i> (2013) [24] Canada	Cross-sectional	36 female university students (nutrition program); (100% F).	FFQ	Intake adequacy according to the Mediterranean Diet Quality Index Score.	Not a single student consumed the recommended portions of vegetable, seed, nut, olive oil, or whole grain servings. Most students did not consume the recommended amount of all food groups.
Zazpe <i>et al.</i> (2013) [25] Spain	Cross-sectional	1,429 university students and employees; (61% F); mean age 23 years.	Questionnaire about eating habits.	Intake frequency of food groups.	Low intake of fruits, vegetables, fish, and dry fruits. High intake of carbonated beverages, bakery products, fast foods, and red meats. Sanitation science students had healthier eating habits than letters students. 39% reported intending to change their eating habits.
Burriel <i>et al.</i> (2013) [26] Spain	Cross-sectional	80 university students (nursing program); (79% F); mean age 21 years.	24-hours recalls (total of 9 days, on 3 weekly occasions, for three consecutive months).	Diet quality assessment by two indices.	98.00% had breakfast and 75.00% had at least four meals a day. High intake of grains and simple sugars, dairy products, and meats; low intake of fish and fibers. 91.25% needed to make dietary changes. 53.00% adhered to the Mediterranean diet.
Travé (2013) [27] Spain	Cross-sectional	740 university students. (61% F); mean age 20.5 years.	24-hours recall of breakfast and/or lunch by interview.	Intake of foods, macro- and micronutrients during breakfast and lunch.	98.6% had breakfast and 54.2% had lunch. The most consumed food groups during breakfast were: milk and dairy products (92.6%), grains and grain-based products (58.8%), cakes, sweets, and desserts (57.9%); and in smaller amounts, fresh fruits (16.6%); 47.6% added sugar to coffee or cocoa powder to milk. The most consumed food groups during lunch were grains and grain-based products (46.6%), fresh fruits (35.0%), and meats and meat-based products (34.9%); low intake of eggs, fish, fruits, and vegetables.

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Bagordo <i>et al.</i> (2013) [28] Italy	Cross-sectional	193 university students (78% F). Mean age 23 years.	FFQ	Food intake frequency.	72.5% lived with their parents. 82.0% had breakfast at home and 11.0% skipped this meal. The most frequently consumed foods were breads/grains, fruits, potatoes/rice pasta, dairy products, meats/poultry. The most consumed beverages were milk, coffee, and tea. Students who lived with their parents had high intake of cooked vegetables, fish, meats, savory snacks, breads/grains, legumes, and sandwiches. Students who did not live with their parents had high intake of raw vegetables, alcoholic beverages, raw/cold meat cuts, and ready-to-eat frozen foods.
Likus <i>et al.</i> (2013) [29] Poland	Cross-sectional	239 university students (health area, first year); (84% F); mean age 20 years.	Questionnaire on eating habits.	Intake frequency of food groups and eating habits.	25.0% did not have breakfast and 45.6% habitually snacked between the main meals. 29.0% consumed fruits and vegetables daily and 12.0% had never eaten fish. 39.0% consumed energy drinks and 40.0% consumed sugars-sweetened beverages daily.
García-Meseguer <i>et al.</i> (2014) [30] Spain	Cross-sectional	284 university students (56% F); Mean age 21 years	2 24-hours recalls (one on the weekend).	Diet quality assessment by two indices.	98.0% had breakfast. Low intake of fruits, vegetables, and fibers. High intake of meats, dairy products, and simple sugars. Main protein sources were meats, grains, and dairy products. The scores of 96.1% of the sample indicated poor diet or diet in need of improvement.
Al-Otaibi (2014) [31] Saudi Arabia	Cross-sectional	960 female university students (100% F); mean age 22 years.	2 questions about daily fruit and vegetable intake frequency.	Daily intake frequency of fruits and vegetables.	78.0% had low intake of fruits and vegetables, and only 22.0% consumed the recommended daily amounts. The main barriers to fruit and vegetable intake were lack of time to prepare them and not finding them at the restaurant or university.
Pérez-Gallardo <i>et al.</i> (2015) [32] Spain	Cross-sectional	77 university students (80% F); mean age 21 years.	7-day food record.	Intake frequency of food groups. Adherence to the Mediterranean diet by undergraduate program.	High intake of fatty meats and sweets, low intake of grains, fruits, and vegetables. Health students' area had higher adherence to the Mediterranean diet (51.4%) than students in other programs (30.8%). 58.9% had low or medium adherence to the Mediterranean diet; 60.0% F and 50.0% M lived with other students, and 56.0% of the students were responsible for preparing their meals.

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De Piero <i>et al.</i> (2015) [33] Argentina	Time series analysis (in 1998-1999 and 2012-2013)	329 university students (75% F); mean age 23 years.	7-day food record; Semi-quantitative FFQ	Food intake frequency.	Monotonous diet and gradual increase in the intake of processed foods with added sugar and snacks. Low intake of dairy products, fish, fruits, vegetables, and dietary fibers.
Agüero <i>et al.</i> (2015) [34] Chile	Cross-sectional	634 university students (nutrition and dietetics programs); (87% F); mean age 22 years.	Questionnaire on eating habits.	Intake frequency of foods and meals.	Low intake of fish, legumes, fruits, vegetables, and whole grains. Frequent intake of alcoholic beverages, savory snacks, deep-fried foods, and sugar-sweetened beverages. 31.5% did not have breakfast and 90.1% did not have dinner/supper.
Alsumi & Badar (2015) [35] Saudi Arabia	Cross-sectional	367 university students (39% F); mean age 22 years.	FFQ	Intake frequency of fruits and vegetables (low, medium, high).	84.5% did not consume the amount of fruits and vegetables recommended by the World Health Organization. Living with parents, planning meals daily, and being aware of the World Health Organization recommendations were related to moderate or high fruit and vegetables intake.
Majeed [36] Saudi Arabia	Cross-sectional	215 female university students (100% F); mean age 19 years.	Questionnaire on eating habits and barriers to healthful eating.	Intake frequency of food groups and barriers to healthful eating.	Reasons for unhealthy eating: 25.0% lack of time and 19.0% lack of access to healthy foods. 81.0% preferred to prepare their meal, 16.3% preferred to consume frozen meals, and 24.0% consumed fast foods. 56.0% had breakfast, 76.0% had lunch, and 58.0% had dinner/supper. Low intake of fruits/fruit juices (89.0%), and green leafy vegetables (92.0%).
Lupi <i>et al.</i> (2015) [37] Italy	Cross-sectional	258 university students (69% F); mean age 23 years.	FFQ	Food intake frequency (living with or without parents).	54.3% did not live with their parents. Students who lived with their parents consumed vegetables, fish, meats and poultry, fresh fruits, eggs, breads, and grains more frequently. Students who did not live with their parents consumed processed foods, ready-to-eat foods, beers and spirit, milk, and chips more frequently.
Teleman <i>et al.</i> (2015) [38] Italy	Cross-sectional	8516 university students (67% F); mean age 22 years.	FFQ	Food intake frequency.	Low intake of fruits and vegetables. Females had lower intake of fruits and vegetables than males. 8.5% consumed 5 meals/day; 64.0% regularly had breakfast. 61.0% consumed energy drinks. 11.0% consumed a large amount of coffee (amount increased with age).

Chart 1. Foreign studies that analyzed the food intake of university students.

Authors (year) Country	Study design	Sample	Assessment instruments	Food-related outcomes	Main results
Gresse <i>et al.</i> (2015) [39] South Africa	Cross-sectional	619 university students (health area); (66% F) N=126 (other areas); (75% F).	FFQ	Dietary patterns and food intake frequency (health area x other areas).	The areas did not differ significantly. 51% did not have breakfast daily. Inadequate fruit intake: 65% in health area and 67% in other areas. Inadequate intake of vegetables: 70% in health area and 64% in other areas. High intake of fast foods and snacks: 75% and 50% in health area, 76% and %52% in other areas, respectively.
Mahfouz <i>et al.</i> (2016) [40] Saudi Arabia	Cross-sectional	436 university students (50% F); aged 19-24 years (98% of the sample).	Multiple-choice questionnaire about eating habits.	Analysis of eating habits compared by gender and undergraduate course.	83.3% M and 95.1% F habitually snacked throughout the day. Few had breakfast daily (14.8% M and 13.4% F). Low daily intake of fruits. High daily intake of sugar-sweetened beverages.
Kowalcze <i>et al.</i> (2016) [41] Poland	Cross-sectional	100 female university students (100% F); Second and third years of the undergraduate programs (natural sciences and humanities).	Questionnaire with close-ended questions about meal intake frequency.	Intake frequency of food groups and meals. 58% consumed fruits and 65% consumed vegetables daily. 44% had a snack for dinner/supper, occasionally or sometimes. 70% never used some sort of dietary supplement. 46% sporadically consumed or had never ate fish.	67% had breakfast daily. 94% had meals at home. The favorite cooking method was deep frying (52%). 70% never used some sort of dietary supplement. 46% sporadically consumed or had never ate fish.

Note: Junk food: foods with high energy density and low nutritional value, such as fast foods (hamburger, French fries, pizza, among others).

F: Female; M: Male; FFQ: Food Frequency Questionnaire; FR: Food Record.

health of adolescents and young adults, there is solid scientific evidence on the benefits of regular breakfast intake for children and adolescents' academic performance, cognitive function [42], and diet quality [43,44].

Spanish studies [21,22,26,30,32] investigated the percentage of university students' adherence to the Mediterranean diet, analyzing the intake frequencies of fruits, vegetables, fish, whole grains, legumes, nuts, seeds, and olive oil. These studies found that most students investigated needed changes on diet to make healthier dietary patterns and pointed out the low adherence to the Mediterranean diet.

Chart 2 [45-52] synthesizes the Brazilian studies that analyzed university students' food intake. Three of the eight Brazilian studies were conducted in the Southeast, three in the Northeast, one in the North, and one in the Federal District.

Brazilian study results were similar to foreign study results. Most studies on the food intake of Brazilian university students found that they had low intakes of fruits and vegetables [45-51], fish [47], and whole grains [46], skipped main meals [45], and had high intakes of fast foods [50], alcoholic beverages [45,46,48,51], carbonated beverages, and sweets [46,47]. On the other hand, two studies reported that most students investigated had the habit to consume legumes daily, especially beans [46,48], which may indicate students' preference for the traditional Brazilian diet.

These results corroborate a Brazilian study conducted by Maciel *et al.* [53], which included 303 individuals of the university community, namely students, professors, and other employees of a public university in São Paulo city. Their results also suggest low intake of fruits, vegetables, and whole grains. In addition their sample had low intake of legumes.

A Brazilian study of 47 female students attending the first year of nutrition and nursing programs found that 48.9% were or had been on some kind of diet. This may indicate that

these young women were concerned with their body image, trying to reach or maintain a beauty standard. Moreover, the need of adhering to a dietary pattern may stem from their being females and most studying nutrition [47].

The approach of identifying dietary intake patterns instead of food or food group intakes is still little explored, even though said approach has been appreciated in the nutritional epidemiology literature. Only three Brazilian and foreign studies on the food intake of university students assessed dietary patterns [16,39,52]. Nevertheless, only one Brazilian study, conducted by Pereira-Santos *et al.* [52], identified and discussed four dietary patterns in students, namely, the traditional pattern, exam day pattern, end-of-semester pattern, and anxiety pattern. Therefore, this literature gap represents an interesting subject for future studies.

The methods used by studies that investigated the food intake of university students varied greatly. Most foreign studies (90%) were cross-sectional, one was of the pre-test/post-test type [15], one was longitudinal [23], and one was a time series analysis [33]. All Brazilian studies had a cross-sectional design.

The instruments used for assessing university students' food intake also varied. Most foreign studies (76%) used the Food Frequency Questionnaire (FFQ), followed by the 24-hour recall (21%), 7-day food record (7%) [32,33], and a score for home food availability of healthy foods (3%) [16]. Thirty-eight percent of the studies used non-validated instruments, 35% used validated instruments, and 27% adapted instruments without validating the adaptations for the target population. Most Brazilian studies (5 of 8) also used the FFQ, two used a semi-quantitative FFQ [48,49], and one used the instrument *Indicador de Saúde e Qualidade de Vida Acadêmicos* (University Student Health and Quality of Life Indicators) [51]. Four studies used validated instruments [47,49,51,52], and four used non-validated instruments

Chart 2. Brazilian studies that analyzed the food intake of university students.

1 of 2

Authors (year) Region	Study design	Sample	Assessment instrument	Diet-related outcomes	Main results
Vieira et al. (2002) [45] Southeast	Cross-sectional	185 first-year university students (57% F); aged 18 to 19 Years; Public university.	Questionnaire on eating habits.	Intake frequency of food groups and meals.	57.3% skipped some main meal. 79.5% did not eat one or more foods of the vegetable group; 72.0% consumed vegetables, and 25.0% consumed fruits 5 to 7 times a week. 86.0% consumed sweets/fats frequently. 73.5% consumed alcoholic beverages
Marcondelli et al. (2008) [46] Brasília (DF)	Cross-sectional	281 university students (health area); (65% F); mean age 22 years; Public university.	Adapted questionnaire with questions about the intake of food groups and eating habits.	Adequacy of intake frequency of food groups.	79.7% had inappropriate diets. Low intake adequacy of milk and dairy products (23.0%), fruits and vegetables (25.0%), and complex carbohydrates (26%); High percentage of individuals (74.0%) with high intake of carbonated beverages and sweets. 83.9% consumed legumes daily. 40.0% consumed alcoholic beverages weekly.
Monteiro et al. (2009) [47] Southeast	Cross-sectional	47 female university students (nutrition and nursing programs, first year) (100% F); aged 19 to 27 years; Public university.	FFQ	Food intake frequency and eating habits.	High intake of foods high in simple carbohydrates, sweets, and carbonated beverages. Low intake of fruits, vegetables, and fish. 76.6% would like to change their eating habits. 48.9% were dieting or had already followed some type of diet.
Feitosa et al. (2010) [48] Northeast	Cross-sectional	718 university students (50% F); public university.	Semi-quantitative questionnaire.	Intake frequency of food servings and meals.	Low intake of fruits (67.7%) vegetables (84.4%) and inadequate for recommendations. 76.0% consumed legumes frequently. F: had higher intake of deep-fried foods, sausages, cured meats, sweets, and snacks. M: were less concerned about removing visible fat from meats and had higher intake of alcoholic beverages.
Cansian et al. (2012) [49] Southeast	Cross-sectional	122 university students (nutrition program); (94% F); mean age 21 years; public university.	Semi-quantitative FFQ.	Intake frequency of fruits and vegetables.	68.9% had ≥ 5 meals/day. Low intake of vegetables. Low intake of fruits (only 28.0% had ≥ 3 servings/day).

Chart 2. Brazilian studies that analyzed the food intake of university students.

2 of 2

Authors (year) Region	Study design	Sample	Assessment instrument	Diet-related outcomes	Main results
Ramalho <i>et al.</i> (2012) [50] North	Cross-sectional	863 university students (62% F); Aged 21 to 30 years (in 45% of the sample); public university.	Questions about weekly intake frequency of some foods.	Regular intake of fruits and vegetables (5 or more times a week).	Low regular intake of fruits and vegetables (14.8%). Low intake frequency of fast foods (less than 2x/week). The factors that contributed to regular fruit and vegetable intake were being in the A/B socioeconomic class, having a domestic partner, practicing physical activity, and having low intake frequency of fast foods.
Sousa <i>et al.</i> (2013) [51] Northeast	Cross-sectional	1,084 university students (55% F); mean age 23.5 years; public university.	ISAQ-A (Student Health and Quality of Life Indicators) (MONISA Study – 10-year follow-up).	Inadequate intake of fruits and vegetables (up to 4 days/week). Excessive intake of alcoholic beverages (consume in the last 30 days five or more shots of alcoholic beverages on the same occasion).	81.2% had inadequate fruit intake and 57.0% had inadequate vegetable intake. M had lower fruit and vegetable intake than women. Males were more likely to have excessive intake of alcoholic beverages.
Pereira-Santos <i>et al.</i> (2016) [52] Northeast	Cross-sectional	125 university students (Nutrition program); (88% F); mean age 22 years; Public university.	FFQ	FFQ transformed into dietary patterns.	Four dietary patterns were identified: Traditional: roots/tubers, legumes, dairy products, meats and eggs, fruit/natural juice and vegetables. Exam day: breads/cereals, sausages, and artificial beverages. End of semester: candy/sugars and snacks. Anxiety: coffee/tea and fats; 38% had inappropriate diets (patterns 2, 3, and 4), characterized by low food variety, and low intake of high-fiber, high-vitamin foods.

Note: Student Health and Quality of Life Indicators); ISAQ-A: *Indicadores de Saúde e Qualidade de Vida de Acadêmicos* (Student Health and Quality of Life Indicators).
F: Female; M: Male; FFQ: Food Frequency Questionnaire; FV: Fruits and vegetables; MONISA: *Monitoramento dos Indicadores de Saúde e Qualidade de Vida de Acadêmicos* (Monitoring

[45,46,48,50]. Given this context, the great methodological variety of the analyzed studies prevents comparing their results, which can be considered a limitation for extrapolating the results of this review. In addition, most studies used non-validated instruments.

Table 1 synthesizes the main characteristics found at the of the Brazilian and foreign studies results on the food intake of university students included in this review.

Foreign and Brazilian studies analyzed most characteristics of university students' food intake. Moreover, all studies, regardless of study site, made similar findings, such as the students' trend to consume unhealthy foods once they enter university.

Relationship between food intake and variables related to the household, undergraduate program, and sex

Many studies compared the food intake of university students who lived with their parents with the food intake of those who did not [14-16,20,23,28,35,37]. Students who lived with their parents did not change their eating habits considerably after entering university. In addition those who lived with their parents had more frequent intakes of fruits, vegetables, fish, meats, eggs, grains/breads, and legumes [20,28,37].

On the other hand, students who moved out of their parents' homes changed their diets considerably, reducing their intake of foods prepared at home, fruits, vegetables, olive oil, nuts, seeds, and legumes, and increasing their intake of fast foods, ready-to-eat foods, sweets, carbonated beverages, and alcoholic beverages [14-16,20,23,28,35,37]. Hence, leaving the parents' home to attend university and having to assume responsibilities, such as food acquisition and preparation, may significantly affect the eating habits of university students.

The only longitudinal study on this subject found in the literature was conducted by Small *et al.* [23] in the United States; they followed 608 university students for seven academic semesters. Most students (98%) lived on campus and had the negative tendency of reducing fruit and vegetables intake over time, but the positive tendency of reducing carbonated beverage intake over time.

Some studies compared the food intake of university students from health programs with those of students from non-health programs. Only two foreign studies, both conducted in Spain, found differences between those two groups, namely healthier eating habits [25] and higher adherence to the Mediterranean diet [32] in students from health programs. Nonetheless, most of results studies either emphasized inadequate intake of fruits, vegetables, fish,

Table 1. Main characteristics of the Brazilian and foreign study results on the food intake of university students.

Results	Article frequency (%)	
	F (n=29)	B (n=8)
Skipping breakfast [13,29,34,36,38-41,45]	24.1	12.5
Having breakfast daily [17,26,27,30]	13.8	-
Habitually snacking or skipping meals [13,29,40,45]	10.3	12.5
Low intake of fruits and vegetables [13,15,17,18,20,23,26,27,29,30-36,38-41,45-51]	69.0	87.5
Low intake of fish [15,17,26,27,29,33,34,41,47]	27.6	12.5
High intake of carbonated beverages [13,17,23,25,29,34,40,46,47]	24.1	25.0
High intake of alcoholic beverages [15,28,34,45,46,48,51]	10.3	50.0
High intake of fast foods, snacks, and sweets [15,18,20,33,34,36,39,41,46,47,50]	27.6	62.5

Note: F: Foreign; B: Brazilian.

and whole grains, and high intake of fast foods by students enrolled in health programs [25,32,34,39,41], or found no differences between those two groups [39]. Only Nola *et al.* [18] found that most of the 441 Croatian Medicine students in their sample consumed fruits and vegetables daily.

Some studies tried to analyze the differences in the food intake of male and female university students. Teleman *et al.* [38] observed that women consumed more fruits and vegetables than men. Yet, other studies found that both genders had low intake of fruits and vegetables [17,40]. Studies of females only also found low intake of fruits and vegetables by most, and the need to improve diet quality [24,31,36,41].

In this sense, although sex may affect food intakes, this relationship in the reviewed studies is not clear. Some studies report that women have healthier eating habits than men [38,51], but others have found no differences between men and women [17,40,48]. Still, regardless of sex, university students' intake of fruits and vegetables remains low [17,24,31,36,40,41,47,51].

Studies of Saudi Arabian [36] and Polish [41] conducted only with women shows that most of them (>80%) had or preferred to have their meals at home. The habit of home cooking has been discussed in the literature, especially the relationship of the development of cooking skills with healthier eating habits, including weekly intake of fruits and vegetables and lower intake of processed foods and ready-to-eat foods [54]. Wolfson *et al.* [55] studied almost ten thousand adult Americans and found a significant association of the habit of making dinner/supper at home with better diet quality and lower intakes of fast foods, ready-to-eat meals, and frozen meals.

Barriers to and facilitators of healthful eating in university students

The outcomes of some studies analyzed were not only related to food intake but also

to a wider context that involves barriers to and facilitators of the acquisition of healthier eating habits.

Al-Otaibi [31] found that the main barriers for the intake of fruits and vegetables by their sample of 960 female Saudi Arabian university students were: lack of time to prepare their own meal and the absence of fruits and vegetables in the university cafeteria. Another study conducted in Saudi Arabia by Majeed [36] corroborated these results as he found that the main barrier to a healthful diet was lack of time and lack of access to healthy foods.

The two studies above corroborate other studies that analyzed facilitators of and barriers to healthful eating in adolescents and young adults, namely: lack of time, financial instability, lack of cooking skills, cooking knowledge, space, and kitchen appliances, and easy access to unhealthy and convenience foods, including fast foods [7-10].

A population-based cohort study included American adolescents and young adults who cited some facilitators of fruit and vegetable intake, namely, personal preference for the taste of vegetables, less importance of the barrier of lack of time, higher availability of vegetables at home, homemade recipes based on vegetables, and the habit of consuming fruits for breakfast. Besides, the main limitation mentioned by the students was home availability of unhealthy foods. Thus, the authors emphasized that personal factors (food preferences) and socioenvironmental factors (home food availability) may influence the intake of fruits and vegetables in young adults, including university students [5].

Also in the United States, a qualitative study of 115 university students found that the main barriers and enablers for healthful weight management were: intrapersonal factors (craving for some food and lack of discipline); interpersonal factors (social situations); and environmental factors (lack of time and easy access to unhealthy foods or meals at the cafeteria, lack of access to healthy foods, and

the higher cost associated with healthier eating habits). The cited facilitators were: intrapersonal factors (regular food intake and physical activity), interpersonal factors (social support), and environmental factors (university environment that facilitates the intake of healthy foods and physical activity). Yet, factors seen as barriers by some students, such as accessibility to the university cafeterias, were seen as facilitators by other students given how they perceived the availability of healthy foods at the universities [7].

A qualitative study of 35 Belgium university students identified the factors that influence behaviors that promote healthful eating, namely: personal (flavor preferences, self-discipline, autonomy, lack of time, and convenience); related to social networks (lack of parental and friend support); physical environment (healthy food availability and accessibility, attractiveness, and price); and macro-environment (media and advertising). The relationships between eating behavior determinants seem to be moderated by the university's environmental characteristics, such as residence halls, student societies, university lifestyle, and exams. Regarding lack of time, some students prefer to use their free time for activities other than food preparation, especially when they have to cook only for themselves. When they cook, they prefer meals that can be prepared more quickly so that they can spend more time watching television, and they also reported that they have more time for cooking after the exams [10].

The foods available at the university snack bars and cafeteria may also influence the food choices of students and other members of the university community. A study conducted at a public university in the Brazilian South used a census to analyze all *campus* food environment, including all restaurants (n=6) and snack bars (n=13) available to selling of foods and beverages. The foods sold by those places had low nutritional quality, and the healthiest

foods were the most expensive. Therefore, both availability and higher prices of products not promote healthy food choices in the university environment [56].

Brazilian university restaurants are part of the students' food environment, especially at public universities as they are subsidized by the *Programa Nacional de Assistência Estudantil* (National Student Assistance Program), managed by the Ministry of Education, whose aim is to support low-income undergraduate students who attend federal higher-education institutions. Therefore, university restaurants should be encouraged to provide proper meals [11] because they have the potential to offer healthy foods, such as fruits, vegetables, and whole grains [56].

Some authors have suggested that the university *campus* may consist of a privileged scenario to incentivize health-promoting strategies, including interventions aimed at student autonomy [1,11,53]. In Brazil some reference documents provide health-promoting strategies, such as the *Marco de Referência de Educação Alimentar e Nutricional* (Food and Nutrition Education Landmark) [57] and the Dietary Guidelines for the Brazilian Population [58]. Still, nationwide public policies that promote healthful eating in the university community do not exist, hence the importance of developing strategies that, for example, encourage cooking skills through interventions or by making health foods more available and accessible at the university.

FINAL CONSIDERATIONS

This review synthesized the main results of studies on the food intake of university students and discussed the possible barriers to and facilitators of healthful eating. The results of said studies suggest that most university students had unhealthy food intakes, characterized by high intake of fast foods, snacks, sweets, and carbonated beverages, and low intake of fruits,

vegetables, fish, whole grains, and legumes, and they habitually skipped main meals and had unhealthy snacks throughout the day. Moreover, university students who did not live with their parents had less healthy eating habits than those who did, after entered at university. Generally, the results of Brazilian and foreign studies made similar findings on the food intake of university students.

These results may help to create a picture of the food intake of university students and provide data for future actions that aim to promote healthful eating in this group.

Given the time these students spend at the university, the university environment is an interesting place for the development of public policies that aim to promote health and healthful eating in the university community. Public policies that promote healthful eating in students should be created, such as interventions to change dietary practices and increase access to healthy foods in the university environment.

CONTRIBUTORS

GL BERNARDO contributed to the planning and design of the manuscript; data collection, analysis, and interpretation data; drafting and critical revision of the manuscript; approved the final manuscript. MM JOMORI and AC FERNANDES contributed with analysis and interpretation data; critical revision of the manuscript; approved the final manuscript. RPC PROENÇA was responsible for the planning and design of the manuscript; analysis, and interpretation data; critical revision of the manuscript; approved the final manuscript.

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