Journal of Taibah University Medical Sciences (2023) 18(6), 1261–1267

Taibah University

Journal of Taibah University Medical Sciences

www.sciencedirect.com

Original Article

Trends in food consumption by adults in a Brazilian northeastern state

Guilherme J. Ribeiro, CNS, RDN [a,*], Ana Erbênia P. Mendes, PhD [b], Eveline de Alencar Costa, PhD [b] and Diana V. Carvalho, PhD [b]

[a] *Graduate Program in Cardiology and Cardiovascular Sciences, Federal University of Rio Grande do Sul – UFRGS, Porto Alegre, RS, Brazil*
[b] *Graduate Program in Gastronomy, Federal University of Ceará – UFC, Fortaleza, CE, Brazil*

Received 19 December 2022; revised 15 April 2023; accepted 29 April 2023; Available online 12 May 2023

الملخص

أهداف البحث: ربما تكون الأزمة الاقتصادية والسياسية التي تعيشها البرازيل، إلى جانب جائحة كوفيد -19، قد أثرت سلبا على استهلاك الغذاء للأسر البرازيلية في السنوات الأخيرة. هدفت هذه الدراسة إلى تحليل اتجاهات استهلاك الغذاء بين البالغين في ولاية شمال شرق البرازيل.

طريقة البحث: دراسة وبائية تم إجراؤها من خلال تحليل البيانات من نظام مراقبة الغذاء والتغذية (سيسفان) فيما يتعلق باستهلاك الغذاء لدى البالغين (20 إلى 59 عاما) في ولاية سيارا في عامي 2015 و 2020. تم تقديم البيانات من خلال توزيع التكرار.

النتائج: في العام 2015 إلى 2020، تم تسجيل ما مجموعه 14840 بالغا في تقييم استهلاك الغذاء. وجد أن عادة تناول ثلاث وجبات رئيسية في اليوم قد انخفضت (-63.5٪)، خاصة بين النساء (-67.9٪). بين عامي 2015 و 2020 كان هناك انخفاض في استهلاك البقوليات (-7.4٪) وزيادة في استهلاك الفاكهة (68.2٪) والخضروات (82.9٪). من بين الأطعمة فائقة المعالجة، كانت هناك زيادة كبيرة في استهلاك الهامبرغر والنقانق (83.3٪)، والكوكيز (39.1٪) والمشروبات المحلاة (25.5٪).

الاستنتاجات: تشير النتائج إلى أن عادة تناول الوجبات الرئيسية الثلاث، وفقا للبيانات العامة المتوفرة في سيسفان، قد انخفضت بين عامي 2015 و 2020 لدى السكان البالغين، وخاصة بين النساء. بالإضافة إلى ذلك، كان هنالك زيادة في استهلاك الأطعمة فائقة المعالجة من قبل السكان الذين تم فحصهم. لذلك، فإن التدخلات الصحية التي تهدف إلى التثقيف الغذائي ومكافحة الجوع ضرورية لمواجهة هذه الظروف التي تؤثر على المجتمع.

الكلمات المفتاحية: استهلاك الغذاء؛ الحالة التغذوية؛ علم الأوبئة؛ صحة البالغين

Abstract

Objective: The economic and political crisis experienced by Brazil, together with the COVID-19 pandemic, may have negatively impacted the food consumption of Brazilian families over recent years. This study aimed to analyze trends in food consumption among adults in a Brazilian northeastern state.

Methods: This was an epidemiological study which involved the analysis of data from the Food and Nutrition Surveillance System (SISVAN) relating to the food consumption of adults (20–59 years-of-age) in the state of Ceará in 2015 and 2020. Data are presented by frequency distribution.

Results: In the year 2015–2020, the food consumption of 14,840 adults were registered in SISVAN. There was evidence of a decline in the habit of having three main meals a day (−63.5%), mainly among women (−67.9%). Between 2015 and 2020, there was a decline in the consumption of beans (−7.4%) and an increase in the consumption of fruits (68.2%) and vegetables (82.9%). When considering ultra-processed foods, there was a significant increase in the consumption of hamburgers and sausages (83.3%), cookies (39.1%) and sweetened beverages (25.5%).

Conclusions: Our findings indicate that the habit of having three main meals a day decreased between 2015 and 2020 in the adult population of Ceará, as determined by public data available in SISVAN, especially among

* Corresponding address: Graduate Program in Cardiology and Cardiovascular Sciences, Federal University of Rio Grande do Sul – UFRGS, Rua Ramiro Barcelos, nº 2400, Porto Alegre, RS, Brazil.
E-mail: guilherme.jose@ufrgs.br (G.J. Ribeiro)

Peer review under responsibility of Taibah University.

ELSEVIER Production and hosting by Elsevier

 https://doi.org/10.1016/j.jtumed.2023.04.008

women. In addition, there was an increase in the consumption of ultra-processed foods. Therefore, health interventions aimed at nutritional education and the fight against hunger are essential to face these challenges that affect society.

Keywords: Adult health; Epidemiology; Food consumption; Nutritional status

Introduction

Diet plays a vital role in preventing and controlling non-communicable chronic diseases (NCDs).[1] The low consumption of fruits and vegetables (FV) is among the ten main risk factors for mortality worldwide.[1] Therefore, some nutritional guidelines have recommended diets a lower abundance of saturated and/or trans fat and a richer abundance of vegetables, fruits, whole grains or foods that are rich in fiber.[2] These choices, however, have been associated with sociodemographic factors, including education, age, gender, income, and marital status.[3] Regional characteristics can also with food choices, including climatic conditions, food availability, and economic development.[4,5]

Over the last few years, significant changes have been observed in food consumption of Brazil's population.[2] The original diet based on fresh or minimally processed foods was gradually replaced by ready-to-eat processed foods.[2] Given this, the Dietary Guidelines for the Brazilian Population have reinforced the importance of good food choices, based on the preference for fresh or minimally processed foods, freshly prepared dishes and meals, to the detriment of ultra-processed foods (UPFs).[2] The consumption of FV should be encouraged, as these are sources of protein, vitamins, and minerals, in addition to bioactive antioxidant compounds, and can benefit health.[6,7] Following these recommendations for the three main daily meals (breakfast, lunch, and dinner), these choices can provide approximately 90% of the total calories consumed throughout the day.[2] Furthermore, maintaining healthy eating, with a variety of FV, can help replace foods with high concentrations of saturated fat, sugar, and sodium.[1]

With regards to food choices, UPFs are among the main foods consumed by the Brazilian population.[8] UPFs are products whose composition is rich in flavorings, colorings, emulsifiers, and sodium; they are also and rich in saturated and trans fat, among other chemical additives that make them highly palatable.[8] Most of these are of low nutritional quality and are increasingly available on market shelves and accessible to all ages.[8] The high consumption of ultra-processed beverages and foods is considered to represent one of the dietary and behavioral factors that contribute most to the increase in obesity and NCDs.[1]

Although UPFs are present in the diet of a large proportion of the population, another scenario is causing increasing concern. For example, information released by the Brazilian Institute of Geography and Statistics (IBGE) revealed an increase in hunger in Brazil over the last few years.[9,10] The return of hunger suggests a loss in the food consumption of the population, which may not have healthy food choices and/or are being forced to have a minimum number of daily meals due to lack of food.[11] Furthermore, the increase in the population in a situation of hunger leads to a violation of the right to food and; thus, the hypothesis is that this condition promotes a change in eating habits or a reduced number of daily meals.[11] Consequently, given the political and economic crisis Brazil is experiencing,[12] some states, especially in poor socioeconomic conditions, have suffered more drastically from food insecurity and increased hunger.[13]

In this context, it is necessary to monitor the population's food consumption, since poor food choices are related to the incidence and risk of developing CNCDs.[1] Enhanced knowledge relating to food consumption can contribute to good health and guide the development of public policies to mitigate the risk of hunger. Therefore, this study aimed to analyze the trends of food consumption by adults in a specific state in the Northeast of Brazil.

Materials and Methods

Methods

This was an ecological study that analyzed information from users facilitated by the Bolsa Família Program (PBF)[14] and assisted by basic health units of Primary Care in the state of Ceará. The PBF is a public income transfer policy to fight hunger and poverty in Brazil, guaranteeing the right to food, health, education and social assistance for families in social vulnerability.[14] The study was limited to food consumption, based on publicly available information held by the database of the Food and Nutritional Surveillance System (SISVAN) integrated into Primary Health Care in Brazil.

Ceará is a state located in the Northeast region of Brazil; the population in this area is estimated at 9,240,580 inhabitants who are distributed in a territorial area of 148,894.447 km^2. Ceará has 184 municipalities with 3793 public health facilities distributed throughout the state, according to data from the IBGE on an online platform: https://cidades.ibge.gov.br/brasil/ce/panorama. We decided to carry out this research in the state of Ceará, as this state has been presenting with high rates of poverty, hunger and social vulnerability among the population of the Northeast region.[15] In addition, despite Brazil's economic and social progress over the last 10 years, this state still suffers in terms of hunger and poverty, as recognized in a report by the Food and Agriculture Organization of the United Nations.[16]

The data extracted from the platform referred to: 1) food consumption 2) region (Northeast); 3) state (Ceará), 4) reference year (2015 and 2020), and 5) reference month (All). We also collated information related to gender (men and women), age group (20−59 years), race/color (white, black, brown, yellow and indigenous) and education. Due to the diversity of information relating to the level of education of those assessed by SISVAN, it was decided to group the population into 1 (no study), 2 (primary education), 3 (secondary education) and 4 (higher education). Data were computed in October 2022. Since this was a study with

Table 1: General characteristics of study participants (adults between 20 and 59 years old from the State of Ceará registered with SISVAN).

Genre	2015 (N = 3.059)	2020 (N = 11.781)
Genre (%)		
Women	2.279 (74.5)	9.295 (78.9)
Men	780 (25.5)	2.486 (21.1)
Race/skin color (%)		
White	214 (7.0)	2.650 (22.5)
Brown	2.475 (80.9)	5.043 (42.8)
Yellow	315 (10.3)	3.616 (30.7)
Black	46 (1.5)	447 (3.8)
Indigenous	9 (0.3)	25 (0.2)
Education (%)		
No study	918 (30.0)	1.590 (13.5)
Up to 8 years	1.646 (53.8)	6.091 (51.7)
More than 8 years	422 (13.8)	3.216 (27.3)
Higher	73 (2.4)	884 (7.5)

Source: adapted from SISVAN (2020).

secondary data that were available to the public and held by a governmental platform, it was not necessary to send the protocol to the Ethics Committee for Research with Human Beings.

The analyzed food consumption data were considered in absolute numbers and in percentages and were obtained through a questionnaire applied by Primary Care health professionals. The objective was to identify healthy or unhealthy eating patterns and behaviors among users of the Unified Health System (SUS) of Primary Health Care. Of the food markers evaluated in the SISVAN WEB, information was available on the habit of eating three main meals a day (breakfast, lunch and dinner). The habit of consuming FV and beans was considered healthy and the consumption of hamburgers and/or sausages, sweetened drinks, instant noodles, packaged snacks or crackers, sweets, sweets, stuffed biscuits and other UPFs, was considered unhealthy.

All collected data were compiled into a Microsoft Excel® spreadsheet. Non-overlapping (95% confidence intervals (95% CI) were used to verify differences in the percentages obtained for each parameter evaluated in 2015 and 2020. For the presentation of the 95% CI, the sample size and the categories of variables made available by SISVAN were considered. Subsequently, the Delta variation (Δ%) was calculated considering the following equation: [(final value − initial value)/initial value] × 100. The numbers were grouped and evaluated by descriptive statistics (frequency distribution) with 95% CIs and analyzed by the BIOESTAT 5.0 program.

Results

In 2015 and 2020, a total of 14,840 adult users of basic health units and families registered in the former Bolsa Família in the state of Ceará were evaluated by SISVAN. In 2015, the number of women was higher (74.5%) when compared to men (25.5%). The distribution of those evaluated in 2020 followed a similar proportion, with more women (78.9%) than men (21.1%). The results, in absolute frequency and percentage, and according to gender, are shown in Table 1.

Information regarding the food consumption of adults from Ceará is presented in Table 2. The habit of eating three main meals a day (85%), eating beans (95%), and consuming

Table 2: Trends in daily meal frequency, along with healthy and ultra-processed foods in Ceará, Brazil.

Variables		2015		2020		Δ%
		P	IC 95%	P	IC 95%	
Habit of having 3 main meals a day	Women	84	82.5–85.3	27	26.1–27.8	−67.9[a]
	Men	89	86.7–90.8	47	45.1–48.6	−47.2[a]
	Total	85	83.7–86.2	31	29.5–32.2	−63.5[a]
Bean	Women	94	93.0–94.8	87	86.3–87.6	−7.4[a]
	Men	97	95.8–98.0	93	92.0–93.9	−4.1[a]
	Total	95	94.2–95.7	88	87.4–88.6	−7.4[a]
Fruit	Women	49	46.9–50.7	76	75.1–76.7	55.1[a]
	Men	30	26.8–32.6	71	69.2–72.5	136.7[a]
	Total	44	41.4–46.2	74	73.1–74.8	68.2[a]
Greens and vegetables	Women	37	35.0–38.7	65	64.0–65.8	75.7[a]
	Men	28	24.9–30.7	65	63.1–66.6	132.1[a]
	Total	35	32.2–37.3	64	63.0–64.9	82.9[a]
Hamburgers and/or sausages	Women	19	17.4–20.4	32	31.1–32.8	68.4[a]
	Men	17	14.4–19.1	41	39.1–42.6	141.8[a]
	Total	18	14.9–20.6	33	31.5–34.3	83.3[a]
Sweetened drinks	Women	50	48.0–51.7	49	48.0–49.9	−2.0
	Men	51	47.5–53.9	63	61.1–64.6	23.5[a]
	Total	51	48.5–53.0	51	49.8–52.1	0.0
Instant noodles, packaged snacks or crackers	Women	39	37.0–40.7	35	34.0–35.8	−10.3
	Men	39	35.6–42.0	34	32.2–35.6	−12.8
	Total	39	36.2–41.3	34	32.6–35.2	−12.8[a]
Biscuits, sweets and sweets	Women	23	21.2–24.5	31	30.1–31.8	34.8[a]
	Men	23	20.0–25.6	32	30.2–33.6	39.1[a]
	Total	23	19.9–25.6	31	29.5–32.2	34.8[a]

Note: P: prevalence; IC 95%: confidence interval of 95%; Δ%: delta variation.
[a] No overlap of IC 95%.

instant noodles (39%) was higher in 2015 for all subgroups. The consumption of fruits (74%), vegetables and legumes (64%), hamburgers and sausages (33%), cookies, sweets, and snacks (31%) was higher in 2020 when compared to those in 2015 (44%, 35%, 18%, 23%, respectively). During the analyzed period, there was a trend towards a significant decline in the habit of having three main meals a day (−63.5%), mainly among women (−67.9%). As for healthy habits, there was a decrease in the consumption of beans (−7.4%) and an increase in the consumption of fruits (68.2%) and vegetables (82.9%). A decline was also observed in the consumption of instant noodles, packaged snacks, or crackers (−12.8%), by both genders. However, analyzing consumption by men alone, there was a significant increase in the consumption of hamburgers and sausages (83.3%), biscuits (39.1%), and consumption of sweetened drinks (23.5%).

Discussion

The main finding of this study draws attention to a clear decrease in the consumption of three main meals a day by adults from Ceará during the period studied (2015 and 2020), especially among women. Accompanying this change in behavior, there was an increase in the consumption of UPFs (except instant noodles, packaged snacks, or crackers). Despite this, the consumption of greens and vegetables increased, indicating a positive point for this period. However, this pattern of growth was still not enough to conclude that the population of Ceará follows a healthy diet, since the consumption of unhealthy foods had also increased. According to Dietary Guidelines for the Brazilian Population, the consumption of fruits and vegetables is suggested from the first orientation of the ten steps for adequate and healthy eating.[2] The same document points out that the consumption of vegetables benefits the human body by containing a nutritional matrix with various nutrients and bioactive compounds that, combined with each other, play a fundamental role in the prevention of various diseases, such as cardiovascular diseases and some types of cancer.[2]

It is believed that the decline in the number of main meals (less than three per day) is the most critical point among our findings during the period investigated. Unfortunately, Brazil does not possess temporal data on food frequency for comparative purposes, and this marker only became part of the SISVAN in 2015. In comparison, in a different period from that of the present study, Kant and Graubard found that the food frequency of American adults showed a downwards trend between 1971 and 2010.[17] Our finding corroborates data collected by the IBGE, which indicated a reduction in hunger in 2013 in the Brazilian population,[9] but with a critical increase in 2017,[10] probably due to the economic and political crisis experienced by the country.[12] This decline in the frequency of consumption may also be the consequence of unemployment and low family income, aspects that contribute to the difficulty in accessing food for the main daily meals.[13] This scenario is also in line with other factors, such as cuts in the budgets of social programs, a drop in the number of people using the Bolsa Família program, and an increase in the cost of basic food.[18] In addition, the consequences brought about by the COVID-19 pandemic only strengthened and contributed to food and nutritional insecurity in the population of Ceará.[19]

The greater decline in eating frequency observed, specifically among women, can be explained by several factors, including economic vulnerability (low income), social vulnerability (immigrants from other regions), and marital vulnerability (women alone, usually taking sole responsible for supporting the family).[20] Furthermore, women below the poverty line are more likely to eat only two meals a day when compared to those with higher incomes.[20] A previous study carried out by Mainardes and Raiher showed that the highest incidence of food insecurity in Brazil occurred in households that were headed by women in the North and Northeast regions, with low levels of education and low insertion in the formal market.[13] Consequently, it is suggested that public policies aimed at women and mothers who are heads of families who live in a situation of social vulnerability, can be implemented and be inserted into the labor market, thus improving access to food.

The economic crisis over recent years, along with the COVID-19 pandemic, have exerted direct impact on the population. In 2017, the rate of unemployment in Brazil reached 13.7%, the highest in recent years; however, a reduction of 13.1% in 2018 and 12.7% in 2019 was also observed.[21] Unemployment in Brazil during the COVID-19 pandemic reached approximately 13.7 million people in 2020.[21] It is important to mention that regional and gender disparities were also evident in the context of the pandemic; these disparities were greater in the Northeast region (17.9%) and among women (16.8%); thus was also verified by the aforementioned authors. In this scenario, the human right to food was violated to the extreme, mainly due to the need for social distancing and isolation adopted by most state and municipal governments, in which low-income families and families in a situation of social vulnerability were the most impacted.[22]

Although the food supply has not declined, it is also possible that changes in the food consumption of primary care users in Ceará were due to the increase in prices practiced by retailers.[23] Several food supply channels, such as popular restaurants, open-air markets, grocery stores, food acquisition programs, and family farming fairs, also suffered consequences due to the COVID-19 pandemic.[24] These channels are key sources of income, food supply, and food security, in the countryside and in the cities, and can exert negative impact on the health and behavior of system consumers.[24] It is also important to mention that the strategies adopted by governments and civil society such as Emergency Basic Income, Food Acquisition Program (PAA), and Emergency Financial Aid (states), during this period were important because even with social isolation there were initiatives to mitigate damage, which could have been even more serious.[25]

It can be considered that the Brazil's economic scenario has increasingly aggravated extreme poverty and social inequality, especially due to the lack of employment which limits family income.[3] It is believed that these conditions were limiting the number of daily meals, as well as the choice of when to buy the necessary food, which were sometimes purchased in insufficient quantities. The Food and Agriculture Organization estimates that approximately 5.2 million Brazilians became victims of hunger and that

the growing trend of hunger was worsening in the country.[26] Thus, the present study, as well as other studies,[9–12,27] suggest that Brazil may be heading back to the haunting past of hunger.

Our research also raised important data on food markers that can directly affect the health of the population. Our findings identified an increase in the consumption of UPFs, highlighting hamburgers and/or sausages, sweetened drinks, stuffed biscuits, sweets, and snacks, all of which were also listed in previous studies.[28,29] According to Monteiro et al., the consumption of UPFs by Brazilian adults increased by 9% between 1987 and 2003[30]; more recently, this consumption has also been observed in Brazilian children, especially those from Ceará.[31] The increased consumption of UPFs may be a reflection of the worsening of food insecurity in low-income families living in the poorest geographic regions and with less availability of natural foods, with lower levels of education and little access to information on good practice food.[3–5]

These factors may favor the consumption of foods that often tend to be nutritionally unbalanced, with a high caloric value, high proportions of sugar and sodium, and a low nutritional value.[19] In a previous study, Caivano et al. noted that the high consumption of these food products has contributed to the emergence of several non-transmissible chronic diseases, mainly cardiovascular diseases and obesity, which should be avoided.[8] These authors highlight the importance of monitoring the consumption of UPFs and the influence these may have on the health and nutrition of individuals. Observing the changes created by the crisis over recent years, together with an increase in the consumption of UPFs, the implementation of measures in the field of health and nutrition is vital if we are to guarantee the population of Ceará with the right to healthy food.

A positive point to highlight in the Ceará population investigated was the increase in FV consumption. These findings are in line with other studies carried out in Brazil.[32,33] This increase may be linked to several factors. First, greater adherence to the recommendations of the Dietary Guidelines for the Brazilian Population ("Always prefer fresh or minimally processed foods and culinary preparations to ultra-processed foods")[34]; Secondly, greater access to community gardens that influence natural food consumption, which are also important means of education in health and sustainable development, contributing to the food security of the less favorable population.[35,36] Third, projects aimed at food and nutritional security such as community kitchens, whose objective is to guarantee adequate food for people with social vulnerability.[37] The consumption of fresh foods should be encouraged, considering that they are sources of protein, vitamins, minerals, and bioactive antioxidant compounds that can benefit the health of the population.[6,7]

Limitations and strengths

There are some limitations to this study that need to be considered. First, the use of secondary data, such as those from the SISVAN; because of this, it is not possible to rule out the possibility of underreporting bias or errors in information management. As this was an ecological study, it was not possible to identify the causality between food consumption and its determinants, especially lifestyle and related factors. In addition, it is also necessary to consider the self-reporting of food consumption, in which subjects tend to provide socially desirable information and are susceptible to memory bias. In this regard, there is a possibility that self-reported data may not accurately reflect the actual patterns of food consumption. Furthermore, the population evaluated by the study is not necessarily representative of the state, since data were collected from users of basic units and from families registered in the former Bolsa Família. Finally, as the data were obtained in a grouped manner, some differences between smaller categories may not have been identified. With regards to the strength of this study, it should be noted that information was collected using a standardized instrument, used national data from basic health units in Brazil. Finally, our findings contribute to the literature relating to the importance of good eating habits for maintaining health.

Conclusions

Our findings indicate that the habit of having three main meals a day decreased between 2015 and 2020 in the adult population of Ceará, as determined by public data available in SISVAN, especially among women. FLV increased and was accompanied by an increase in UPA intake. The consumption of UPAs is directly related to the epidemic of obese individuals or those with excessive body weight, in addition to the cardiovascular consequences of obesity. Therefore, health interventions focused on food and nutrition assessment and education are essential to deal with these conditions in the general population.

Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

Not applicable.

Authors contributions

GJSR provided research material, collected and organized data, conducted research and interpreted data, and wrote initial drafts. EAC and AEPM wrote the methods and results. GJSR wrote the introduction and discussion. DVC supervised the research, participated in the review, provided logistical support, and revised the final version of the article. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Acknowledgment

We would like to thank Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM) for awarding a Graduate Scholarship to GJSR.

References

1. Melo Ribeiro PV, Andrade PA, Hermsdorff HH, Dos Santos CA, Cotta RM, Estanislau JD. Dietary non-nutrients in the prevention of non-communicable diseases: potentially related mechanisms. **Nutrition 2019 Oct**; 1(66): 22–28. https://doi.org/10.1016/j.nut.2019.03.016.
2. Ministry of Health of Brazil. *Dietary guidelines for the Brazilian population*. Brasília, Brazil: Ministry of Health of Brazil; 2015150p.
3. Sperandio N, Priore SE. Prevalência de insegurança alimentar domiciliar e fatores associados em famílias com pré-escolares, beneficiárias do Programa Bolsa Família de Viçosa, Minas Gerais, Brasil. **Epidemiol Serv Saude 2015 Oct**; (24): 739–748. https://doi:10.5123/S1679-49742015000400016.
4. Hutchinson J, Tarasuk V. The relationship between diet quality and the severity of household food insecurity in Canada. **Public Health Nutr 2022 Apr**; 25(4): 1013–1026. https://doi:10.1017/S1368980021004031.
5. Leung CW, Fulay AP, Parnarouskis L, Martinez-Steele E, Gearhardt AN, Wolfson JA. Food insecurity and ultra-processed food consumption: the modifying role of participation in the Supplemental Nutrition Assistance Program (SNAP). **Am J Clin Nutr 2022 Feb**; (24). https://doi.org/10.1093/ajcn/nqac049.
6. Moubarac JC, Martins AP, Claro RM, Levy RB, Cannon G, Monteiro CA. Consumption of ultra-processed foods and likely impact on human health. Evidence from Canada. **Public Health Nutr 2013 Dec**; 16(12): 2240–2248. https://doi:10.1017/S1368980012005009.
7. Casas R, Estruch R, Sacanella E. Influence of bioactive nutrients on the atherosclerotic process: a review. **Nutrients 2018 Nov**; 10(11): 1630. https://doi.org/10.3390/nu10111630.
8. Caivano S, Lopes RF, Sawaya AL, Domene SM, Martins PA. Conflitos de interesses nas estratégias da indústria alimentícia para aumento do consumo de alimentos ultraprocessados e os efeitos sobre a saúde da população brasileira. **DEMETRA Aliment Nutr Saúde 2017 May**; 12(2): 349–360. https://doi.org/10.12957/demetra.2017.26928.
9. Instituto Brasileiro de Geografia e Estatística. *Pesquisa Nacional por Amostra de Domicílios: segurança alimentar*. Rio de Janeiro: IBGE; 2014.
10. *Pesquisa de Orçamentos Familiares 2017-2018: análise da segurança alimentar no Brasil*. Rio de Janeiro: IBGE; 2020.
11. Araújo ML, Nascimento DR, Lopes MS, Passos CM, Lopes AC. Condições de vida de famílias brasileiras: estimativa da insegurança alimentar. **Rev Bras Estud Popul 2020 May**; 15: 37. https://doi.org/10.20947/S0102-3098a0110.
12. Gubert MB, Santos SM, Santos LM, Perez-Escamilla R. A municipal-level analysis of secular trends in severe food insecurity in Brazil between 2004 and 2013. **Glob Food Sec 2017 Sep**; 1(14): 61–67. https://doi.org/10.1016/j.gfs.2017.03.004.
13. Mainardes F, Raiher AP. (In) Segurança Alimentar no Brasil: Prevalência e Fatores Associados. **Cad Ciênc Sociais Apl 2018 Jun**; 7(23). https://doi.org/10.22481/ccsa.v15i25.3978.
14. BRASIL. *Ministério do Desenvolvimento Social e Combate à Fome (mds)*. Bolsa Família: Cidadania e Dignidade para Milhões de Brasileiros; 2010.
15. Bezerra MS, Jacob MCM, Ferreira MAF, Vale D, Mirabal IRB, Lyra CO. Insegurança alimentar e nutricional no Brasil e sua correlação com marcadores de vulnerabilidade. **Ciênc Saúde Colet 2020 Sep**; (25): 3833–3846. https://doi.org/10.1590/1413-812320202510.35882018.
16. Food and Agriculture Organization of the United Nations (FAO). http://www.fao.org/americas/prioridades/100territorios/es/. Accessed April 2019.
17. Kant AK, Graubard BI. 40-year trends in meal and snack eating behaviors of American adults. **J Acad Nutr Diet 2015 Jan**; 115(1): 50–63. https://doi.org/10.1016/j.jand.2014.06.354.
18. Costa NS, Santos MO, Carvalho CPO, Assunção ML, Ferreira HS. Prevalence and factors associated with food insecurity in the context of the economic crisis in Brazil. **CDN 2017 Sep**; 1(10):e000869. https://doi.org/10.3945/cdn.117.000869.
19. Rede Brasileira de Pesquisa em Soberania e Segurança Alimentar (PENSSAN). *VIGISAN – Inquérito Nacional sobre Insegurança Alimentar no Contexto da Pandemia da Covid-19 no Brasil*. Rio de Janeiro: Rede PENSSAN; 2021.
20. Lhuissier A, Tichit C, Caillavet F, Cardon P, Masullo A, Martin-Fernandez J, Parizot I, Chauvin P. Who still eats three meals a day? Findings from a quantitative survey in the Paris area. **Appetite 2013 Apr**; 1(63): 59–69. https://doi.org/10.1016/j.appet.2012.12.012.
21. Neves JA, Machado ML, Oliveira LD, Moreno YM, Medeiros MA, Vasconcelos FD. Unemployment, poverty, and hunger in Brazil in Covid-19 pandemic times. **Rev Nutr 2021 Jun**; 2(34). https://doi.org/10.1590/1678-9865202134e200170.
22. Silva Filho OJ, Gomes Júnior NN. O amanhã vai à mesa: abastecimento alimentar e COVID-19. **Cad Saúde Pública 2020 Jun**; 1(36):e00095220. https://doi.org/10.1590/0102-311X00095220.
23. Schneider S, Cassol A, Leonardi A, Marinho MD. Os efeitos da pandemia da Covid-19 sobre o agronegócio e a alimentação. **Estud Av 2020 Nov**; 11(34): 167–188. https://doi.org/10.1590/s0103-4014.2020.34100.011.
24. Dudek M, Śpiewak R. Effects of the COVID-19 pandemic on sustainable food systems: lessons learned for public policies? The case of Poland. **Agriculture 2022 Jan**; 12(1): 61. https://doi.org/10.3390/agriculture12010061.
25. Gurgel AM, Santos CCS, Alves KPS, Araújo JM, Leal VS. Estratégias governamentais para a garantia do direito humano à alimentação adequada e saudável no enfrentamento à pandemia de Covid-19 no Brasil. **Ciênc Saúde Colet 2020 Dec**; 4(25): 4945–4956.
26. Organización de las Naciones Unidas para la Alimentación y la Agricultura. *El estado de la inseguridad alimentaria en el mundo: 2018*. Roma: Organización; 2018 [citado 2020 12]. Disponible en: http://www.fao.org/3/I9553ES/i9553es.pdf.
27. Vasconcelos FD, Machado ML, Medeiros MA, Neves JA, Recine E, Pasquim EM. Public policies of food and nutrition in Brazil: from Lula to Temer. **Rev Nutr 2019 Feb**; 4(32). https://doi.org/10.1590/1678-9865201932e180161.
28. Costa CD, Sattamini IF, Steele EM, Louzada ML, Claro RM, Monteiro CA. Consumo de alimentos ultraprocessados e associação com fatores sociodemográficos na população adulta das 27 capitais brasileiras (2019). **Rev Saude Publica 2021 Aug**; 6(55). https://doi.org/10.11606/s1518-8787.2021055002833.
29. Nardocci M, Leclerc BS, Louzada ML, Monteiro CA, Batal M, Moubarac JC. Consumption of ultra-processed foods and obesity in Canada. **Can J Public Health 2019 Feb**; 110(1): 4–14. https://doi.org/10.17269/s41997-018-0130-x.
30. Monteiro CA, Levy RB, Claro RM, Castro IR, Cannon G. Increasing consumption of ultra-processed foods and likely impact on human health: evidence from Brazil. **Public Health Nutr 2010 Dec**; 14(1): 5–13. https://doi:10.1017/S1368980010003241.
31. Ribeiro GJ, de Araújo Pinto A. Consumption of ultra-processed foods in Brazilian children: an analysis of regional trends. **J Pediatr Nurs 2021 Nov**; 1(61): e106–e111. https://doi.org/10.1016/j.pedn.2021.06.006.

32. Bernal RT, Iser BP, Malta DC, Claro RM. Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (Vigitel): mudança na metodologia de ponderação. **Epidemiol Serv Saude 2017 Oct**; (26): 701−712. https://doi.org/10.5123/S1679-49742017000400003.
33. Silva LE, Claro RM. Tendências temporais do consumo de frutas e hortaliças entre adultos nas capitais brasileiras e Distrito Federal, 2008-2016. **Cad Saúde Pública 2019 May**; 20(35):e00023618. https://doi.org/10.1590/0102-311X0002361.
34. Gabe KT, Jaime PC. Práticas alimentares segundo o Guia alimentar para a população brasileira: fatores associados entre brasileiros adultos, 2018. **Epidemiol Serv Saude 2020 Mar**; 23(29):e2019045. https://doi.org/10.5123/S1679-49742020000100019.
35. Jacob MM. Biodiversidade de plantas alimentícias não convencionais em uma horta comunitária com fins educativos. **DEMETRA Aliment Nutr Saúde 2020 Jan**; 30(15): 44037. https://doi.org/10.12957/demetra.2020.44037.
36. dos Santos M, Machado MC. Agricultura Urbana e Periurbana: Segurança Alimentar e Nutricional, comportamento alimentar e transformações sociais em uma horta comunitária. **Segur Aliment Nutr 2020**; (27):e020010. https://doi.org/10.20396/san.v27i0.8650689.
37. Garajau NI, Afonso ML. Articulação intersetorial como estratégia de gestão na Política de Segurança Alimentar e Nutricional no Brasil: análise do Programa Cozinha Comunitária. **Segur Aliment Nutr 2016 Dec**; 21(23): 1065−1079. https://doi.org/10.20396/san.v23i0.8635603.

How to cite this article: Ribeiro GJ, Mendes AEP, Costa EdeA, Carvalho DV. Trends in food consumption by adults in a Brazilian northeastern state. J Taibah Univ Med Sc 2023;18(6):1261−1267.