

Association between consumption of ultra-processed foods and sociodemographic variables: evidence from a nationally representative cross-sectional study

Associação entre consumo de alimentos ultraprocessados e variáveis sociodemográficas: evidências de um estudo transversal representativo nacionalmente

Asociación entre consumo de alimentos ultraprocessados y variables sociodemográficas: evidencia de un estudio transversal representativo a nivel nacional

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ABSTRACT

The evidence about the socioeconomic factors associated with the high consumption of ultra-processed foods using the NOVA classification is still poorly understood, especially in developing countries. Therefore, the aim of this study was to estimate the prevalence of ultra-processed foods (UPF) and assess their association with sociodemographic variables in individuals over the age of 18 in the Brazil. Cross-sectional study using data from the National Health Survey (NHS), 2019. UPF consumption was estimated by the sum of positive answers about the consumption of ten subgroups of UPF. Poisson regression was used to describe associations between UPF consumption and sociodemographic variables (sex, age group, race/skin color, income, living with partner, macro-region and area of residence). A total of 88,531 individuals were included. The prevalence of UPF consumption was 14.3% and was twice as high in young people (18-24 years old) compared to the older people (60 years or older), in lower income strata and in more developed regions of the country (region South and urban area). UPF are consumed with high frequency among Brazilian adults. Being male, younger, having a lower income and residing in developed regions are factors that increased UPF consumption.

Keywords: ultra-processed foods, socioeconomic factors, diet, adults, industrialized food.

RESUMO

As evidências sobre os fatores socioeconômicos associados ao alto consumo de alimentos ultraprocessados utilizando a classificação NOVA ainda são pouco compreendidas, especialmente nos países em desenvolvimento. Portanto, o objetivo deste estudo foi estimar a prevalência de alimentos ultraprocessados (AUP) e avaliar sua associação com variáveis sociodemográficas em indivíduos maiores de 18 anos no Brasil. Estudo transversal utilizando dados da Pesquisa Nacional de Saúde (PNS), 2019. O consumo de AUP foi estimado pela soma das respostas positivas sobre o consumo de dez subgrupos de AUP. A regressão de Poisson foi utilizada para descrever associações entre o consumo de AUP e variáveis sociodemográficas (sexo, faixa etária, raça/cor da pele, renda, convivência com companheiro, macrorregião e zona de residência). Foram incluídos 88.531 indivíduos. A prevalência do consumo de AUP foi de 14,3% e foi duas vezes maior nos jovens (18-24 anos) em comparação aos mais velhos (60 anos ou mais), nas camadas de renda mais baixa e nas regiões mais desenvolvidas do país (região Sul e zona urbana). Os AUP são consumidos com elevada frequência entre adultos brasileiros. Ser do sexo masculino, ser mais jovem, ter menor renda e residir em regiões desenvolvidas são fatores que aumentaram o consumo de AUP.

Palavras-chave: alimentos ultraprocessados, fatores socioeconômicos, dieta, adultos, alimentos industrializados.

RESUMEN

La evidencia sobre los factores socioeconómicos asociados con el alto consumo de alimentos ultraprocessados utilizando la clasificación NOVA aún no se comprende bien, especialmente en los países en desarrollo. Por lo tanto, el objetivo de este estudio fue estimar la prevalencia de alimentos ultraprocessados (UPF) y evaluar su asociación con variables sociodemográficas en individuos mayores de 18 años en Brasil. Estudio transversal utilizando datos de la Encuesta Nacional de Salud (NHS), 2019. El consumo de UPF se estimó mediante la suma de respuestas positivas sobre el consumo de diez subgrupos de UPF. Se utilizó la regresión de Poisson para describir asociaciones entre el consumo de UPF y variables sociodemográficas (sexo, grupo de edad, raza/color de piel, ingresos, convivencia, macrorregión y área de residencia). Se incluyeron un total de 88.531 personas. La prevalencia del consumo de UPF fue del 14,3% y

fue dos veces mayor en jóvenes (18-24 años) respecto a las personas mayores (60 años o más), en estratos de menores ingresos y en regiones más desarrolladas del país (región Sur y zona urbana). Los UPF son consumidos con alta frecuencia entre los adultos brasileños. Ser hombre, ser más joven, tener menores ingresos y residir en regiones desarrolladas son factores que incrementaron el consumo de UPF.

Palabras clave: alimentos ultraprocesados, factores socioeconómicos, dieta, adultos, alimentos industrializados.

1 INTRODUÇÃO

Noncommunicable diseases (NCDs) represent an important public health problem in the world (WHO, 2018). The main types of NCDs are cardiovascular diseases, cancers, chronic respiratory diseases and diabetes, due to the great magnitude (WHO, 2018). According to data from the Global Burden of Disease (GBD), these four groups of diseases are responsible for more than 80% of all premature deaths from NCDs in the world annually, affecting people under 70 years of age. Most premature deaths from NCDs are preventable. In Brazil, deaths from NCDs corresponded to 1 million people, equivalent to 76% of all deaths (GBD 2019).

Part of this panorama is characterized by dietary changes that involve the replacement of in natura and minimally processed foods for ready-to-eat industrialized foods (processed or ultra-processed) (Singh. et al., 2020). The relationship between the consumption of ultra-processed foods (UPF) and NCDs is well established (Suksatan. et al., 2022; Lane. et al., 2021). Studies have reported association with obesity, metabolic syndrome (Suksatan. et al., 2022; Martínez. et al., 2019), hypertension and dyslipidemia (Donat-Vargas. et al., 2021).

Among the limitations for analyzing the prevalence of UPF, the absence of a consensus on the definition and classification of “processed foods” stands out. In 2009, the European Prospective Investigation into Cancer and Nutrition (EPIC) (Slimani. et al., 2009) proposed a classification of foods into three categories: highly processed, moderately processed and unprocessed. In Brazil, researchers coordinated by Monteiro, proposed the NOVA classification, which classifies foods into four categories based on their degree of processing, without providing any indication of their nutritional content: (i) in natura and minimally processed foods; (ii) processed culinary ingredients including oils, butter, lard, sugar and salt; (iii) processed foods; and (iv) ultra-processed foods (Monteiro. et al., 2016).

As defined by the NOVA classification system, UPF are industrial formulations of substances derived from foods with little or no whole food, often with the addition of colors,

flavors, emulsifiers, thickeners and many other additives to make them palatable or even hyperpalatable (Monteiro. et al., 2016). Since Monteiro et al. suggested the NOVA classification to classify foods based on the degree of processing (Monteiro. et al., 2016), several studies have been carried out to estimate the level of UPF consumption and its association with chronic diseases (Leffa. et al., 2020; Juul. et al., 2018) and mortality (Bonaccio. et al., 2021). Currently, the NOVA classification is the most used worldwide (Batal. et al., 2018; Julia. et al., 2018).

Despite the existing literature, the epidemiology and factors associated with high UPF consumption are still poorly understood, especially in developing countries such as Brazil. In addition, few studies have explored prevalence according to sociodemographic variables in order to identify groups with greater vulnerability. According to previous systematic reviews, most studies assess the impact of UPF on health (Marino. et al., 2021; Chen. et al., 2020). Thus, the aim of this study was to estimate the prevalence of UPF and evaluate its association with sociodemographic variables in Brazilian adults.

2 METODOLOGIA

2.1 STUDY DESIGN

This is a population-based cross-sectional study using data from the National Health Survey (NHS) cross-sectional survey conducted in Brazil in 2019. The NHS was approved by the Research Ethics Committee of the National Health Council under number 3,529,376. All participants signed the informed consent form (Stopa. et al., 2020).

2.2 SETTING

The NHS is representative of urban and rural areas, large regions of Brazil, federative units, capitals and metropolitan regions. In 2019, the country had 5,570 municipalities and a total population of 210,147,125 inhabitants. The general objective of the NHS was to generate data on the conditions and determinants of the population's health in order to contribute to the planning and evaluation of public policies in Brazil (Stopa. et al., 2020).

2.3 DATA COLLECT

The collection of NHS data is the responsibility of the IBGE. The interviews were carried out at home using mobile data collection devices. Data collection for the 2019 NHS took place between August 2019 and March 2020. The information in the questionnaire was answered by a resident aged 18 years or older. The questionnaire used was validated by specialists and applied by standardized researchers (Stopa. et al., 2020).

2.4 PARTICIPANTS

The target population of the NHS includes individuals aged 15 years or over living in permanent private households in one of the country's federation units. Permanent private households are those built for the sole purpose of housing. Therefore, sectors that had populations from indigenous groups, barracks and military bases, lodgings, camps, prison units, long-stay institutions for the elderly, networks of integrated care for children and adolescents, convents, hospitals, etc., were excluded from the sampling process. rural settlements and quilombola groups. In this study, individuals aged 18 years or older were included (Stopa. et al., 2020).

2.5 VARIABLES

The outcome variable was UPF consumption defined as the consumption, on the day before the survey date, of five or more of the subgroups of foods considered ultra-processed from a list of ten: (i) Soda; (ii) Fruit juice in a box or can or powdered soft drink; (iii) Chocolate drink or flavored yogurt; (iv) Packed snacks or crackers/crackers; (v) Sweet or stuffed biscuit/cookie or packet cake; (vi) Ice cream, chocolate, gelatin, flan or other industrialized dessert; (vii) Parsley, sausage, mortadella or ham; (viii) Loaf bread, hot dog or hamburger bread; (ix) Margarine, mayonnaise, ketchup or other industrialized sauces and; (x) Instant noodles, packet soup, frozen lasagna or other frozen dish bought ready-made industrialized (Stopa. et al., 2020).

The sociodemographic variables included were gender, age group (18 to 24 years old; 25 to 39 years old; 40 to 59 years old and 60 years old or more), race/skin color (white, brown, black and yellow or indigenous), income in number of monthly minimum wages (≤ 1 , 2 to 3, 4

to 5 or >5), living with partner, macro-region (North, Northeast, Southeast, South or Midwest) and area of residence (urban or rural).

2.6 STUDY SIZE

The 2019 NHS sample calculation considered the desired precision to estimate the main risk and protection factors for NCDs, disease prevalence and access to health services, among other variables, in addition to a 20% non-response rate. The sample was estimated at 108,525 households and data were collected from 94,114 households, with a non-response rate of 6.4%. In this study, the sample consisted of 88,531 adults (Stopa. et al., 2020).

2.7 STATISTICAL METHODS

Initially, the consumption frequency on the day before the interview of each of the 10 UPF subgroups included in the NHS questionnaire was described. Poisson regression models were used to describe the crude and adjusted associations between sociodemographic variables and the frequency of high UPF consumption (five or more UPF subgroups). All analyzes were performed in Stata software, version 15.0, using the *survey* command set for complex samples. Variables with $p < 0.20$ were included in the multiple analysis. The measure of association was the Prevalence Ratio (PR) with the respective 95% confidence interval (95%CI). To perform the regression analysis, the race/skin color variable was categorized as “white” and “non-white”.

3 RESULTS

A total of 88,531 individuals were included, of which 46.8% (95%CI: 46.2-47.4) were men and 53.2% (95%CI: 52.6-53.8) were women. Most individuals were aged between 40 and 59 years (35.3%; 95%CI: 34.7-35.9) were white (43.3%; 95%CI: 42.5-44.0) or brown (43.8%; 95%CI: 43.1-44.5), were low-income (≤ 1 minimum wage) (51.2%; 95%CI: 50.4-52.0), lived with a partner (61.4%; 95%CI: 60.7-62.0), were from the Southeast region (43.4%; 95%CI 42.6-44.2) and lived in an urban area (86.2%; 95%CI: 85.8-86.6) (Table 1).

Table 1. Sample characteristics (n=88,531).

Variables	% (CI95%)
Sex	
Men	46.8 (46.2-47.4)
Women	53.2 (52.6-53.8)
Age group (years)	
18-24	13.9 (13.4-14.4)
25-39	29.2 (28.6-29.8)
40-59	35.3 (34.7-35.9)
≥60	21.6 (21.1-22.2)
Race/skin color*	
White	43.3 (42.5-44.0)
Brown	43.8 (43.1-44.5)
Black	11.5 (11.1-11.9)
Other (yellow or indigenous)	1.4 (1.3-1.6)
Income (minimum wages)**	
≤1	51.2 (50.4-52.0)
2 to 3	37.3 (36.6-37.9)
4 to 5	6.4 (6.0-6.7)
>5	5.2 (4.8-5.6)
Lives with a partner	
No	38.6 (38.0-39.3)
Yes	61.4 (60.7-62.0)
Macroregion	
North	7.8 (7.6-8.1)
Northeast	26.5 (25.9-27.0)
Southeast	43.4 (42.6-44.2)
South	14.7 (14.3-15.1)
Midwest	7.6 (7.3-7.9)
Area of residence	
Urban	86.2 (85.8-86.6)
Rural	13.8 (13.4-14.2)

CI 95%: 95% confidence interval.

*Missing: 6 men e 3 women.

**Missing: 4 men e 18 women.

Font: National Health Survey, 2019.

The high consumption of UPF was 14.3% (95%CI: 13.8-14.8). Regarding the frequency of consumption on the day before the interview of each of the 10 UPF subgroups, the margarine, mayonnaise, ketchup or other industrialized sauces group had the highest prevalence (45.9%; CI95%: 45.2-46.6), followed by soda (32.9%; CI95%: 32.3-33.5), sandwich bread, hot dog or hamburger (31.0%; CI95% 30.4-31.7) and; Parsley, sausage, mortadella or ham (27.2%; CI95%: 26.6-27.8) (Table 2).

Table 2. Prevalence of consumption of subgroups of ultra-processed foods (UPF) and five or more UPF subgroups in adults.

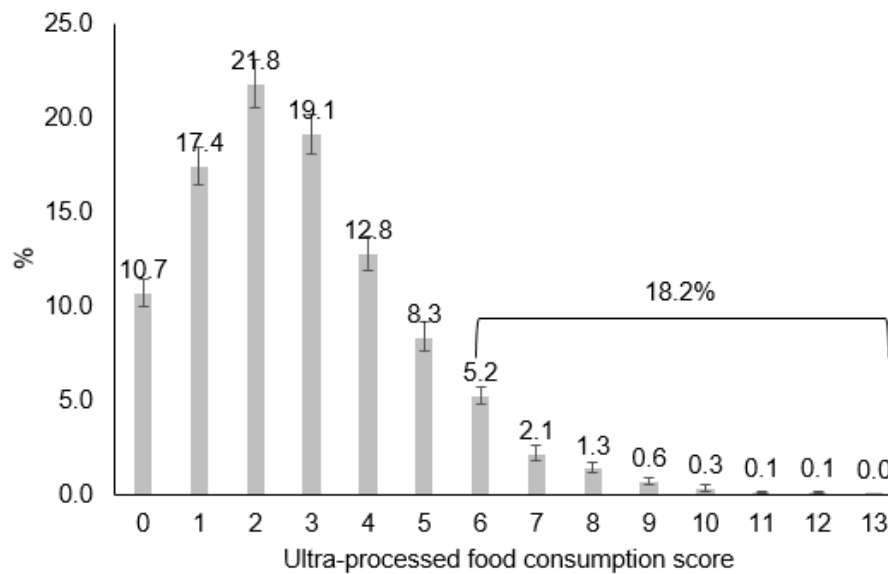
UPF food subgroups	% (CI 95%)
Margarine, mayonnaise, ketchup or other industrialized sauces	45.9 (45.2-46.6)
Soda	32.9 (32.3-33.5)
Loaf bread, hot dog or hamburger bread	31.0 (30.4-31.7)
Sausage, sausage, mortadella or ham	27.2 (26.6-27.8)
Fruit juice in a box or can or powdered soft drink	24.3 (23.7-24.9)
Biscuit/cookie sweet or stuffed or packet cake	23.8 (23.3-24.4)
Packaged snacks or crackers/crackers	23.3 (22.7-23.8)

Ice cream, chocolate, gelatin, flan or other processed dessert	19.9 (19.4-20.4)
Chocolate drink or flavored yogurt	14.9 (14.4-15.3)
Instant noodles, packet soup, frozen lasagna, or other ready-to-eat frozen dish	6.0 (5.7-6.3)
Consumption of ≥ 5 UPF subgroups	% (CI 95%)
No	85.7 (85.2-86.2)
Yes	14.3 (13.8-14.8)

CI 95%: 95% confidence interval; UPF: ultra-processed foods.
Font: National Health Survey, 2019.

Regarding the prevalence of consumption by state in Brazil, São Paulo (29.5%; 95%CI: 27.5-31.6) had a much higher consumption compared to other regions (Figure 1).

Figure 1. Frequency (%) of the population according to ultraprocessed food consumption score* among individuals aged 18 years and older. (n = 27.093).



*Number of subgroups of ultra-processed food (n = 10) consumed the day before the interview.
Font: National Health Survey, 2019.

Men have higher UPF consumption (1.18; 95%CI 1.11-1.25). We observed a negative gradient between age group and UPF consumption. Individuals in the 18 to 24 age group had twice as much UPF consumption compared to those in the 40 to 59 age group (PR: 2.93; 95%CI: 2.59-3.31 and PR: 1.45; 95%CI: 1.30-1.62, respectively). The greatest magnitude of the highest UPF consumption was observed in the lowest income strata: ≤ 1 minimum wage (PR: 1.44; 95%CI: 1.22-1.70) and from 2 to 3 minimum wages (PR: 1.46; 95%CI: 1.25-1.71). Regarding the Brazilian macro-regions, the more developed regions (Southeast and South) showed higher prevalences for UPF consumption, with greater magnitude in the South region (PR: 1.77; 95%CI: 1.60-1.95). On the other hand, residing in one of the less developed macro-regions, such as the Northeast region, was a protective factor (PR: 0.80; 95%CI: 0.73-0.88). Individuals

from the urban area had higher UPF consumption (1.71; 95%CI: 1.56-1.88) compared to residents of the rural area.

4 DISCUSSION

Using a nationally representative sample, we found that UPF consumption was prevalent in the Brazilian adult population. Alarmingly, nearly one in five Brazilian adults consumed five or more UPF subgroups. The three UPF subgroups with the highest consumption prevalence, respectively, were: Margarine, mayonnaise, ketchup or other industrialized sauces; Soda and; Loaf bread, hot dog or hamburger bread. Multiple regression analyzes showed that the high consumption of UPF linearly decreased with age, was lower in men and in people with lower income and higher in residents of more developed regions of the country.

The differences observed according to sex in the present study were similar to the results of other studies. It coincides with what was found in Canada (Moubarac. et al., 2017) and in the United Kingdom (UK) (Adams. et al., 2015). On the other hand, in Chile (Adams. et al., 2015), the consumption was higher among women. Although in the United States (Baraldi. et al. 2018) and Mexico (Adams. et al., 2015), the consumption was similar for both sexes. The reasons for the observed differences between the sexes are not clear, but may be related to the fact that women look for basic health care and preventive medicine more often than men. A review study in the UK (Banks, 2001) reported that men, regardless of income and ethnicity, had more difficulty talking about their health problems and tended to seek medical attention in more advanced and life-threatening stages of the disease. Also, most health services are mostly open during the day when there are more men than women working (Kalache, 2002).

The association between UPF consumption and age identified by our study in Brazil has already been reported in other countries by studies that considered the daily consumption of the set of ultra-processed foods (Adams. et al., 2015; Baraldi. et al. 2018; Koiwai. et al., 2019). This association may reflect a cohort effect or greater health concerns among older adults, or more likely both. In any case, the higher consumption of UPF among young people – consumption twice as high in the 18-24 age group compared to the 40-59 age group – justifies special attention to this group, since, as well as children and adolescents, in public policies aimed at reducing the consumption of UPF, such as taxation on the production and sale of ultra-processed products; marketing restriction and dissemination and incorporation of labels with visible warnings (Srour. et al., 2020).

Our results showed that low income was associated with higher UPF consumption. The literature reports that low socioeconomic status has been associated with higher consumption of processed and ultra-processed foods, while high socioeconomic status has been associated with increased consumption of whole grains, lean meats, fish, low-fat dairy products and fresh fruits. and vegetables (Darmon. et al., 2008). We believe that one of the reasons for the increase in UPF consumption among people with lower incomes is due to the drop in the prices of these foods in Brazil. According to data from the family budget survey in Brazil, the purchase of ultra-processed foods in the period 2002/2003-2008/2009 increased more among low-income families than among higher-income families in the country (Kalache, 2002). In addition, the rapid expansion of the share of ready-to-eat products in Brazil and in other developing countries, such as China and Mexico, can also be explained by changes in the food systems of these countries, mainly due to national economic growth and transnational food industries (Big Food) penetrating local markets (Stuckler; Nestle., 2012).

The five regions of Brazil showed inequalities in the prevalence of consumption of five or more UPF subgroups. The South and Southeast regions had a higher prevalence, similar to that previously reported (Louzada. et al., 2023; Costa. et al., 2019). These results reflect socioeconomic inequalities in access to health services. The states in the South and Southeast regions, which include the cities of São Paulo and Rio de Janeiro, have a higher percentage of urban population (IBGE, 2010) and are more industrialized compared to the North and Northeast regions (Singh. et al., 2020). These results facilitate greater access to UPF.

This study has some limitations. First, the cross-sectional nature does not allow establishing causality between sociodemographic variables and the consumption of five or more UPF subgroups. Thus, longitudinal studies are needed. Second, it is inherent to the use of dietary surveys that the consumption of certain food groups is underestimated or overestimated. To minimize part of this bias, the NHS pre-tested and validated the collection instruments, performed quality control procedures during data collection and excluded inconsistent records, replacing them with imputed values. However, our investigation has several strong points, such as the complex sample design, which makes it representative of the Brazilian adult population. Furthermore, this study used the NOVA classification to identify the consumption of UPF, which is an effective tool in national surveillance and monitoring and evaluation systems that broaden the evaluation of ultra-processed foods in populations.

5 CONCLUSION

Considering the evidence demonstrating the harmful effect of the consumption of ultra-processed foods on the quality of the diet and the risk of several chronic non-communicable diseases and the high consumption of five or more subgroups of UPF, public policies that reduce the consumption of these ultra-processed foods and the emphasis in strata of the population at greater risk are essential. In addition, monitoring the consumption of ultra-processed foods in studies and populations will be important to assess the success of these policies.

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