

Food consumption markers and associated factors in Brazil: distribution and evolution, *Brazilian National Health Survey, 2013 and 2019*

Marcadores de consumo alimentar e fatores associados no Brasil: distribuição e evolução, *Pesquisa Nacional de Saúde, 2013 e 2019*

Marcadores de consumo de alimentos y factores asociados en Brasil: distribución y evolución, *Encuesta Nacional de Salud, 2013 and 2019*

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Abstract

This study objective was to describe the distribution of food consumption markers in Brazil per sociodemographic characteristics and its evolution from 2013 to 2019. Healthy food consumption markers (regular consumption of beans, fruits, vegetables, and fish, recommended consumption of red meat, and never replacing meals with snacks) and unhealthy food consumption markers (regular consumption of sweetened beverages and confectionery and excessive salt intake) were studied for adult participants of the Brazilian National Health Survey. The prevalence of food consumption markers was estimated according to sociodemographic characteristics and compared to data of 2013 and 2019. Most of the population regularly consumes beans, fruits, and vegetables, they also follows the recommendation to limit red meat consumption, and never replaces meals with snacks. The percentage of people who regularly consume sweetened beverages and perceive their salt intake as excessive is relatively low. The distribution of food consumption markers was associated with sex, age, income, race/skin color, area of dwelling, and schooling level. From 2013 to 2019, the prevalence of most food consumption markers declined, except for the regular consumption of fruits and recommended consumption of red meat, that increased 8.5% and 18.5%, respectively, and the regular consumption of vegetables, which did not vary. Healthy and unhealthy food consumption markers should be monitored to evaluate the effect of healthy eating policies implemented in the country.

Feeding Behavior; Eating; Health Surveys

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Introduction

Inadequate nutrition greatly affects the burden of diseases worldwide. In 2017, 11 million deaths and 255 million disability-adjusted life years (DALYs) were attributed to dietary risk factors, mostly high sodium intake and low consumption of whole grains and fruits ¹. In Brazil, in 2015, inadequate diet was the top risk factor for deaths and disability, contributing with 12.2% of DALYs in men and 11.1% in women ².

Two groups of foods have been recognized as indicators of healthy or unhealthy diets in the literature: ultra-processed foods and natural food. High intake of ultra-processed foods – including sweetened beverages, processed meats, ready-to-eat meals, and packaged snacks – has been associated with obesity and several noncommunicable chronic diseases – including diabetes, cancer, and hypertension ^{3,4}. On the other hand, the abundant and diversified intake of plant-based foods – including fruits, vegetables, whole grains, and beans – has been considered health protective ⁵. The *Dietary Guidelines for the Brazilian Population* recommend to base diets on natural or minimally processed foods, mainly plant-based, and to avoid ultra-processed foods ⁶.

In Brazil, three national surveys periodically obtain data on the population's food consumption. The *Brazilian Household Budget Survey* (POF) of the Brazilian Institute of Geography and Statistics (IBGE) collect data about food consumption using 24-hour dietary recall (24HR) and foods that are purchased by families for household consumption. Despite providing a detailed analysis of Brazilian's food patterns, POFs are expensive, complex, and therefore planned to be less frequent than other simpler surveys. On the other hand, the *Risk and Protective Factors Surveillance System for Chronic Non-Communicable Diseases Through Telephone Interview* (Vigitel) survey, conducted by the Brazilian Ministry of Health, annually inquires the frequency of consumption of foods that are markers of healthy and unhealthy dietary patterns from dweller of the states capitals. Using the same food markers of Vigitel, the *Brazilian National Health Survey* (PNS), firstly conducted in 2013 in a partnership between IBGE and the Brazilian Ministry of Health, was designed to describe the health status and lifestyle of Brazilians every five years, at a national level ^{7,8}.

Overall, data from Vigitel and POFs have already indicated changes in the Brazilian dietary pattern over the last decade. According to Vigitel, the prevalence of regular consumption of fruits and vegetables among inhabitants of Brazilian capitals showed a slight trend of increase from 19.5% (2010) to 22.9% (2019). On the other hand, the consumption of beans decreased progressively from 65.6% to 59.7% in the same period ⁹. Data from the 2008-2009 and 2017-2018 POFs confirm the decline of beans in the Brazilian diet, whereas the consumption of ready-to-eat meals increased in about 60% from 2008-2009 to 2017-2018 for adults (from 10.5% to 17%) ¹⁰. Both surveys indicated a significant decrease in the consumption of soft drinks in Brazil ^{9,10}.

Worldwide, studies have shown that food consumption can vary widely across sociodemographic subgroups. In the United States and in Europe, the consumption of fruits and vegetables was directly associated with income in recent representative surveys ^{11,12}. In Brazil, data from the 2013 PNS showed that these foods were mostly consumed by people with higher schooling levels, a proxy of income ¹³. The survey also showed that women consumed more fruits and vegetables and less sweetened beverages and beans than men ^{13,14}. Therefore, to create better informed policies that promote healthy eating, we must observe the general prevalence and trends of the population's food consumption and consider its distribution across sociodemographic groups.

In Brazil, nutritional surveillance and dietary guidance were instituted under the Brazilian Unified National Health System (SUS) by the Organic Health Law (*Law n. 8,080/1990*). Food and nutritional surveillance continuously describe and predict trends in the population's diet and nutrition conditions and their determining factors, seeking to support actions, programs, and policies to improve people's health status ^{15,16}. The PNS allows updating and monitoring the consumption of important healthy and unhealthy food consumption markers in the entire country. This study aims to describe the distribution of food consumption markers in Brazil according to sociodemographic characteristics and its evolution from 2013 to 2019.

Methods

Data used for this study come from the PNS conducted by the IBGE in partnership with the Brazilian Ministry of Health in two periods: from August 2013 to February 2014 and from August 2019 to March 2020^{17,18}.

The PNS is a home-based and nationwide study, part of IBGE's Integrated System of Household Surveys (SIPD) but with its own design, specifically created to collect information on health¹⁷. Its main objective is to investigate the health situation and lifestyle of the Brazilian population and to assess health care regarding the access and use of services, preventive actions, continuity of care, and assistance financing¹⁹.

PNS is a subsample of the Master Sample of the SIPD, whose geographic coverage consists of the census sectors of the Geographic Operational Base of the 2010 *Demographic Census*, which is a representative sample of Brazil's macroregions, urban and rural populations, and capitals¹⁷.

The sampling plan used was cluster sampling in three stages: census tracts, households, and residents aged 18 or over to answer the individual questionnaire for the 2013 survey, and residents aged 15 or over for the 2019 survey. In all stages, a simple random sample was used as a selection method. In total, 60,202 individuals were interviewed in 2013 and 90,846 were interviewed in 2019, out of which 88,531 were aged 18 or older^{20,21}.

In the 2019 survey individual questionnaire, selected residents were asked "How many times a week do you usually eat/drink..." for their consumption of some food items, including: beans; fruits; vegetables; fish; red meat; canned, packaged, or powdered juice; soft drinks; and confectionery such as cookies/sandwich cookies, chocolate, jelly, candies, and others. For eating behavior, the following questions were asked: "How many times a week do you usually replace your lunch with a quick snack, such as sandwiches, pizza, hot dogs, etc.?" and "Considering freshly prepared food and processed foods, do you think your salt intake is: (a) very high, (b) high (c) adequate, (d) low, and (e) very low."

From these questions, healthy and unhealthy food consumption markers were defined according to categorizations adopted in previous studies (except for the red meat and the meal replacement indicators)^{22,23,24}. Unhealthy markers included consuming sweetened beverages (canned, packaged, or powdered juices and soft drinks) and confectionery at least five days a week and self-perceived salt intake as high or very high. Healthy food consumption markers included: consuming beans, fruits, and vegetables at least five days a week; consuming fish at least once a week; consuming red meat three days a week at most; and never replacing lunch with quick snacks. Both red meat and meal replacement indicators were based on the *Dietary Guidelines for the Brazilian Population*⁶, which recommend limiting the consumption of red meat to three meals a week at most and not replacing main meals with snacks.

Firstly, frequencies of food consumption, meal replacement practice (0; 1 to 2; 3 to 4; 5 to 6; or 7 days/week), and salt intake perception were described. The prevalence of healthy and unhealthy food consumption markers, with their respective 95% confidence intervals (95%CI), was estimated for the total population and according to the following sociodemographic variables: sex (male and female); age group (18-39, 40-59, and ≥ 60 years); disposable household per capita income (categorized in quintiles: ≤ 418 , 419-750, 751-1,100, 1,001-2,000, > 2000); race/skin color (white, black, mixed-race, Asian, and indigenous); place of residence (urban and rural); macroregions (Central-West, South, Southeast, Northeast, and North), and schooling level (no elementary school or incomplete elementary school, complete elementary school or incomplete high school, complete high school or incomplete higher education, and complete higher education). Significant differences were identified between the 95%CI, such as the absence of overlap considering 5% significance level.

Variables on confectionery consumption and replacement of meals with snacks were not analyzed for the prevalence of food consumption markers between 2013 and 2019 since the questions differed between the years (in 2013, questions included the preparation of sweets and replacement of lunch or dinner, whereas only confectionery and replacement of lunch were considered in 2019). The proportions were compared using the Pearson's chi-square test, corrected for the sample design with Rao-Scott. The relative changes from 2013 to 2019 were calculated for all markers by subtracting the 2013 prevalence (P1) of the 2019 prevalence (P2) and dividing the result by P1 ($(P2-P1)/P1$).

Data analysis was performed using the Stata software version 15 (<https://www.stata.com>). The sample design was considered for the analyses using the survey prefix command (*svy*) in Stata. We employed expansion factors calibration to the PNS 2013 dataset according to the population projection of the Federative Units by sex and age for the 2010-2060 period, released in 2018. This same population projection was used to calibrate the weights of the PNS 2019, thus ensuring comparability between the two editions of the survey.

The Brazilian National Ethics Research Committee (CONEP) approved the PNS 2013 in July 2013 (n. 328,159) and the PNS 2019 in August 2019 (n. 3,529,376). All participants signed the informed consent form.

Results

The population of the PNS 2019 was composed of 88,531 adults (≥ 18 years old), mostly women (53%), of mixed-race (50%) and white (37%) race/skin color, young adults (aged between 18 and 24 years old – 38%), and residents in the urban area (77%) and the macroregions of Northeast (35%) and Southeast (22%).

Regarding the frequency of food consumption, most Brazilians reported never consuming fish (53.4%), fresh fruit juice (31%), sweetened beverages (37.5%), and confectionery (40.9%) or replacing meals with snacks (75.1%). Around 54.1%, 32.9%, and 41.1% of individuals reported daily consumption of beans, fruits, and vegetables, respectively. Moreover, 61% considered their salt intake to be adequate (Table 1).

The most frequent healthy marker was never replacing meals with snacks, observed in three out of four individuals (75%), followed by the consumption of beans at least 5 days/week (68%). Moreover, more than half of the individuals also reached the vegetable (consumption at least five days/week) and meat (consumption three days/week at most) markers, with 55.2% and 58.4% prevalence, respectively. On the other hand, the less frequent markers were the consumption of fruits at least 5 days/week (45.1%) and fish at least once a week (46.6%) (Table 2).

Table 1

Frequency (%) of food consumption markers. *Brazilian National Health Survey, 2019* (N = 88,531).

Marker	Frequency (%) of consumption				
	Never	1 or 2 times/week	3 or 4 times/week	5 or 6 times/week	Daily
Beans	4.9	12.0	14.7	14.2	54.1
Fruits	11.0	21.1	22.8	12.2	32.9
Fish	53.4	37.8	6.2	1.7	1.0
Vegetables	6.5	16.6	21.8	14.1	41.1
Red meat	7.0	28.3	36.0	13.9	14.8
Replacement of meals with snacks	75.1	18.2	4.6	1.0	1.1
Sweetened beverages	37.5	27.9	14.0	7.8	12.9
Confectionery	40.9	29.3	15.0	5.3	9.6
	Very high	High	Adequate	Low	Very low
Perceived salt intake	1.6	11.1	61.1	22.8	3.3

Table 2Prevalence (%) of healthy food consumption markers, according to sociodemographic variables. *Brazilian National Health Survey, 2019* (N = 88,531).

Characteristic	Beans *		Fruits *		Fish **		Vegetables *		Red meat ***		Replacing meals with snacks #	
	%	95%CI	%	95%CI	%	95%CI	%	95%CI	%	95%CI	%	95%CI
Sex												
Male	74.9	74.2-75.7	39.2	38.3-40.0	46.8	45.9-47.7	50.7	49.8-51.6	51.6	50.7-52.5	75.4	74.6-76.2
Female	62.5	61.7-63.3	50.3	49.4-51.1	46.4	45.7-47.2	59.1	58.3-59.9	64.6	63.6-65.3	74.9	74.1-75.6
Age (years)												
18-39	66.8	66.0-67.7	35.9	34.9-36.8	42.3	41.4-43.3	47.8	46.8-48.8	54.0	53.0-54.9	66.2	65.2-67.1
40-59	69.0	68.1-70.0	47.7	46.7-48.7	49.7	48.7-50.7	59.1	58.2-60.1	60.8	59.8-61.8	78.7	77.8-79.5
> 60	70.1	69.1-71.1	59.2	58.1-60.3	50.0	48.9-51.1	63.4	62.4-64.4	63.4	62.3-64.4	87.3	86.4-88.1
Income quintiles (BRL)												
≤ 418	73.4	72.3-74.4	29.1	27.9-30.4	47.0	45.6-48.4	37.9	36.6-39.2	67.9	66.5-69.2	80.6	79.4-81.7
419-750	74.9	73.8-77.0	38.1	37.0-39.3	45.3	44.0-46.6	47.8	46.5-49.1	61.1	59.8-62.4	75.8	74.5-77.0
751-1,100	73.4	72.3-74.4	44.7	43.5-45.9	42.8	41.5-44.1	55.7	54.4-57.0	58.2	56.8-59.6	76.2	74.9-77.5
1,001-2,000	67.9	66.7-69.2	50.0	48.6-51.3	43.9	42.6-45.3	61.7	60.4-62.9	53.7	52.4-54.9	72.1	70.8-73.3
> 2,000	51.8	50.3-53.4	61.3	60.0-62.5	54.9	53.4-56.3	70.1	68.8-71.4	53.1	51.8-54.3	72.1	70.9-73.4
Race/Skin color												
White	63.8	62.8-64.7	50.4	49.4-51.4	44.1	43.1-45.1	61.6	60.6-62.6	55.3	54.3-56.3	72.7	71.7-73.7
Black	72.8	71.4-74.2	40.0	38.3-41.7	47.0	45.3-48.7	50.2	48.5-51.8	60.3	58.6-62.0	75.2	73.6-76.8
Asian	55.6	48.8-62.2	51.9	44.0-58.7	52.6	45.5-59.6	63.6	56.9-69.8	66.7	60.8-72.2	76.2	70.5-81.2
Mixed-race	72.0	71.2-72.7	41.0	40.1-41.8	48.8	47.9-49.7	49.9	49.0-50.8	60.7	59.9-61.6	77.5	76.6-78.3
Indigenous	67.2	59.7-73.9	44.8	36.1-53.8	51.7	43.4-60.0	54.8	46.5-62.8	65.4	55.7-74.0	79.2	72.9-84.4
Place of residence												
Urban	66.9	66.3-67.6	46.6	45.9-47.3	46.6	45.9-47.3	57.0	56.3-57.7	58.4	57.7-59.1	73.2	72.5-73.9
Rural	76.9	75.8-77.9	35.1	34.1-36.5	46.7	45.2-48.2	43.9	42.6-45.2	58.2	56.7-59.7	87.1	86.3-88.0
Macroregions												
North	48.1	46.6-49.6	37.3	35.9-38.7	74.1	72.6-75.6	41.4	40.0-42.9	64.5	63.2-65.8	83.0	81.7-84.3
Northeast	71.8	71.0-72.6	43.0	42.1-43.9	56.3	55.2-57.3	42.3	41.4-43.3	67.2	66.1-68.2	85.2	84.6-85.8
Southeast	73.1	71.9-74.2	46.8	45.6-48.0	40.8	39.7-42.0	62.1	60.8-63.3	59.2	58.0-60.4	68.5	67.3-69.7
South	55.4	53.8-57.0	49.5	48.1-50.8	34.3	32.9-35.8	63.0	61.6-64.3	48.2	46.9-49.4	69.7	68.3-71.1
Central-West	75.2	73.9-76.4	41.9	40.4-43.4	40.9	39.2-42.7	59.3	57.7-61.0	36.7	35.3-38.2	80.1	78.8-81.3
Schooling level												
No elementary school or incomplete elementary school	76.4	75.7-77.2	41.3	40.4-42.2	46.1	45.1-47.1	50.9	49.8-51.9	62.5	61.5-63.5	84.6	83.8-85.3
Complete elementary school or incomplete high school	72.6	71.3-74.0	40.2	38.8-41.7	43.6	42.1-45.2	50.7	49.1-52.3	56.6	55.1-58.1	71.9	70.4-73.3
Complete high school or incomplete higher education	66.9	65.9-67.8	43.7	42.6-44.7	44.3	43.3-45.3	54.8	53.8-55.8	56.5	55.4-57.5	68.7	67.7-69.8
Complete higher education	49.8	48.3-51.4	60.9	59.4-62.3	55.4	53.9-56.9	69.5	67.9-70.9	55.4	53.9-56.9	71.5	70.0-72.9
Brazil	68.3	67.7-68.0	45.1	44.4-45.7	46.6	46.0-47.2	55.2	54.5-55.8	58.4	57.8-59.0	75.1	74.5-75.7

95%CI: 95% confidence interval.

* Consumption at least 5 days/week;

** Consumption at least 1 day/week;

*** Consumption no more than 3 days/week;

Never replace meals with snacks.

Healthy food consumption markers were influenced by sociodemographic variables. Regarding sex, women had the highest prevalence of fruit, vegetables, and red meat markers and the lowest prevalence of the bean marker. Generally, the prevalence of all healthy food consumption markers increased between the youngest and the oldest age category. Regarding income, the poorest categories had the most adequate prevalence of bean and red meat consumption and meal replacement, but only half of the prevalence of adequacy for fruits and vegetables observed among the richest. This same pattern was observed for different schooling categories (Table 2).

Regarding race/skin color, we emphasize the contrast between the high adequacy of beans and low adequacy of fruit and vegetables among black and mixed-race people compared to other groups. Regarding the place of residence, the regular consumption of beans and never replacing meals with snacks were more prevalent in rural areas whereas fruits and vegetables were more prevalent in urban areas. Among macroregion, the South had the highest prevalence of fruit and vegetable markers and the lowest of fish markers, contrasting with the North. The Central-West had the highest adequacy of beans and the lowest adequacy of red meat whereas the Northeast had the highest adequacy of meal replacement (Table 2).

Table 3 shows the prevalence of unhealthy food consumption markers according to sociodemographic variables. All unhealthy markers were far less frequent than healthy food markers. The most frequent (consumption of sweetened beverages at least 5 days/week) was observed in one out of 5 subjects. Around 15.3% of the population consumed confectionery at least 5 days/week and 12.2% perceived their salt intake as excessive.

Men had the highest inadequacy for both sweetened beverages consumption and salt intake perception, whereas women had the highest inadequacy for confectionery. Regarding age, the youngest group had the highest inadequacy for all unhealthy food consumption markers, similarly to what was observed for healthy markers. Regarding income, prevalence of sweetened beverages was significantly lower among the fifth quintile (16.6%) but did not vary for the other categories, ranging from 20.6% to 22.2%. The prevalence of confectionery and salt intake perception tended to increase from the poorest to the richest category (Table 3), that is, these variables were the lowest for people with lower schooling levels, but did not vary for other levels.

People with complete primary school or incomplete high school had the highest inadequacy for sweetened beverages whereas people with complete higher education had the lowest. No significant difference was observed in the prevalence of unhealthy food consumption markers for race/skin color groups. Urban areas had the highest inadequacy for all markers. Regarding macroregions, the South and the Southeast had the highest inadequacy for the 3 unhealthy markers (Table 3).

From 2013 to 2019, the regular consumption of beans (from 72% to 68.3%), sweetened beverages (from 23.3% to 20.4%), and fish (from 54.6% to 46.6%) significantly decreased. Moreover, the proportion of people who perceive their salt consumption as excessive decreased from 14.2% to 12.2%. On the other hand, regular fruit consumption (from 41.4% to 45.1%) and the prevalence of people who meet the recommendation for red meat consumption (from 49.3% to 58.4%) significantly increased. Regular consumption of vegetables did not vary (Table 4).

Figure 1 shows the evolution of the prevalence of regular consumption of fruits, beans, and sweetened beverages across sociodemographic characteristics. These indicators were chosen because they represent extreme opposites of the *Dietary Guidelines for the Brazilian Population* recommendations: basing the diet on plant-based fresh or minimally processed foods vs. avoiding ultra-processed foods. The vegetables marker was not included because it did not vary from 2013 to 2019. The evolution of all food consumption markers across sociodemographic characteristics is shown in Table S1 and S2 (Supplementary Material: http://cadernos.ensp.fiocruz.br/static//arquivo/suppl-e00118821_2191.pdf). For both men and women, the prevalence of these three food consumption markers changed in a similar proportion. Regarding age, the evolution was worse for the youngest since they had the lowest decrease of sweetened beverages, the lowest increase of fruits, and the highest decrease of beans. Both the richest and the people with higher schooling levels had the highest decreases for both sweetened beverages and beans, whereas the poorest and people with lower schooling levels had the lowest. In general, healthy foods varied in the same direction across all race/skin color groups; however, sweetened beverages increased among Indigenous and Asian despite its general decrease (Figure 1).

Table 3Prevalence (%) of unhealthy food consumption markers, according to sociodemographic variables. *Brazilian National Health Survey, 2019.* (n = 88,531).

Variables	Sweetened beverages *		Confectionery *		Salt intake perceived as excessive **	
	%	95%CI	%	95%CI	%	95%CI
Sex						
Male	23.4	22.6-24.1	14.41	13.76-15.1	14.5	13.8-15.2
Female	18.3	17.6-18.9	15.22	14.59-15.9	11.2	10.7-11.8
Age (years)						
18-39	27.6	26.7-28.4	18.4	17.5-19.2	16.6	15.9-17.4
40-59	16.4	15.7-17.2	11.9	11.2-12.6	11.4	10.7-12.1
> 60	13.8	12.99-14.7	12.7	11.9-13.5	7.2	6.6-7.9
Income quintiles (BRL)						
≤ 418	20.6	19.5-21.7	13.0	12.1-14.0	11.8	10.9-12.7
419-750	22.2	21.2-23.3	14.3	13.4-15.3	11.7	10.9-12.5
751-1,100	21.4	20.3-22.6	13.7	12.8-14.7	11.4	10.6-12.4
1,001-2,000	22.0	20.9-23.2	15.9	15.0-16.9	14.3	13.3-15.3
> 2,000	16.6	15.5-17.7	16.8	15.8-17.9	14.2	13.3-15.1
Race/Skin color						
White	20.7	19.9-21.5	15.7	15.0-16.4	13.4	12.7-14.1
Black	23.0	21.6-24.4	14.6	13.3-15.9	14.3	13.0-15.6
Asian	22.0	16.1-29.4	17.6	12.9-23.5	12.8	9.1-17.7
Mixed-race	19.9	19.2-20.6	14.1	13.4-14.8	11.7	11.2-12.3
Indigenous	26.9	17.9-38.4	11.1	7.7-15.7	11.7	8.2-16.4
Place of residence						
Urban	21.6	21.0-22.1	15.3	14.8-15.9	13.3	12.8-13.9
Rural	14.9	14.0-15.8	11.8	10.9-12.8	9.0	8.2-9.8
Macroregions						
North	15.8	14.8-16.8	9.7	8.9-10.7	11.0	10.2-11.9
Northeast	11.4	10.8-12.0	11.8	11.2-12.4	10.1	9.5-10.6
Southeast	24.9	24.0-25.9	17.3	16.4-18.3	13.3	12.4-14.2
South	26.2	24.9-27.4	16.6	15.7-17.6	17.5	16.3-18.8
Central-West	23.0	21.8-24.3	13.2	12.2-14.3	11.3	10.4-12.3
Schooling level						
No elementary school or incomplete elementary school	18.3	17.5-19.1	11.5	10.9-12.1	9.6	9.1-10.3
Complete elementary school or incomplete high school	26.7	25.3-28.2	16.2	15.1-17.5	13.7	12.7-14.9
Complete high school or incomplete higher education	23.4	22.5-24.3	16.7	15.8-17.7	14.5	13.7-15.3
Complete higher education	14.2	13.1-15.3	16.8	15.7-17.9	14.7	13.7-15.7
Brazil	20.4	19.8-21.0	15.3	14.8-15.9	12.2	11.7-12.7

95%CI: 95% confidence interval.

* Consumption at least 5 days/week;

** Perception of consumption as "high" or "very high".

In rural areas, the prevalence of regular consumption of beans, fruits, and sweetened beverages slightly increased, though the latter greatly decreased among urban residents. Regarding the macroregions, the range of both fruits and beans prevalence decreased between 2013 and 2019 because of the expressive increase of fruits and the small decrease of beans in the North and the stagnation of fruits in the South. Moreover, the North and the Northeast had the highest decreases of sweetened beverages (Figure 1).

Table 4

Comparison of prevalence of healthy and unhealthy food consumption markers. *Brazilian National Health Survey, 2013 and 2019.*

Marker	Period				Variation (%) (P2-P1/P1) x 100	p-value *
	2013 (n = 60.202)		2019 (n = 88.531)			
	%	95%CI	%	95%CI		
Healthy						
Beans **	72.0	71.3-72.7	68.3	67.7-68.9	-5.1	0.0000
Fruits **	41.4	40.7-42.2	45.1	44.4-45.7	8.8	0.0000
Fish ***	54.6	53.7-55.5	46.6	46.0-47.2	-14.7	0.0000
Vegetables **	54.4	53.6-55.1	55.2	54.5-55.8	1.5	0.1061
Red meat #	49.3	48.5-50.1	58.4	57.8-59.0	18.5	0.0000
Unhealthy						
Sweetened beverages **	23.3	22.7-24.0	20.4	19.8-21.0	-12.5	0.0000
Salt intake perceived as excessive ##	14.2	13.7-15.0	12.2	11.7-12.7	-14.1	0.0000

95%CI: 95% confidence interval.

* Chi-square test with correction of Rao-Scott;

** Consumption at least 5 days/week;

*** Consumption at least 1 day/week;

Consumption no more than 3 days/week;

Perception of consumption as "high" or "very high".

Discussion

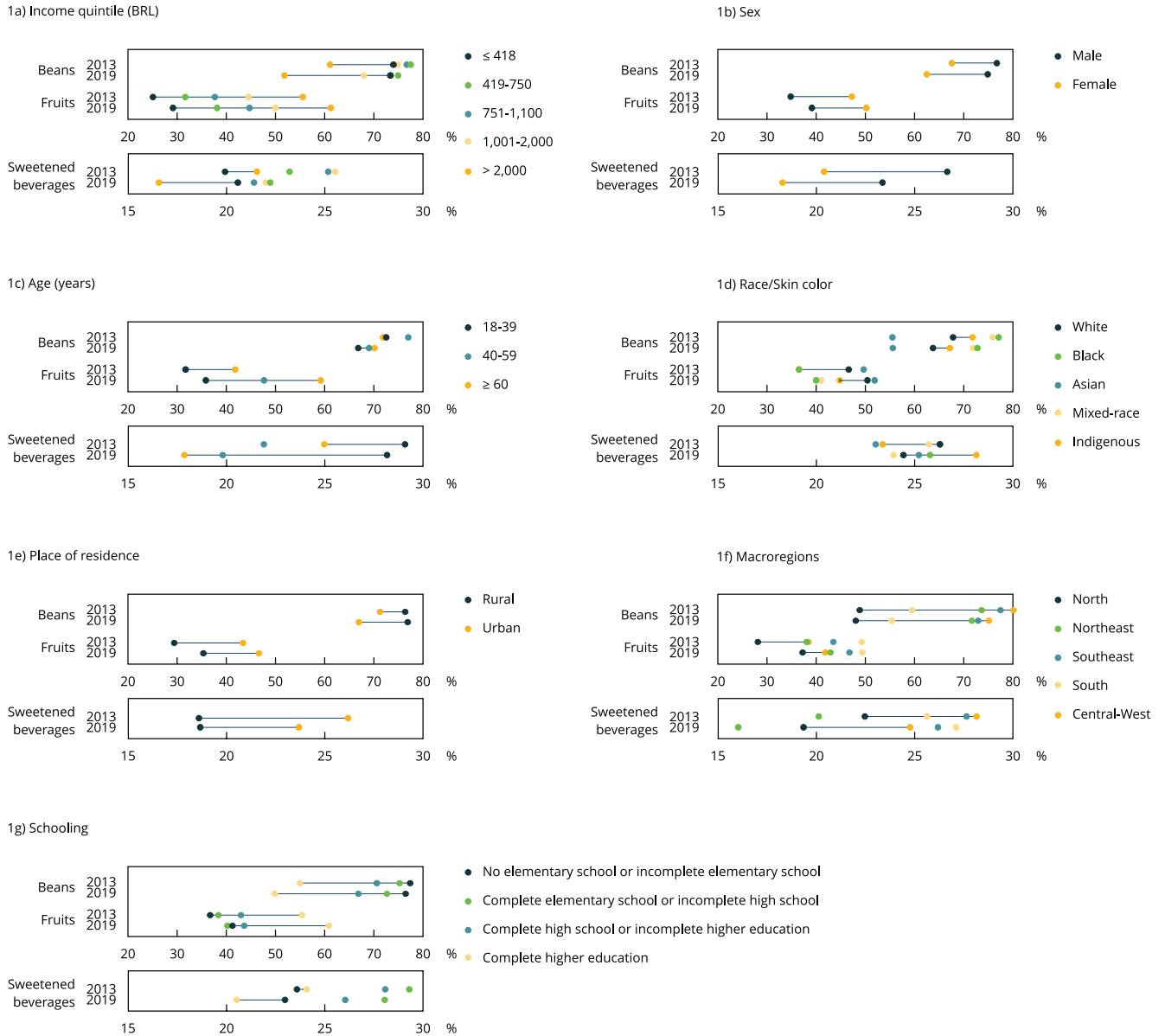
According to this study, many Brazilian adults and older adults regularly consume beans, fruits, and vegetables, follow the recommendation to limit red meat consumption, and never replace meals with snacks. The percentage of people who regularly consume sweetened beverages and perceive their salt intake as excessive was relatively lower, but varied greatly across sociodemographic subgroups. For instance, the percentage of people from the highest income levels who regularly consume fruits and vegetables is almost twice that of people from the lowest levels. From 2013 to 2019, the prevalence of most food consumption markers declined, except for the regular consumption of fruits and recommended consumption of red meat, which increased 8.5% and 18.5%, respectively, and the regular consumption of vegetables, which did not vary.

Our results can be compared to the data of *Vigitel*, a Brazilian annual telephone-based survey which monitors the frequency of similar food indicators in 27 Brazilian state capitals⁹. In 2019, 59.7% of the survey participants (n = 52,443) reported regular consumption of beans (95%CI: 58.8-60.6) and only 34.3% of the participants reported consumption of fruits and vegetables (95%CI: 33.4-35.2). Our study may have found higher frequencies because unlike *Vigitel*'s, PNS' sample represents the whole country and not only capitals. Moreover, *Vigitel* 2019 might have found a lower prevalence (15%) of regular consumption of soft drinks (95%CI: 14.3-15.8) because the unhealthy indicator did not consider other sugary drinks⁹.

This study results reinforce previous studies regarding sociodemographic factors' influence on food^{13,14,25,26}. Regarding sex, age, and education, our data corroborates with findings of *Vigitel* 2019, in which the frequency of regular consumption of fruits and vegetables was also higher for women (39.8%) than men (27.9%) and tended to increase with age and schooling level. Moreover, the frequency of regular consumption of beans was also higher for men and people with lower schooling levels, whereas the prevalence of regular consumption of soft drinks tended to decrease with age and was higher for men and people with an intermediary schooling level⁹.

Figure 1

Comparison of prevalence of food consumption markers, according to sociodemographic variables. *Brazilian National Health Survey, 2013 and 2019.*



Similarly to high schooling levels, the highest levels of income had the highest adequacy for fruits, vegetables, and fish, higher percentages of confectionery consumption and excessive salt intake, and lower percentages of sweetened beverages consumption. On the other hand, the lowest levels had the highest adequacy for red meat and beans and meal replacement. These results can be compared with data of the POF 2017-2018 food availability report, in which the relative share to the total energy of fruits, vegetables, red meat, fish, confectionery, and sweetened beverages available at the household tended to increase from the lowest to the highest income level. In this study, the distribution of most

indicators also followed food availability according to income level, which is expected since the relative contribution to the total energy of food groups available in the household is strongly associated with food consumption for most groups²⁷. The prevalence of sweetened beverages, however, was lower among richer people and varied slightly in the other categories.

Our comparative analysis between PNS 2013 and 2019 also corroborated to trends found in other national surveys in comparable periods. Studies based on Vigitel data showed that: the regular consumption of beans was likely to decrease, varying from 65.6% in 2008 to 59.7% in 2019²⁶; the prevalence of regular consumption of fruits and vegetables significantly increased between 2008 and 2016 (from 33% to 35.2%, an increase of 1.86%/year)²⁸; and the regular consumption of sweetened beverages decreased from 2007 to 2016 (from 26.3% to 14.7%, a reduction of 1.11%/year)²⁹. Data on effective food consumption from POF shows that, from 2008-2009 to 2017-2018, the percentage of people who consumed beef (from 48.7% to 38.2%), fish (from 6.2% to 5.7%), and sweetened beverages (from 7.7% to 4.6% for industrialized juices and from 23% to 15.4% for soft drinks) on a given day decreased, thus corroborating to our results¹⁰.

The decline in the regular consumption of beans – observed in this and in previous studies^{26,30} – is concerning since this food is important to the Brazilian diet. Beans and rice combined composed about 20% of the total food energy available at the Brazilian households³⁰ and help structure meals. Studies seeking to identify Brazilian food patterns have found that beans are the main marker of the country's traditional diet, which is protective against weight gain^{31,32}. This emphasizes the need to stimulate the daily consumption of vegetables. We must prioritize policies seeking to disseminate the *Dietary Guidelines for the Brazilian Population* and to help individuals overcome barriers to a healthy diet, including the lack of time and poor cooking skills.

On the other hand, results for sweetened beverages, fruits, red meat, and salt intake perceived as excessive already follow the *Dietary Guidelines for the Brazilian Population* and therefore can be partially explained by their implementation. These guidelines are summarized in a “golden rule”: base the diet on plant-based fresh or minimally processed foods and their culinary preparations and avoid ultra-processed foods; limit the amount of salt added to culinary preparations⁶. Although they do not concern the whole diet, the foods used as food consumption markers in PNS show significant factor loadings in studies on Brazilians' food patterns³¹. This suggests that these simple indicators can be useful to assess the population's adherence to the guidelines.

Excessive salt consumption is considered one of the main risk factors for the development of non-communicable diseases (NCDs), including arterial hypertension and other cardiovascular diseases. Considering the seriousness of NCDs and their impacts on society and the world economy, strategic action plans have been proposed worldwide³³, regionally³⁴, and nationally³⁵ to control the main modifiable risk factors, such as inadequate food. One of the national goals established in the Strategic Action Plan to Tackle Noncommunicable Diseases (NCDs) in Brazil, 2011-2022 is to reduce Brazilian people's average salt consumption from 12g to 5g³⁶. The observed reduction in the proportion of people who consider their consumption of salt excessive could indicate a positive result of this set of actions.

Although red meats are considered excellent sources of protein, iron, zinc, and vitamin B12⁶, their amount and the frequency with which they are consumed is important, since their excessive consumption is related to the development of diseases and increased mortality^{36,37,38}. Furthermore, raising cattle negatively impacts the environment since it requires large amounts of water, increases deforestation, and emits tons of greenhouse gases³⁹. The decrease in the prevalence of red meat consumption can both suggest that the Brazilian population is becoming aware of this problem and that their income and purchasing power has decreased⁴⁰. Although prevalence decreased in all income levels, richest people had the smallest change between 2013 and 2019 (as shown in Supplementary Material: http://cadernos.ensp.fiocruz.br/static//arquivo/suppl-e00118821_2191.pdf).

The economic factor can also be related to the significant reduction in the prevalence of regular fish consumption observed in this study. According to the *Dietary Guidelines for the Brazilian Population*, fish is an excellent alternative to red meat from a nutritional point of view since it contains large amounts of unsaturated fats, which are considered healthy⁶. Our findings reinforce that, besides educational measures, physical and financial access to healthy foods could guarantee an adequate and healthy diet with food price policy control or employment and income offer to the population.

Regarding the evolution in sociodemographic characteristics from 2013 to 2019, we emphasize some results for schooling level, income, and skin color. Our findings for schooling level are similar to data from a study on social inequality trends in the food consumption of individuals dwelling in Brazil from 2008 to 2019²⁶. Such study found a lower than recommended consumption of fruits and vegetables (≥ 5 portions/day in ≥ 5 day/week) among individuals with minor schooling levels, lower regular consumption of beans (≥ 5 day/week) in individuals with 12 or more years of schooling, and an expressive reduction in the regular consumption of sweetened beverages (≥ 5 day/week), mainly among individuals with higher schooling levels²⁶. Regarding income, the regular consumption of beans and sweetened beverages decreased mostly among the richest, whereas the poorest had little or no reduction of these beverages. Regarding ethnic groups, trends for white people and the richest were similar, whereas trends for black and brown people were similar to those of the poorest. Moreover, indigenous people had a huge increase of sweetened beverages, but since they are less numerous, this opposite and relevant group-specific trend was hidden behind the general trend. Thus, all ethnic categories should be assessed in health-related studies in Brazil.

This study has some limitations. Although food consumption markers are not a unique measure of diet quality⁴¹, they allow monitoring the consumption of foods that are indicators of Brazilians' healthy and unhealthy eating patterns. Most markers changed in the same direction indicated by the POF 24HR data, showing that these simplified indicators were important to food and nutrition surveillance and must therefore be recognized as a validated method^{22,23,24} to assess diet in a relatively simple, economical, and fast way⁴². The Brazilian Ministry of Health, via the Food and Nutrition Surveillance System (SISVAN), uses food consumption markers to monitor the Brazilian population in primary health care services⁴². Moreover, differences in the way the two PNS collected variables did not allow analyzing the evolution of some markers (confectionery consumption and meal replacement); however, changes were made in 2019 to better align the variables with national recommendations to a healthy diet. Lastly, although the categorization of variables possibly affected the comparison between our study and other studies on population food consumption, it improved the comparison between the two PNS.

Among this study's strengths, we emphasize that, as a national population-based study with complex probabilistic sampling and methodological rigor, its results can be applied to the entire adult population of the country. Food indicators must be monitored with population-based surveys for population diagnosis and subsidization and guidance of public policies in food and nutrition.

In conclusion, the diet of many Brazilian adults is based on the regular consumption of foods considered healthy; however, the proportion of individuals who regularly consume foods considered unhealthy is still high. Food consumption is influenced by sociodemographic variables, including sex, age, income, race/skin color, and place of residence. The prevalence of regular consumption of beans, sweetened beverages, fish, and salt intake perceived as excessive decreased between 2013 and 2019. On the other hand, the prevalence of regular consumption of fruit and recommended consumption of red meat increased. Healthy and unhealthy food consumption markers should be monitored to assess the impact of healthy eating promotion policies implemented in the country.

Contributors

F. Santin and K. T. Gabe contributed to study conception and design of the study and drafted to the article, data analysis and interpretation. R. B. Levy contributed to the data analysis and interpretation and review. P. C. Jaime contributed to the study conception and design, data analysis and interpretation, and review. All authors approved the final version of the manuscript, and are responsible for all aspects of the work.

Additional informations

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Resumo

O estudo teve como objetivo descrever a distribuição de marcadores de consumo alimentar no Brasil de acordo com características sociodemográficas e sua evolução entre 2013 e 2019. Foram estudados os marcadores de consumo alimentar saudável (consumo regular de feijão, frutas, verduras e peixe, consumo de carne vermelha em níveis recomendados e consumo de refeições em vez de lanches) e de consumo alimentar não saudável (consumo regular de bebidas açucaradas e doces e ingestão excessiva de sal) entre os adultos que participaram na Pesquisa Nacional de Saúde. A prevalência de marcadores de consumo alimentar foi estimada de acordo com as características sociodemográficas e comparada com os dados entre 2013 e 2019. A maioria da população relata consumo regular de feijão, frutas e verduras, segue a recomendação de limitar o consumo de carne vermelha e nunca substituir refeições por lanches. É relativamente baixa a proporção de pessoas que consome bebidas açucaradas regularmente e que relata alta ingestão de sal. A distribuição de marcadores de consumo alimentar esteve associada a gênero, idade, raça/cor, área de residência e escolaridade. Entre 2013 e 2019, diminuiu a prevalência da maioria dos marcadores de consumo alimentar, exceto do consumo regular de frutas e do consumo recomendado de carne vermelha, que aumentaram em 8,5% e 18,5%, respectivamente, e do consumo regular de verduras, que não variou. Os alimentos marcadores de consumo saudável e não saudável devem ser monitorados para avaliar o efeito das políticas de alimentação saudável no país.

Comportamento Alimentar; Ingestão de Alimentos; Inquéritos Epidemiológicos

Resumen

El objetivo del estudio fue describir la distribución de los marcadores de consumo de alimentos en Brasil, según sus características sociodemográficas y su evolución de 2013 a 2019. Se estudiaron los marcadores de consumo de comida saludable (consumo regular de frijoles, frutas, verduras, pescado, consumo recomendado de carne roja y nunca sustituir comidas por aperitivos) y marcadores de comida no saludable (consumo regular de bebidas azucaradas, repostería y consumo de sal percibido como excesivo) entre adultos de la Encuesta Nacional de Salud. La prevalencia de los marcadores de consumo de alimentos se estimó según características sociodemográficas y se comparó la prevalencia de los años 2013 y 2019. Una gran parte de la población regularmente consume frijoles, frutas y verduras y cumple la recomendación del consumo de carne roja, además, nunca sustituye comidas por aperitivos. El porcentaje de gente que regularmente consume bebidas azucaradas y percibe su consumo de sal como excesivo es relativamente más bajo. La distribución de los marcadores de consumo de alimentos estuvo asociada con sexo, edad, ingresos, raza/color de piel, lugar de residencia y nivel educativo. Desde 2013 a 2019, la prevalencia de la mayoría de los marcadores de consumo de alimentos decayó, excepto en el caso del consumo regular de frutas y consumo recomendado de carne roja, que se incrementó en un 8,5% y 18,5% respectivamente, al igual que el consumo regular de verduras, que no varió. La supervisión de los marcadores de consumo de las comidas sanas e insanas puede ser útil para evaluar el impacto de políticas de promoción de la comida sana implementadas en el país.

Conducta Alimentaria; Ingestión de Alimentos; Encuestas Epidemiológicas

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