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Systematic Review and Meta-Analysis

Frequency of sugar-sweetened food consumption among Brazilian schoolchildren: a scoping review

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Aim: To map the available evidence about the frequency of consumption of sugary foods among schoolchildren enrolled in public and private schools, in urban areas, in Brazil. **Methods:** This scoping review followed the methodological procedures established by the Joanna Briggs Institute (JBI) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) for its reporting. Studies whose data were collected in the last 10 years until July 2021 were included. The search was conducted in five electronic databases: MEDLINE (via PubMed), Embase, Web of Science, Scopus, and LILACS, and for unpublished studies, the CAPES Theses and Dissertations Library. **Results:** Of the 9.028 studies retrieved in the search, 24 were included in the review. The largest number of publications is between the years 2011 and 2016. Among the sugar-rich foods evaluated, the consumption of soft drinks was the most investigated. A high frequency of consumption of these foods among schoolchildren was observed. **Conclusion:** This review allowed us to identify a high frequency of sugar-sweetened food consumption among schoolchildren, and thus contribute to the formulation and strengthening of public policies that favor healthier eating habits.

Keywords: Sugars. Students. Noncommunicable diseases.

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Introduction

Reducing dietary intake of added sugars has been emphasized as a strategy to prevent chronic noncommunicable diseases (NCDs)[1]. Understanding the risk factors for chronic diseases is one of the first steps in developing effective prevention programs. The etiology of chronic disease is complex and multifactorial. Risk factors include age, family history, genetic predisposition, current and lifetime weight, current and lifetime physical activity, smoking, alcohol, and diet. Of these risk factors, the greatest impact on public health will be made by reducing modifiable risk factors such as diet[2].

In Brazil, similar to many other countries, the dietary pattern has changed rapidly and drastically in the last decades with an increase in the intake of processed foods and consequently of saturated fats and simple sugars. Data from the 2008-2009 national survey[3] showed that average energy intake was 7.958 kJ/d (1.902 kcal/d) and added sugar accounted for 13% of total energy, exceeding the World Health Organization (WHO) recommended value of reducing free sugar intake to less than 10% (strong recommendation) and 5% (conditional recommendation) of total energy intake[1]. Thus, the authors concluded that the dietary intake of Brazilians is compatible with high risk of obesity and noncommunicable chronic diseases, being characterized by high intake of added sugar and saturated fat[3]. In addition, 68% of Brazilian adolescents consume some sweetened beverage daily[4].

Prevention and health promotion actions are considered fruitful when targeted at the adolescent stage, since during this stage of life the physical, emotional, social, and cognitive attributes and skills acquired become the foundation for future life, and it is recognized that investments related to adolescent health and well-being have repercussions for future generations[5]. Based on this information, data on adolescent health and its associated factors such as diet are necessary to guide and support strategies for this age group[5]. Moreover, it is important to note that many studies in the literature involve only the consumption of sugary drinks, not considering the participation of other types of foods that have high sugar content in its composition, highlighting the usefulness of studies that synthesize consumption data on these other foods.

Thus, the present analysis sought to provide an overview of the use and daily frequency of sugary foods and beverages in schoolchildren (children and adolescents), presenting epidemiological data and thus contributing to measures that can prevent the occurrence of chronic noncommunicable diseases.

Materials and Methods

A scoping review of the literature was performed, following the methodological procedures established by the Joanna Briggs Institute (JBI) and the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR), to report this review[6,7]. Therefore, with the purpose of exploring the types of evidence available on the frequency of consumption of sugary foods among Brazilian schoolchildren, verify how the investigations are being conducted

and identify the possible gaps in the scientific literature, the scoping review methodology was chosen. The review steps consisted of elaboration of the research question, search and survey of studies, selection of studies according to inclusion criteria, data extraction, organization and mapping of studies, and presentation of results[6]. The review was registered in the Open Science Framework (OSF) platform with DOI identification: 10.17605/OSF.IO/6JMZY.

The research question was established using the PCC strategy, according to the JBI methodology, which corresponds to Population (P), Concept (C) and Context (C), represented by the guiding question: "What is the daily frequency of consumption of sugary foods among schoolchildren in Brazil?". It is noteworthy that a preliminary search was conducted in PROSPERO, MEDLINE (via PubMed), and the Joanna Briggs Institute Database of Systematics Review and Implementation Reports and no reviews with this same guiding question were found.

Selection Criteria

The inclusion criteria consisted of primary research studies: observational studies (cohort studies, case-control studies, and cross-sectional studies) with quantitative or qualitative approaches and systematic literature reviews that had their data collected in the last 10 years until July 2021. This time limit was determined considering the period coinciding with the publication of the "Plano de Ações Estratégicas para o Enfrentamento das Doenças Crônicas Não Transmissíveis (DCNT) no Brasil 2011 - 2022", by the Ministry of Health/ Federal Government[8]. The document aims to establish a plan to confront and mitigate chronic noncommunicable diseases in Brazil, such as diabetes, hypertension, and cardiovascular diseases.

This review selected studies involving schoolchildren aged 6 to 19 years properly enrolled in public and private schools in urban areas of Brazil and that had been evaluated regarding the frequency of consumption of sugary foods in their daily diet. Duplicate studies in more than one database, studies that evaluated the consumption of sugar in specific groups with some pathology, disease or syndrome, studies that evaluate the energy potential of the diet consumed and studies in which the consumption of sugary foods among schoolchildren was reported by parents and/or guardians were excluded. Editorials, letters to editors, book chapters, and conference abstracts were also excluded. Regarding language, it was limited to those understood by the researchers, represented by English, Portuguese, and Spanish.

Search Methods

The search was conducted in five electronic databases: MEDLINE (via PubMed), Embase, Web of Science (via Clarivate Analytics), Scopus and LILACS. In addition to these, the Catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES Periodicals) was used to search for unpublished studies/gray literature. And finally, a manual search through the references of the included studies was done to screen for possible additional studies.

The keywords and descriptors were stipulated through discussions among the researchers, a consultation with a librarian for assistance, and preliminary searches

to identify the keywords that best fit the objective of the study. Three controlled health vocabulary tools: Medical Subject Headings (MeSH), Health Sciences Descriptors (Decs), and EMTREE (Embase) were also consulted in order to adapt the search strategy for each database. The complete and detailed search strategy for one of the databases used is presented in Appendix 1.

After searching the databases, the studies were exported to the Endnote® reference manager for organization and removal of duplicates, proceeding with the selection of studies conducted by two reviewers independently. First, the selection was performed by evaluating the title and abstract according to the eligibility criteria. Subsequently, the selection was made by reading the full texts. In cases of disagreement in both steps, these were resolved by mutual agreement between the two reviewers. The selection steps were performed using the Rayyan®[9] web application.

Data Extraction and Summary of the Results

The data extraction corresponded to the filling of a table, elaborated with the use of Microsoft Excel® spreadsheets, also executed independently between two reviewers and containing the following fields: Authors, Year of Publication, City of Origin, Objectives, Population and Sample Size, Age, Methodology, Outcomes (i.e., the type and quantity of sugary foods consumed by Brazilian schoolchildren), and the Main Results.

After extracting the data, it was possible to explore the bibliographic information and perform a more accurate visualization of the studies, providing a descriptive analysis of the information collected in order to present an overview of the material surveyed. In this step, the results were compiled and presented in tabular and descriptive format to map the findings, following the recommendations of the JBI manual[6].

Results

From the database search, 9.028 studies were found. After removing the duplicates, 7.657 studies remained for analysis of the titles and abstracts and thus, 92 potentially eligible studies were kept for full reading. Of these, 56 articles did not meet the inclusion criteria, 11 were excluded because they corresponded to book chapters, letters to editors, and abstracts from scientific conferences, and 6 were excluded because access to the full article was not available. Therefore, 19 studies were included at this stage[10-28]. It was succeeded with a search of the references of the included articles, which resulted in the addition of 2 more articles[29,30]. In the gray literature search, 289 studies were retrieved, however only 3 were deemed eligible and were included[31-33], resulting in a total of 24 included studies[10-33] as shown in the flowchart in Figure 1.

The frequency of sugar-sweetened food consumption among Brazilian schoolchildren was reported in 24 studies, as presented in Table 1. Of these, twenty-two studies had their data collected between 2011 and 2016[10-26,29-33] and two studies between 2017 and 2021[27,28]. Among the sugary foods evaluated by the studies are: soft drinks, chocolate milk, candies such as lollipops and chewing gum, cookies, chocolate, ice cream, milkshakes, artificial juices, sweet popcorn, cakes, confectionary foods, and sugar to sweeten. Soft drink consumption was the most evaluated among the studies, being present in approximately 92% (n = 22)[10-12,14-23,25-33,] of the publications included in this review.

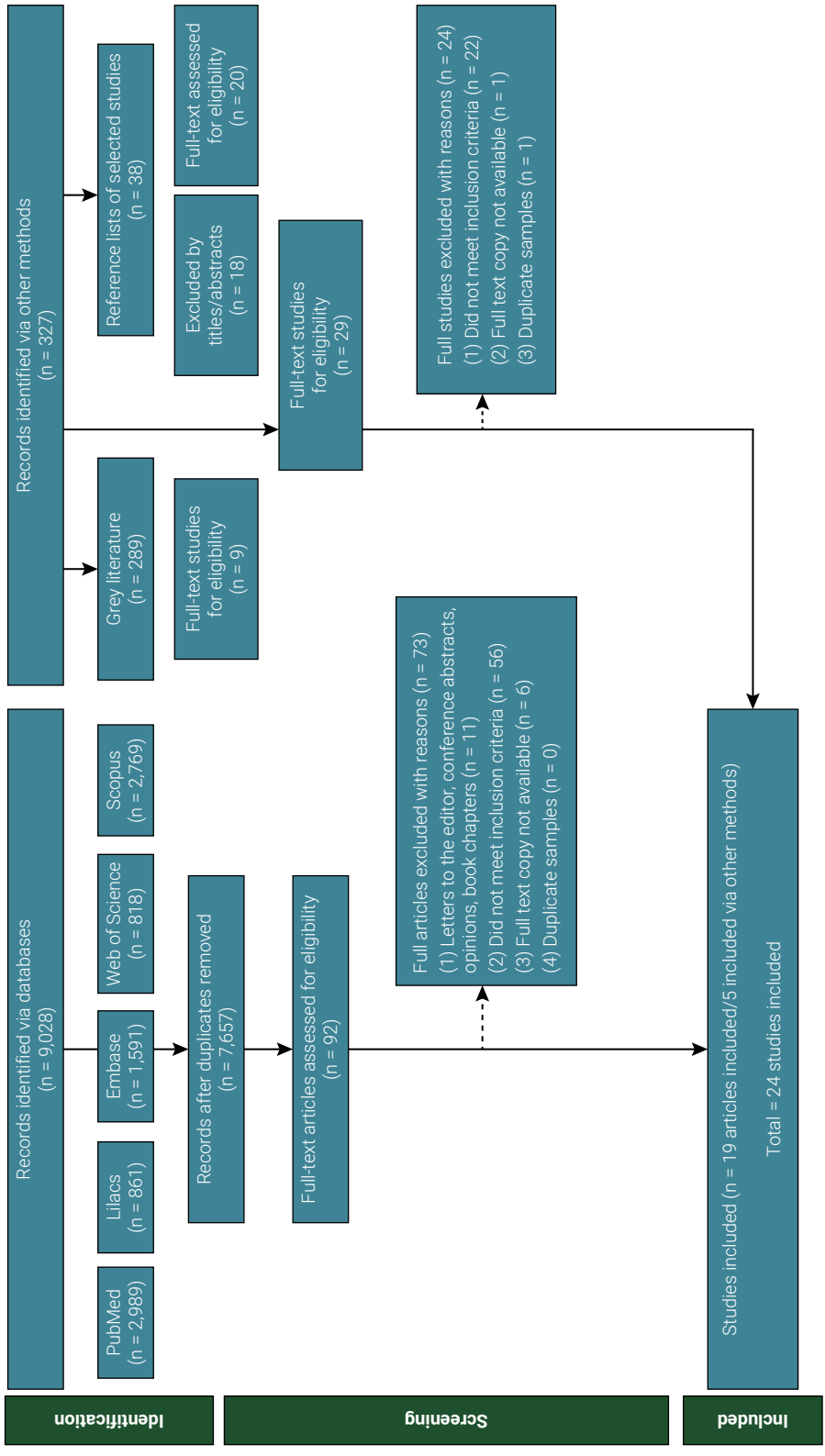

Figure 1. Flowchart of studies on the frequency of consumption of sugar-sweetened foods in schoolchildren in Brazil.

Table 1. Characteristics of studies that evaluated the frequency of consumption of sugar-sweetened foods in brazilian schoolchildren.

Author(s), year of publication	City of origin	Aim	Population and sample size	Age	Methods	Outcome	Main findings related to the scope review question.
Amaral et al.[19] (2014)	Piracicaba-SP (2011)	Compare estimates of food behavior related to oral health.	The study population consisted of 87 students (39.2% male) attending public schools.	Mean age: 13.4 years old.	Cross-sectional study using a dietary recall (R24h) and a self-report instrument with three questions for each of the eleven food items. The questions were about food intake related to oral health, as well as the frequency and time of day the food was	Ice cream, fruits, chocolate, soft drinks, vegetables, juices with added sugar, cookies (with and without filling), vegetables, chocolate, and sweets (gum, candy). Instruments: Food frequency questionnaire self-report about consumption of sweet products.	The frequency of intake "one or more times a day" was higher in the food frequency questionnaire, when compared with the R24h, for all foods except soft drinks. The consumption (1 or more times a day) by R24hs of the items of ice cream, chocolate, soft drinks, juice with sugar, cookies with filling, milk with chocolate, cookies without filling, and sweets were 0, 4.6, 50.57, 19.6, 0, 25.29, 4.6, 36.78, respectively. The consumption (1 or more times per day) by self-reported frequency of the items ice cream, chocolate, soft drinks, juice with sugar, cookies with filling, chocolate milk, cookies without filling, and candy were 13.79, 25.29, 55.17, 40.23, 43.68, 56.32, 24.14, 64.37, respectively.
Barbosa Filho et al.[25] (2012)	Curitiba, PR (2011)	To examine the prevalence and correlate the isolated and concurrent presence of behavioral risk factors for cardiovascular healthamong adolescents.	The final sample was composed of 1,628 adolescents enrolled in 44 public schools with a higher participation of boys 773, (52.5%).	11 to 17.9 years	Cross-sectional study. The sample was selected by two-stage conglomerate (microregions and schools). Data were collected using a self-reported food frequency questionnaire, asked to report the quantity and frequency each item was consumed in the previous month.	Intake of soft drinks, fruits and vegetables, and current alcohol use. Soft drink consumption was considered high if adolescents reported daily use.	Daily consumption of soft drinks was reported by 47.6%, (95% CI: 45.1-50.0) of the adolescents.

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Barbosa Filho et al.[20] (2014)	Brazil (2011)	To analyze the prevalence of physical inactivity, sedentary behaviors, and unhealthy eating habits.	The systematic review counted 5,872 potential articles and 69 were selected, according to the inclusion criteria. The sample size of the included studies ranged from 105 to 60,973 individuals.	10 to 19 years old.	The search strategies were built around three groups of keywords: risk behaviors, sample type and nationality. observational studies showing the prevalence of at least one of the behavioral risk factors included in the review.	The studies that evaluate the prevalence of unhealthy eating habits considering food consumption in two ways: low consumption of healthy foods (fruits and vegetables) or high consumption of unhealthy foods (sweets, soft drinks).	High consumption of soft drinks was the most studied outcome (37.5%), followed by high consumption of sweets (31.2%). The prevalence of high soft drink consumption ranged from 20.4% to 71.0% and 84.6% of these found prevalence above 30%. In the 10 studies examining high consumption of sweets, the prevalence ranged from 20.1% to 96.9%. Four of these studies (40%) estimated a prevalence of high sweet consumption above 50%.
Barbosa et al.[14] (2016)	Jequié, BA (2012)	To describe health risk behaviors of high school students from public schools.	The sample size was 827 students from 788 schools with 331 (40%) male and 496 (60%) female.	14 to 19 years old.	Cross-sectional population-based study with simple random sampling. A validated questionnaire was used for sociodemographic research, physical activity, eating habits, tobacco use, and alcohol consumption.	Weekly frequency of consumption of fried foods, sweets and soft drinks, fruits and natural juices and vegetables. Consumption of sweets and soft drinks three or more days a week was considered a bad habit.	The consumption of sweets/soft drinks was considered inappropriate in 55.8% and 60.6% in the male and female sexes, respectively.
Brito[32] (2016)	Teresina, PI (2015)	To investigate the relationship between diet and dental caries in adolescents with high sugar consumption in the childhood.	In the first phase of the study, 220 students from three to five years were examined. After 10 years, a response rate of 80% of the initial sample was obtained. Of the 176 re-examined, 61.4% were female.	13 to 15 years old.	Cohort study with schoolchildren from a private educational institution. The participants completed a Food Frequency Questionnaire (FFQ).	Daily consumption of extrinsic sugar, which was considered as zero (0), when the food was not consumed; the frequency option "once a day" as a value one (1) and went to transform the other options into daily frequencies proportionally. The variable was categorized into consumption ≤6x per day and >6 times per day.	The number and percentage of students who consumed coffee, tea, milk with sugar; fruit vitamins with sugar; soft drinks, natural/artificial juice with sugar; chocolate; candies, chewing gum, lollipops; sweet or filled cookies and sweet cake were:107 (60.8%), 98 (55.7%), 142 (80.7%), 165 (93.8%), 167 (94.9%), 165 (93.8%), 151 (85.8%),140 (79.5%), respectively. The analysis of the frequency of sugar-rich foods showed that 50% of the schoolchildren consume more than 6 times daily.

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Carmo et al.[21] (2018)	São Luís, MA (January 2014 and July 2016).	To estimate the association between added sugar consumption and chronic oral disease burden in adolescents.	Students enrolled in 13 public high schools. The final sample was composed of 405 adolescents, 44.4% were male and 55.6% were female.	17 to 18 years old.	Observational and analytical cross-sectional study considering the pathways of obesity and systemic inflammation through structural equation modeling. Three-stage complex random sampling procedure was performed. A food frequency questionnaire was used to identify added sugars.	A latent variable named added sugar consumption was composed of the following foods: candies, soft drinks, cookies and chocolates. Consumption was obtained by multiplying the weekly (0 to 7 times per week) and daily (1 to 6 times per day) consumption frequency for each food.	Regarding the frequency of consumption of soft drinks, 33% of the students reported consuming them three or more days a week, while for the consumption of sweets this percentage was 52.8%.
D'Avila et al.[10] (2016)	Florianópolis, SC (September 2012 to June 2013)	To evaluate the association between diet, physical activity, and socioeconomic factors with body fat percentage.	The sample consisted of 2,506 students (1,172 males and 1,334 females) from public (n=19) and private (n=11) schools.	7 to 14 years old.	Cross-sectional study with a probabilistic sample. The Food Questionnaire of the Previous Day (QUADA), version 3, was applied.	Foods belonging to the risk group (chocolate milk, juices, soft drinks, sweets, industrialized snacks, potato french fries, and fast food snacks).	The frequency of students consuming risky foods inappropriately (>3 times per day) was 40.5%.
Do Carmo et al.[23] (2016)	Belo Horizonte, MG (2013)	To evaluate food frequency and nutritional status among students according to participation in the Bolsa Família Program.	The sample consisted of 319 students, with 56.4% male and 43.6% female.	Average: 8.6 to 11.9 years.	Cross-sectional study. Conglomerate sampling was used in two stages according to the regions of the municipality. Food intake was assessed by the Food Frequency Questionnaire (FFQ).	The consumption of nine foods in the last six months (soft drinks, artificial juice, processed snacks, stuffed cookies, sweets, fruits, vegetables, milk, and beans). The frequency of consumption was classified as regular (≥ 5 times per week) and irregular (< 5 times per week).	High prevalence of regular consumption of soft drinks (34.3%), artificial juice (49.5%) and sweets (40.3%). Frequency of food consumption by the students: Soft drinks - Irregular: 65.7%, Regular: 34.3%, Artificial juice - Irregular: 50.5%, Regular: 49.5%, Filled cookies - Irregular: 67.3%, Regular: 32.7%, Candy: Irregular: 59.7%, Regular: 40.3%.

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Duarte Jr et al.[28] (2021)	Porto Alegre, RS (2019)	To verify the multivariate relationships among dietary habits, cardiorespiratory fitness, body mass index and cardiometabolic risk factors in children.	The study population included all students from first to fifth grade in a public school (n=480). The convenience sample consisted of 60 students (27 boys and 33 girls).	6 to 11 years old.	Quantitative cross-sectional study. Food habits were assessed through the Food Frequency Survey of the National Food and Nutrition Security System (SISVAN).	Consumption of unhealthy dietary foods such as fried snacks, sweets and candies, soft drinks, ultra-processed salty foods. Consumption was classified as frequent (more than five times per week) and infrequent (for less than five times per week).	For the markers of unhealthy eating, 48.3% of the children consumed ultra-processed foods, 41.3% consumed soft drinks, 69.2% consumed sweets, and 14.5% fried snacks.
Fernandes et al.[11] (2015)	DF (2014)	To evaluate the food intake and socioeconomic profiles of full-time students in a public school.	The sample was composed of 22 students of both genders, 63.6% being male.	10 to 12 years old.	A descriptive cross-sectional study using the 24-hour recall (R24), with information on food and beverages ingested from the first to the last meal, and a Food Frequency Questionnaire (FFQ).	Consumption of foods such as fast food, soft drinks, fruits, vegetables and packaged snacks. Frequency was categorized as: no consumption, once a week, two or more times a week, or daily.	Among the most consumed daily foods were sweets, fruits and soft drinks; packaged snacks two or more times a week and “fast food” once a week. Soft drinks were consumed two or more times a week by 59.09 % of the students and 54.55 % consume sweets daily.
Ferrari[27] (2019)	Barra dos Garças, MT (2018)	To evaluate the prevalence of excessive body weight and eating habits in students ofelementary school.	The sample consisted of 202 students (87 girls and 115 boys), with 98 from public school and 104 from private school.	8 to 9 years old.	No information about the study design. A food frequency and physical activity questionnaire was applied (not validated).	Intake of sweets, candies and confectionery, assessed by a food frequency questionnaire.	The food intake of sweets and candies was considered excessive, with 37.13% and 39.11% of the students consuming from two to four days or five to seven days, respectively. As for the consumption of soft drinks, 49.5% and 27.23% consumed them from two to four days and five to seven days, respectively.
Linhares et al.[12] (2018)	Mucambo, CE (2012)	Compare the food consumption of public and private school children.	The sample was composed of 90 students, 60 from public schools (n=37) and 30 from private schools (n=19), 63.3% being female.	9 to 12 years old.	Descriptive cross-sectional study using a Food Frequency Questionnaire (FFQ). The students were asked about their consumption of foods from different food groups during the seven days prior to the application of the questionnaire.	Consumption of items belonging to the following groups: “milk and dairy products”, “meat and eggs”, “fruits and vegetables”, “cereals and legumes”, “fats”, and “soft drinks and snacks”.	In the “soft drinks and snacks” group, the private school students reported consuming these products four or more days a week. The frequencies of consumption of “artificial juices”, “plain sweet cookies/biscuits”, “cookies/biscuits with filling, sweets, chocolate or ice cream” and “chips” were considered moderate, occurring on one to three days, or even not at all during the period assessed, but most public school students reported not consuming such foods.

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Longo-Silva et al.[18] (2016)	Brasil (2012)	To investigate the frequency of consumption of obesogenic foods among adolescents andsociodemographic, family, behavioral and environmental factors associated with their regular consumption based on data from PeNSE-2012.	The study population consisted of 9th grade (high school) students attending publicand private schools during the day. The final sample consisted of 109,104 students, with a predominance of females (57.1%).	11 to 19 years or older; the largest number ofadolescents were younger than 14 years old (68.4%).	Cross-sectional study. A structured self-report questionnaire was used. For food consumption, the variables were categorized as follows: consumption of 3 or more days and 2 or fewer days in the seven days prior to the study.	The dependent variables were, among other foods, sweets (candy, hard candy, chocolates, gum, and lollipop sticks) and soft drinks.	The proportion of students who regularly consumed sugar sweets (60.9%) and soft drinks (56.2%) and higher among girls. Regarding the consumption of the investigated food groups (fried snacks, packaged snacks, sugar sweets and soft drinks), the proportion of students who consumed regularly (three or more days a week) ranged between 27.17% and 65.96%. The prevalence of consumption sweets seven days a week was 27.9% for both genders and 34% for girls, while soda consumption was 19.4% for both genders.
Messias et al.[16] (2016)	Petrolina – PE (August 2013 to June of 2015).	To evaluate the consumption of ultra-processed foods and food coloring agents by adolescents in a public school.	The sample was composed of students enrolled in the year 2013 of both genders (n = 526), with 66.54% female.	10 to 17 years old.	Cross-sectional study. The instrument used to evaluate food intake was the 24-hour recall (R24 h). The recall was applied in two interviews (a typical day - Monday to Friday, and an atypical day - Saturday, Sunday and holiday).	The Collegiate Resolution (RDC) No. 24, dated June 15, 2010, was used as a reference to classify foods high in sodium, sugars and fats. The classification for foods high in sugars was ≥ 15 g per 100 g of food or 7.5 g per 100 mL).	The percentage of consumption of sugar-rich foods was: powdered chocolate and ready-made chocolate: Female: 88 (25.14%), Male: 38 (21.59%); filled cookies: Female: 75 (21.42%), Male: 42 (23.86%); breakfast cereal: Female: 20 (5.71%), Male: 17 (9.65%); soft drinks: Female: 165 (47.14%), Male 107 (60.79%); Ice cream and milkshakes: Female: 58 (16.57%), Male: 13 (7.38%); Candy, lollipops, gum: Female: 39 (11.14%), Male: 13 (7.38%).
Moura[31] (2013)	Cuiabá, MT (2012)	To evaluate the association between sugar consumption pattern and the presence of oral changes.	The sample involved 1,169 students, 596 (50.9%) male and 573 (49.1%) female.	6 to 12 years(average of 8.3 years).	Cross-sectional study. A food frequency questionnaire was applied, with the foods characterized according to the frequency consumed without estimating the quantity.	The foods with sugar were classified in categories: foods containing retentive sugars: candies, dried fruits, sweets containing sugar, jellies, sauces; foods containing starch and sugar: cookies, cereals and industrialized cakes; milk and dairy products: chocolate milk, yogurt, flans, creams and ice cream; beverages with sugar: juices and soft drinks.	A high daily intake of sugars and carbohydrates was observed. Approximately 70% (n=807) of the respondents reported eating chocolate milk, yogurt, flans, creams, and ice cream every day.

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Noll et al.[17] (2016)	Pole city-GO. (2014)	To evaluate the anthropometric profile and the eating habits of schoolchildren from different educational networks.	A total of 827 high school students of both genders participated in the study, with 408 (49.3%) male students and 419 (50.7%) female students.	14 to 19 years old.	Cross-sectional population-based study. The instrument used to assess eating habits was the developed and validated questionnaire used in the National Survey of School Health (PeNSE).	The foods were divided into two groups: healthy eating markers and unhealthy eating markers (candies, sausages, fried snacks, pizza, sandwiches and french fries, salty cookies and crackers, sweet cookies and crackers, soda and processed juice).	The consumption of sweet cookies, candies, industrialized sodas and juices, and energy drinks was higher than recommended. The highest weekly frequency (five days or more) for sweet cookies was 20.1%, 28.8%, and 18.8%; for candy was 35.4%, 49.8%, and 45.3%; for soft drinks and industrialized juices was 28.3%, 49.8%, and 39.6%, for the federal, state, and private networks, respectively.
Oliveira-Campos et al.[26] (2018)	Brazil (2012- 2015)	To analyze trend estimates on the prevalence of risk and protective behaviors for chronic noncommunicable diseases in adolescents, according to data from the 2009, 2012, and 2015 editions of the (PeNSE).	Data from the sample of 9th grade students residing in Brazilian capitals were used. In 2015, 51,192 adolescents were interviewed.	Average age: 14 years	Cross-sectional study with secondary data from PeNSE from the years 2009, 2012 and 2015*. The sampling plan was conducted in conglomerates with stages and selection with proportional probabilities. Students completed an individual questionnaire. * In the present scoping review, only data from the 2015 edition was used.	Consumption of sweets (candies, chocolate, gum or lollipops) and soft drinks. Consumption was considered regular for students who reported ingesting these items on at least five of the seven days prior to data collection.	Regular consumption (>5 days a week of sweets and soft drinks) was reported by 41.8% (41.0 - 42.5) and 28.8% (28.2 - 29.5) of the schoolchildren, respectively.

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Paiva et al.[24] (2018)	Poços de Caldas, MG (2015-2016)	Identify BMI (body mass index) and evaluate the relationship between biochemical analysis, anthropometric data, and dietary patterns.	A sample of 104 children was obtained from a population of 350 children, 58 from public school and 46 from private school, and 53.9% (56) male and 46.2% (48) female.	6 to 12 years old.	Cross-sectional study. The evaluated variables were bio-socioeconomic, anthropometric data and eating habits through an interview. The food history considered one day before data collection and the frequency of food consumption in portions over a one-week period by feeding classification according to the Brazilian Society of Pediatrics (SBP).	Consumption and portions of breads, cereals, tubers and roots, oils and fats, sugars, fruits, vegetables and legumes, meat and eggs, milk, cheese and yogurt, and water.	Regarding food portions, an exacerbated intake of sugars was observed, at all ages, in both public and private schools, with a value above the recommended by SBP.
Pinto et al.[29] (2016)	Ribeirão Preto, SP (2013-2014)	To determine the prevalence of overweight and obesity and its association with dietary and behavioral factors.	The sample consisted of 505 students, of which 265 (53%) were male.	10 to 16 years old.	Cross-sectional, randomized study conducted in 11 elementary schools. Data were collected through interviews with the selected students. Data on diet were obtained through a structured questionnaire.	Eating habits (drinking water, eating breakfast, lunch, snacks and dinner daily; eating sweets and drinking soft drinks).	Daily consumption of sweets and soft drinks was reported by 54.1% of adolescents being significantly more frequent among girls [RR=0.75 (0.64-0.88) and PR=0.82 (0.70-0.97), respectively].

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Rego et al.[22] (2020)	Manaus, AM (2016)	To investigate the relationship between nutritional status and dental caries among 12-year-old low-income children considering socioeconomic, psychosocial, and behavioral factors.	The randomized sample involved 406 students, 235 (57.9%) female and 171 (42.1%) male.	12 years old.	Cross-sectional study with a representative sample of students using a two-stage, randomized sampling process. Free sugar intake was investigated using a Food Frequency Questionnaire (FFQ).	Frequency and amount of sugary foods and beverages consumed in the past 12 months, including sugar, milk chocolate, soda, powdered chocolate, candy/ gum, jelly, guava, candy, chocolate bars, stuffed cookies, cake, sweet popcorn, corn snacks, and ice cream. Frequency and annual sugar intake were categorized into three groups according to terciles (low, moderate, and high).	The mean of daily frequency of sugar intake was 7.2 times per day, and the mean annual sugar intake was 42.5 kg.Sugar intake less than once a day, one to four times a day, five to eight times a day, and nine or more times a day was observed in 1%, 37%, 34%, and 28% of the sample, respectively.
Silva et al.[13] (2015)	Cupira, PE (2013)	To analyze how adolescents perceive healthy eating.	The sample was composed of 40 adolescents of both sexes, 15 (37.5%) males and 25 (62.5%) females.	10 to 14 years old.	A descriptive and exploratory study, with a qualitative approach. A script was used with the following questions: "How do you eat daily?" "What information have you received about healthy eating in the school environment?" "What do you understand by healthy eating?" "What helps you to maintain a healthy diet?" "What makes it difficult for you to maintain a healthy diet?"	The eating practices were divided into two classes: "Routine food recall" and "Eating during the weekend"; and Educational Practices with four classes: "Factors that interfere and facilitate the maintenance of healthy eating practice", "Role of the school in the process of education for healthy eating", "Knowledge about healthy eating", and "Family and the promotion of healthy eating".	Snacking corresponded to the favorite meal, even among adolescents who reported hating eating, reinforcing the replacement of the main meals. The increased consumption of snacks favored the consumption of foods rich in sugars and fats: "In the afternoon I have a snack, sometimes I eat cookies, rarely fruit, which I don't like very much. I really like to eat cookie, chocolate". The weekend recall of eating routine and habits showed frequent omission of main meals, practice of irregular and restricted diets, high consumption of energy foods rich in sugars and fats.

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Continuation

Silva et al.[15] (2016)	Flores da Cunha, RS (2013)	To identify the nutritional pattern, food consumption and school performance of students from a state school.	The sample was composed of 100 high school students. Most of the adolescents were female (74%).	14 to 17 years old.	Descriptive and cross-sectional study. Clinical and anthropometric variables, frequency of food consumption and academic performance were evaluated. Food quality was investigated using a food frequency questionnaire.	Consumption of soft drinks, sweets, candies and sugar to sweeten.	Regarding soft drink consumption: 9% did not consume; 37% consumed less than once a week; 41% consumed from 1 to 3 times a week; and 13% consumed 4 or more times a week. Candy and sweets: 9% consumed less than once a week; 43% consumed 1 to 3 times a week; and 45% consumed 4 or more times a week. Use of sugar to sweeten: 10% consumed it less than once a week; 21% consumed it 1 to 3 times a week, and 63% consumed it 4 times a week or more.
Silva et al.[30] (2016)	Sergipe (2011)	To determine the prevalence of fruit and vegetable consumption and identify the association with low physical activity level, exposure to sedentary behavior, soft drink consumption and overweight/obesity in adolescents.	The final sample consisted of 3,992 adolescents (61.3% female and 38.7% male).	14 to 19 years old.	Study with secondary data from a cross-sectional epidemiological survey in adolescents living in rural and urban areas. The sampling was by stratified conglomerate. Data collection was by applying a questionnaire on regular consumption of soft drinks.	Soft drink consumption, which was considered affirmative if reported one or more times a day.	The consumption of soft drinks (57.5%) was considered excessive by the adolescents. The frequency of one or more times a day was reported by 843 (54.6%) females and 1,453 (59.4%) males.
Vieira[33] (2013)	Viçosa, MG (2012)	To verify the influence of family and school on children's consumption of foods rich in sugarfat and sodium.	The sample was composed of 45 children, 25 enrolled in public school and 20 in private school.	7 to 9 years old.	Qualitative study. The data were collected from the children and their respective parents (or guardians). Together with the children, direct observation was done at school playtime. The focus group technique was also used, which occupies between participant observation and in-depth interviews.	Frequency of consumption of 17 foods high in sugar, fat, and sodium consumed by the children at meal breaks and/or during meals in the past six months.	It was found that, although the children belonged to groups with different characteristics, they had similar tastes, preferring foods with high sugar, fat, and sodium content. Among the children's speeches it can be highlighted: "…. I like a lot of soft drinks and filled cookies", "Candy is very tasty", "I like brigadeiro and popsicles", "Every day I eat filled cookies", "I chew gum every day", "Every day I drink soda!".

Most of the studies are scientific articles published in journals (n = 21, 87.5%)[10-30], with the remainder published in a repository of theses and dissertations[31-33]. As for articles, these were published in journals in the areas of public health (n = 4)[10,11,13,20], pediatrics (n = 4)[23,25,29,30], medicine (n = 4)[15-17,27], dentistry (n = 3)[19,21,22], nutrition (n = 2)[18,28], nursing (n = 2)[14,24], epidemiology (n = 1)[26], and interdisciplinary (n = 1)[12].

In the matter of study designs, twenty observational studies were included, with nineteen cross-sectional studies[10-12,14-19,21-26,28-31], and one cohort study[32], one systematic review[20], two qualitative studies[13,33], and one study that did not report its design[27]. As for the type of data, twenty studies used primary data[10-17,19,21-25,27-29,31-33], while four used secondary data, being a systematic review[20], a population-based cross-sectional study in Sergipe[30], and two using data from the National School Health Survey (PeNSE)[34]. For this review, it was chosen to select two studies, representing PeNSE 2012 and 2015, respectively[18,26].

In regard to the methods used, there was a predominance in the use of quantitative approaches[10-12,14-19,21-32,] to assess the frequency of sugar-sweetened food consumption among Brazilian schoolchildren, with only two of the included studies conducted by qualitative approaches, being one study using the interview method[13] and one study using the focus group technique[33]. It was also observed that most of the studies (79%) used questionnaires to collect data[10-12,14,15,17-19,21-23,25-32]. With regard to the characteristics of the schoolchildren in the included studies, their age ranged from 6 to 19 years of age, with a predominance of female participants, that is, fourteen of the studies that used primary data obtained girls as the majority of the sample[10,12-19,21,22,28,30,32]. As for the type of institution, fourteen of these involved exclusively schoolchildren enrolled in public schools[11,13-16,19,21-23,25,28-31].

The studies were conducted in the states of Santa Catarina (n = 1), Distrito Federal (n = 1), Ceará (n = 1), Pernambuco (n = 2), Mato Grosso (n = 2), Minas Gerais (n = 3), Bahia (n = 1), Rio Grande do Sul (n = 2), Goiás (n = 1), São Paulo (n = 2), Maranhão (n = 1), Amazonas (n = 1), Paraná (n = 1), Sergipe (n = 1), and Piauí (n = 1).

From the analysis of the studies included, it was found a significant frequency of consumption of foods rich in sugar in the daily diet of brazilian schoolchildren, considering that most studies showed a consumption considered high or inadequate of this food group. Furthermore, despite the significant part of the evidence included being characterized as quantitative and cross-sectional studies, the qualitative studies showed agreement with this scenario, identifying the eating habits of school-age children and adolescents, consisting of the high intake of foods rich in sugar and with a high degree of potential harm to health.

Discussion

The purpose of this review was to map the evidence on the frequency of consumption of sugary foods among schoolchildren in Brazil, and for this purpose it was able to identify twenty-four studies. Most of the studies were published between the years 2011 and 2016, where it is also noticed an uneven distribution among the publications obtaining few studies that were concentrated in the Northern region of Brazil, for example. The review also showed that there is a

predominance of quantitative and cross-sectional studies and with predominance in public schools, although some studies performed their inferences in public and private schools concomitantly.

It is also noteworthy that most studies used questionnaires to conduct their investigation and that among the sugar-sweetened foods evaluated, soft drinks were the most investigated among the studies. This might be associated with the production of recent scientific literature, in witch sugary drinks are in evidence due to their high consumption and contribution to the onset of chronic noncommunicable diseases, and that for these reasons, taxation for this type of product in order to reduce their intake have been implemented with positive results in some countries, such as Mexico[35]. Brazil also has some initiatives to tax sugary drinks in its history, but not yet consistently and sufficiently to reduce their consumption[36].

From the studies included, sugary foods such as soft drinks, processed juices, chocolate drinks, candies, sweets, filled cookies, and confectionary foods are notably present in the daily diet of Brazilian children and adolescents, with a significant portion of the studies reporting daily and habitual consumption. This consumption was also reported by an epidemiological study that among its objectives reported the intake of sugars among children and adolescents aged 10 to 19 years. The authors identified that the main sources of sugars in the diet were sugary drinks, cookies, candies, cakes, bread and table sugar, with only 20.1% of these adolescents reporting an adequate consumption, corroborating the findings observed in this review[37].

In addition to data published in the scientific literature, a national survey conducted periodically with students from public and private schools also aims, among its assumptions to characterize the food consumption of children and adolescents. The National School Health Survey (PeNSE), had in its latest edition held in 2019, the evaluation of the habitual consumption of food markers of healthy and unhealthy eating, having as representatives of the markers of unhealthy eating, sweets and soft drinks[38]. The consumption proportions reached 32.8% for sweets and 17.2% for soft drinks, showing a reduction in the proportions of students with habitual consumption of soft drinks compared to PeNSE 2015[38]. However, a previous study presenting data from a household-based survey also reported this sugar consumption profile, demonstrating a high consumption of sugars by the Brazilian population that exceeds the limits established by official recommendations[39].

An increase in sugar consumption has been reported in emerging countries, such as those in Latin America. In these developing countries, between 1963 and 2003, a 127% increase in calories from sugars was observed, with a concomitant decline in consumption of legumes and tubers in both developed and emerging countries over the same period[40]. These changes in food consumption have among their facilitating factors urbanization, globalization, food industry marketing, the actions of transnational food corporations, and trade liberalization, leading to a change in the food environment and in the behavior of consumers and contributors to an unhealthy and unsustainable food system[40].

This consumption by Brazilian schoolchildren leads to reflect on how much this population group may be exposed to chronic diseases in the short or long term, since

the high consumption of sugar has been associated with obesity and diseases such as diabetes mellitus[41]. Oral disorders can also be a consequence of this high intake such as periodontal disease, oral cancer, dental caries and consequently tooth loss, which also burden the global public health services, along with an economic burden of high relevance, presenting direct and indirect costs[42]. These consequences are aggravated due to the high prevalence of these diseases, having untreated dental caries for example, as the most prevalent condition in the year 2010, impacting 35% of the population worldwide[42].

Relations between high sugar intake and health harms are under constant discussion in scientific productions. Thus, in a review that synthesized recommendations at individual and population level to reduce its consumption and consequently reduce the incidence of dental caries and other chronic diseases, such as: education strategies for families, taxation of sugary drinks, regulation of advertising, labeling of sugary foods, reformulation of foods with high sugar content and promoting sugar-free areas are among the actions to achieve these goals[43]. The latter is one of the objectives in which Brazil already has norms in order to achieve this purpose specifically for schoolchildren, such as the National School Feeding Program (PNAE)[44]. However, the program still has obstacles that demand a greater engagement and strengthening, such as the commitment to establish itself as a social policy and the recognition as a right to children[44].

These actions to control sugar consumption have some barriers to be achieved, since economic interests are involved in this scenario. The sugar industry represents a notable segment of the commercial determinants of health, a concept that establishes the role of the private sector in exercising strategies in order to promote products that are harmful to health, with corporate actions that involve lobbying, influence in the political agenda, performance in the media and marketing strategies[45]. A food system that values profit over the health status of the population is suggested, including the influence of commercial interests on research agendas and a consequent disconnect between research agendas and public health priorities[46,47].

Given the purposes of a scoping review, it was possible to identify whether there are scientific gaps about this theme in the scope of publications found and discussed by the authors. Despite the diversity of designs, methodologies, and samples of the studies included, it was found that a significant portion of the studies have a limited sample size, and may be non-representative, thus restricting their assumptions and findings. It was also observed that although studies from various parts of the country were included, an uneven concentration of studies was perceived, demonstrating a scarce number of studies in some regions. Taking into consideration the continental size of the country and the particularities of each region, future studies are needed in order to understand more rigorously the dietary profiles and the consumption of sugary foods among Brazilian students.

This review has some limitations, and they should be listed. Considering a scoping design, consequently a mapping purpose, an assessment of the quality of the included studies was not performed. Nevertheless, it follows as a contribution to draw a profile of the frequency of consumption of foods rich in sugars among children and adolescents from public and private schools in Brazil, and establish an

overview about the scientific productions that encompass this proposal. And consequently, cooperate with the formulation of public policies that favor changes in eating patterns, achieving healthier eating habits.

In conclusion, this study has shown that the frequency of sugar consumption was considered high, requiring the immediate search for solutions to mitigate this frequency. A healthy and adequate diet is considered in universal terms, a human right. Therefore, environments that favor access to healthy foods and without harmful effects on health are essential for healthy eating patterns to be achieved, especially for children and adolescents who require good nutrition for their development.

Conflict of Interest

The authors have no conflict of interest to disclose.

Data availability

Datasets related to this article will be available to the corresponding author upon request.

Author Contribution

Larissa Neves Quadros: designed the study, contributed to data collection and analysis, wrote the first draft of the article. **Janete Maria Rebelo Vieira, Andressa Coelho Gomes and Ana Cyra dos Santos Lucas**: contributed to data collection and analysis**. Maria Augusta Bessa Rebelo**: designed the study, contributed to data collection and analysis, wrote the first draft of the article. All authors read and approved the final manuscript and actively participated in the discussion of the manuscript's findings.

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Appendix 1. Search strategy used in one of the searched databases.

Database	Search Estrategy
MEDLINE (via PubMed)	Sugar OR Sugars OR "Sugar-Sweetened Beverages" OR "Beverage, Sugar Sweetened" OR "Beverages, Sugar-Sweetened" OR "Sugar-Sweetened Beverage" OR "Sugar-Added Beverages" OR "Sugar Added Beverages" OR "Sugar Sweetened Beverage" OR "Beverage, Sugar Sweetened" OR "Beverages, Sugar Sweetened" OR "Sugar Sweetened Beverages" OR "Sweetened Beverage, Sugar" OR "Sweetened Beverages, Sugar" OR "Sugar-Added Beverage" OR "Beverage, Sugar-Added" OR "Beverages, Sugar-Added" OR "Sugar Added Beverage" OR "Sweetened Drinks" OR "Sweetened Drink" OR "Drink, Sweetened" OR "Drinks, Sweetened" OR "Sugar-Sweetened Soft Drinks" OR "Sugar Sweetened Soft Drinks" OR "Sugar-Sweetened Soft Drink" OR "Drink, Sugar-Sweetened Soft" OR "Drinks, Sugar-Sweetened Soft" OR "Soft Drink, Sugar-Sweetened" OR "Soft Drinks, Sugar-Sweetened" OR "Sugar Sweetened Soft Drink" OR "Sweetened Beverages" OR "Sweetened Beverage" OR "Beverage, Sweetened" OR "Beverages, Sweetened" OR "Sugar-Sweetened Sodas" OR "Sugar Sweetened Sodas" OR "Sugar-Sweetened Soda" OR "Soda, Sugar-Sweetened" OR "Sodas, Sugar-Sweetened" OR "Sugar Sweetened Soda" OR "Dietary Sugars" OR "Sugars, Dietary" OR "Dietary Sugar" OR "Sugar, Dietary" OR "Feeding Behavior" OR "Behavior, Feeding" OR "Feeding Behaviors" OR "Eating Behavior" OR "Behavior, Eating" OR "Eating Behaviors" OR "Feeding-Related Behavior" OR "Behavior, Feeding-Related" OR "Feeding Related Behavior" OR "Feeding-Related Behaviors" OR "Feeding Patterns" OR "Feeding Pattern" OR "Pattern, Feeding" OR "Food Habits" OR "Food Habit" OR "Habit, Food" OR "Eating Habits" OR "Eating Habit" OR "Habit, Eating" OR "Dietary Habits" OR "Dietary Habit" OR "Habit, Dietary" OR "Diet Habits" OR "Diet Habit" OR "Habit, Diet" OR "Habits, Diet" OR "Fast Foods" OR "Fast Food" OR "Food, Fast" OR "Foods, Fast" OR "Convenience Foods" OR "Convenience Food" OR "Food, Convenience" OR "Foods, Convenience" OR "Ready-Prepared Foods" OR "Food, Ready-Prepared" OR "Foods, Ready-Prepared" OR "Ready Prepared Foods" OR "Ready-Prepared Food" OR "Ready-To-Eat Meals" OR "Ready To Eat Meals" OR "Meals, Ready-To-Eat" OR "Meal, Ready-To-Eat" OR "Meals, Ready To Eat" OR "Ready-To-Eat Meal" OR Sucrose OR Saccharose OR Snacks OR Snack OR "Snack Food" OR "Food, Snack" OR "Foods, Snack" OR "Snack Foods" OR Snacktime OR Snacktimes OR Snacking OR Candy OR Candies OR Confection OR Confections OR "Caramel Candy" OR "Candies, Caramel" OR "Candy, Caramel" OR "Caramel Candies" OR Carbohydrates OR Carbohydrate OR Meals OR Meal OR Mealtimes OR "Meal Times" OR "Time, Meal" OR "Times, Meal" OR "Meal Time" OR Mealtime OR "Energy intake" OR "Caloric intake" OR"Sugar intake" OR "Sugar consumption" OR "Free sugars" OR "Extrinsic sugar" OR "Ultra-processed foods" AND Child OR Children OR Adolescent OR Adolescents OR Adolescence OR Teens OR Teen OR Teenagers OR Teenager OR Youth OR Youths OR "Adolescents, Female" OR "Adolescent, Female" OR "Female Adolescent" OR "Female Adolescents" OR "Adolescents, Male" OR "Adolescent, Male" OR "Male Adolescent" OR "Male Adolescents" OR Students OR Student OR Schoolchildren AND Brazil OR Brazilians