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Consumption of ultra-processed foods and socioeconomic position: a cross-sectional analysis of the *Brazilian Longitudinal Study of Adult Health*

O consumo de alimentos ultraprocessados e nível socioeconômico: uma análise transversal do *Estudo Longitudinal de Saúde do Adulto*, Brasil

Consumo de comida ultraprocesada y nivel socioeconómico: un análisis transversal del *Estudio Longitudinal Brasileño sobre Salud en la Edad Adulta*

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Abstract

The objective of the study was to estimate the contribution of ultra-processed foods to total caloric intake and investigate whether it differs according to socioeconomic position. We analyzed baseline data from the Brazilian Longitudinal Study of Adult Health *(ELSA-Brasil 2008-2010; N = 14.378) and data on dietary intake using a food frequency questionnaire, assigning it into three categories: unprocessed or minimally processed foods and processed culinary ingredients, processed foods, and ultra-processed foods. We measured the associations between socioeconomic position (education, per capita household income, and occupational social class) and the percentage of caloric contribution of ultra-processed foods, using generalized linear regression models adjusted for age and sex. Unprocessed or minimally processed foods and processed culinary ingredients contributed to 65.7% of the total caloric intake, followed by ultra-processed foods (22.7%). After adjustments, the percentage of caloric contribution of ultra-processed foods was 20% lower among participants with incomplete elementary school when compared to postgraduates. Compared to individuals from upper income classes, the caloric contribution of ultra-processed foods was 10%, 15% and 20% lower among the ones from the three lowest income, respectively. The caloric contribution of ultra-processed foods was also 7%, 12%, 12%, and 17% lower among participants in the lowest occupational social class compared to those from high social classes. Results suggest that the caloric contribution of ultra-processed foods is higher among individuals from high socioeconomic positions with a dose-response relationship for the associations.*

Handling; Eating; Socioeconomic Factors; Multicenter Study

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Introduction

Since the 1970s and the 1980s, human diets have been changing from raw, unprocessed foods and traditional dishes to an increasing intake of ultra-processed food and beverages [1]. Advances in food science and technology and globalized food distribution [2] have made these foods more accessible and convenient at relatively low prices [3,4].

Industrial processing creates food products with ingredients and food additives to enhance flavor, increase durability and contribute to the consumer's convenience. However, these food products have more calories, higher glycemic indexes, more trans fats, sugars, and sodium, also being lower in fiber, micronutrients, and phytochemicals [5,6,7]. There is growing evidence that the increased consumption of ultra-processed foods is associated with overweight [5,8], obesity [9,10] and chronic diseases [5,11,12,13], including diabetes [14].

Despite the consumption of ultra-processed foods being higher in high income countries, it has been growing both in relative and absolute terms [15,16] in high and middle-income countries, especially in the latter [8]. In Brazil, household purchases of ultra-processed food represented 18.7%, 21%, 26.1%, and 29.6% of all food purchases in four successive surveys (1987-1988, 1995-1996, 2002-2003, and 2008-2009, respectively). In the last two periods, ultra-processed food purchases were higher among higher income classes, but have increased in all income groups, mainly among those of lower income [17].

There are several studies on the health outcomes of social disparities [18,19], indicating its influence on health-related behaviors such as diets; in fact, it has been reported that people with higher socioeconomic status generally have a healthier dietary pattern [20,21]. However, we only identified one study on the association between diet quality (measured by the degree of food processing) and per capita monthly income, whose results go in opposite directions [17]; despite that, it is unknown whether it would be possible to observe this variation with other socioeconomic indicators. Therefore, this study aims at exploring socioeconomic inequalities in the consumption of ultra-processed foods in a cohort of Brazilian workers.

We investigated the association between socioeconomic position indicators and consumption of ultra-processed foods among participants of the *Brazilian Longitudinal Study of Adult Health* (ELSA-Brasil). Additionally, we estimated the contribution of unprocessed or minimally processed foods and processed culinary ingredients, processed foods, and ultra-processed foods to the participants' mean daily dietary intake.

Methods

Study population

This cross-sectional study used data from the ELSA-Brasil collected between 2008 and 2010. ELSA-Brasil is a multicenter cohort study designed to investigate the incidence and progression of diabetes and cardiovascular diseases and their biological, behavioral, environmental, occupational, and psychosocial determinants in Brazilian adults. The ELSA-Brasil cohort consists of 15,105 actives and retired civil servants aged 35-74 years from six higher education institutions in six cities from the South, Southeast, and Northeast regions of Brazil. Data was collected via face-to-face interviews by trained and certified professionals, using standardized and validated questionnaires [22]. Detailed information on the ELSA-Brasil cohort profile can be found in Schmidt et al. [23]. ELSA-Brasil was approved by the Research Ethics Committees from the six participating institutions and all participants provided written consents to participate in the study (approval n. 189/2006).

ELSA-Brasil participants with missing data for dietary intake (n = 36), whose total calorie intake (kcal/day) was below the 1st percentile (1,146.3kcal/day, n = 150) and above the 99th percentile (7,176.9kcal/day, n = 151), due to possible underreporting or overreporting of dietary intake, and participants with missing data for occupational social class (n = 238), per capita household income (n = 50), who reported having undergone bariatric surgery (n = 102) (which could result in consequent reductions in dietary intake) were excluded from the analyses, totaling 727 participants. Thus, the final the study population comprised 14,378 participants.

Study variables

Dietary intake was assessed using a one-year, semi-quantitative 114-item food frequency questionnaire (FFQ). The FFQ used showed satisfactory reliability for all nutrients and reasonable relative validity for energy and macronutrients [24,25].

Energy values of foods in the FFQ were estimated based on the formula: amount of servings consumed per occasion x weight/serving size x daily intake frequency x nutritional composition of the food serving. The nutritional composition of food items was determined using the Nutrition Data System for Research (NDSR; http://www.ncc.umn.edu/products/) software of the University of Minnesota and the Brazilian Food Composition Table (TACO) of the University of Campinas (UNICAMP) [24].

Food items on the FFQ were assigned to four groups according to the NOVA food classification proposed by Monteiro et al. [14], which is based on the nature, extent, and purpose of industrial food processing: unprocessed or minimally processed foods and processed culinary ingredients, processed foods, and ultra-processed foods. In this study, processed culinary ingredients were grouped with unprocessed or minimally processed foods. The food items classification from ELSA-Brasil's FFQ is presented in Table 1.

The contribution percentage of each food group (unprocessed or minimally processed foods and processed culinary ingredients, processed foods, and ultra-processed foods) was calculated for total calorie intake. The contribution percentage of ultra-processed foods was treated as a continuous variable and used as a response variable.

In the FFQ administered in this study, bread roll, white bread, pita bread, and toasted bread were being considered a single food item. However, according to the classification proposed by Monteiro et al. [14], bread roll is classified as a processed food, whereas the other bread types are classified as ultra-processed foods. Thus, we estimated the caloric contribution of bread rolls separately from that of other bread types, using the bread roll caloric contribution reported by the *Brazilian Household Budget Survey* 2008-2009 for people aged 35-74 years from the South, Southeast, and Northeast regions of Brazil, and incorporated its calories into the caloric contribution of processed foods. Similarly, we incorporated the calories of other bread types into ultra-processed foods.

Socioeconomic position indicators

Education was based on the answer to the question "What is the highest level of education you have completed?", participants were assigned to the following education levels: incomplete elementary school, complete elementary school, who attended high school, graduate and postgraduate degrees. Per capita household income was expressed in quintiles of study group distribution. The occupational social class was defined based on the socioeconomic status of the participant's current job. The socioeconomic status of a job is a measure obtained when comparing the expected and the observed educational and income levels of a job, according to the Brazilian occupational matrix [26] from 2008 to 2010. The resulting socioeconomic status measurements were grouped into seven strata to achieve a minimum intra-stratum variance and a maximum variation between the strata. The seven occupational social class groups were subsequently named as it follows: "high-upper", "high-low", "middle-upper", "middle-middle", "middle-low", "low-high" and "low-low" [27]. For the current analysis, the strata were grouped into the following groups: high (upper-high + upper-low), middle (upper-middle + middle-middle), lower-middle, lower-high, and lower-low.

These indicators were chosen because each of them provide a partial view of socioeconomic inequalities and food patterns. For instance, education level can contribute to food choices [28,29], either by providing more access to information or by being indirectly associated with more highly qualified occupations and higher wages [28]. Income directly measures the material resources available to be used as health resources, such as food choices [30,31]. The occupational social status can influence people's diet, through eating habits shared in the workplace, in social networks, and through cultural aspects regarding their occupation [29,32].

Table 1

Classification of foods according to the nature, extent and purpose of industrial processing. ELSA-Brasil (2008-2010).

Food group	
Unprocessed or minimally processed foods and processed culinary ingredients	Brown rice, white rice, oatmeal/cereal, farofa/couscous, cassava/maize flour, corn polenta/mush/porridge, potatoes/ mashed potatoes, cassava/banana/sweet potato/fried polenta, orange/tangerine, banana, papaya, apple/pear, watermelon, melon, pineapple, avocado, mango, grapes, guava, strawberry, peach/plum/kiwi/cashew, persimmon/ jackfruit/custard apple/cherimoya, fruit salad w/ sugar, fruit salad w/o sugar, lettuce, kale, cabbage, chicory, tomato, squash, zucchini/chayote/eggplant, peas, okra, onions, garlic, carrots, beets, cauliflower, broccoli, corn, beans, feijoada/ feijão tropeiro, lentils/chickpeas/peas, nuts/chestnut/ almonds, baked/poached eggs, fried eggs/omelet/scrambled eggs, skim milk, semi-skim milk, whole milk, soy milk, butter, liver/offal, stomach/tripe, bone-in meat, boneless meat, pork, chicken beast/poultry, fried chicken, baked chicken, baked fish, fried fish, shrimp/seafood, pasta, acarajé, popcorn, stroganoff, vatapá, caruru, fish stew, sushi, sashimi, tofu, yakisoba, vegetable soup, honey, coffee w/ sugar, coffee w/o sugar, coffee w/ sweetener, natural juice w/ sugar, natural juice w/o sugar, natural juice w/ sweetener, tea/mate w/ sugar, tea/mate w/sugar, tea/mate w/ sweetener, chimarrão, coconut water.
Processed foods	White cheese, yellow cheese, bacon/lard/pork rinds, sardines/ tuna, beer, red wine, white wine, bread roll
Ultra-processed foods	Light bread, white/pita bread, sweet/homemade bread, whole grain/rye bread, Brazilian cheese bread, cake, stuffed cake, crackers, sweet biscuit w/ filling, sweet biscuit w/o filling, light mayonnaise, regular mayonnaise, light yogurt, regular yogurt, light cream cheese, regular cream cheese, margarine, sausage/chorizo/Vienna sausage, hamburger (beef), ham/mortadella/salami, pizza, instant noodles, baked snacks, fried snacks, hot dogs, instant soup, ice cream, fruit popsicles, caramel/candy, gelatin, chocolate powder, chocolate/bonbons/sweets, pudding/mousse, jam/jelly, cereal bars, diet soda, regular soda, processed juice w/ sugar, processed juice w/o sugar, processed juice w/ sweetener, artificial juice w/ sugar, artificial juice w/ sugar, artificial juice w/ sweetener, distilled beverages

Adjustment variables

The variables age group (35-44, 45-54, 55-64, 65-74 years) and sex were also included in the analysis. These variables were considered as adjustment factors because the consumption of ultra-processed foods ranges according to sociodemographic levels.

Statistical analysis

The caloric contribution percentage of each food group (unprocessed or minimally processed foods and processed culinary ingredients, processed foods, and ultra-processed foods) and of the most consumed foods from each group were calculated for total calorie intake. The mean (interquartile range) of the contribution percentage of ultra-processed foods was calculated according to each explanatory variable. Differences in mean caloric contribution of ultra-processed foods across explanatory variables were compared using the Kruskal-Wallis test.

Generalized linear models (GLM) with gamma distribution and logarithmic link function were used to estimate the strength of the association between socioeconomic status indicators and consumption of ultra-processed foods. The results are presented as arithmetic mean ratios (AMR) and 95% confidence intervals (95%CI), which are exponential regression coefficients [33].

We performed separated models for each socioeconomic position indicator: education, per capita household income, and occupational social class. First, we estimated the crude models, which were then adjusted for sex and age. All variables associated with the response variable at $p < 0.2$ in univariable analysis were included in multiple regression models and retained in the final model when associated with the response variable at $p < 0.05$. Final models were adjusted using the the Pearson's statistical test. All analyses were performed using the software Stata 12.0 (StataCorp LP, College Station, USA).

Results

From 14,378 participants, 39.4% were aged between 45 and 54 years, most were women and self-reportedly white, 36.6% had a postgraduate degree, 33.6% were part of high occupational social classes, and 15.2% were in the lower-low occupational social class (Table 2). The mean of per capita household income was BRL 1,742.3 ± 1,431.

The mean for total calorie intake was 2,945 ± 1,084kcal/day, 1,146-7,164kcal/day. Unprocessed or minimally processed foods and processed culinary ingredients contributed to nearly two-thirds (65.7%) of the total calorie intake, followed by ultra-processed foods (22.7%), and processed foods (11.6%). Fruits, rice, red meat and derivatives, and poultry contributed with more than 30% of total caloric intake. Bread roll (9%) was the one that contributed with most calories among processed foods, followed by white cheeses and yellow cheeses. The most common ultra-processed foods in terms of caloric contribution were ultra-processed-bread (3.8%), treats (3.1%), followed by cakes and biscuits, pizza and snacks, soft drinks and processed or artificial juices (Table 3).

Percentage caloric contribution of ultra-processed foods

The mean caloric contribution percentage of ultra-processed foods decreased with age and was higher among female. In addition, the mean caloric contribution percentage of ultra-processed foods gradually decreased as the education level was higher, having the lowest value in participants with incomplete elementary school; it also decreased according to higher levels of per capita household income. Mean caloric contribution percentage was lower in lower-low and lower-high occupational social classes (Table 4).

In the multiple regression analysis (Table 5), compared to those with postgraduate degree, the arithmetic mean of caloric contribution percentage of ultra-processed foods was 4%, 12%, 16% and 20% lower among participants with university degree, who had completed high school and elementary school, and who had not complete elementary school, respectively. The mean caloric contribution percentage of ultra-processed foods was 5%, 10%, 15%, and 20% lower among participants from the lowest four income quintiles (4^{th}, 3^{rd}, 2^{nd}, 1^{st}), respectively, compared to those from the upper income quintile (5^{th}). Compared to individuals from high occupational social classes, the mean caloric contribution percentages of ultra-processed foods was 7%, 12%, 12%, and 17% lower among middle, lower-middle, lower-high, and lower-low occupational social classes, respectively. All the associations suggest a dose-response gradient.

Table 2

Sociodemographic characteristics of the participants under study. ELSA-Brasil (2008- 2010; N = 14,378).

Sociodemographic characteristics	n *	%
Sex		
Male	6,590	45.8
Female	7,788	54.2
Age group (years)		
35-44	3,200	22.3
45-54	5,663	39.4
55-64	4,012	27.9
65-74	1,503	10.4
Education		
Postgraduate	5,262	36.6
University degree	2,309	16.1
High school	4,993	34.7
Complete elementary school	981	6.8
Incomplete elementary school	833	5.8
Occupational social classes		
High	4,829	33.6
Middle	3,414	23.7
Lower-middle	2,634	18.3
Lower- high	1,325	9.2
Lower-low	2,176	15.2

Discussion

In this study, unprocessed or minimally processed foods and processed culinary ingredients, such as fruits, rice, meat, and beans contributed with two-thirds of people's total daily calorie intake, while ultra-processed foods contributed with more than one-fifth. Additionally, participants with worse socioeconomic indicators (education, income, and occupational social class) reported a lower caloric contribution from ultra-processed foods with indication of a dose-response relationship in the associations.

The overall contributions of unprocessed or minimally processed foods and processed culinary ingredients, processed foods, and ultra-processed foods to total calorie intake observed in this study are similar to the findings reported for Brazilians with 10 or more years old living in urban and rural areas from 2008 to 2009. It is worth to highlight that this study collected dietary information on the Brazilian population in two dietary recall interviews on nonconsecutive days [34], whereas, in the current study, participants completed a single FFQ, which is a more adequate dietary pattern measure [35]. Ultra-processed foods contributed with more one-fifth of the mean total calories consumed by both ELSA-Brasil participants and the urban and rural population of Brazil, a lower proportion compared to the one observed for the US population over one year of age (~60%) [36], and lower proportion compared to the contribution of ultra-processed foods to the total of purchased food for home consumption in Chile and Canada (> 50%) [8,37]. Variations in age-ranges and survey methods among the compared countries and this cohort might account for part of the largely observed differences, but are unlikely to be the main cause of them. We suppose that the strong Brazilian food culture may influence the higher contribution of unprocessed or minimally processed foods, and processed culinary ingredients, and the lower contribution of processed and ultra-processed foods in the diet of the participants of this study, and also the results from the comparison between the Brazilian population diet and the developed countries diet [38].

Table 3

Caloric contribution percentage of main unprocessed or minimally processed and processed culinary ingredients, processed foods and ultra-processed foods. ELSA-Brasil (2008-2010).

Groups of food/Consumable items	Total energy consumption (%)
Unprocessed or minimally processed foods + processed culinary ingredients	65.7
Fruits	10.7
Rice	9.6
Red meat and derivates *	6.1
Poultry	5.9
Beans	5.0
Milk	4.0
Fish, shrimp/seafood, crab	3.9
Natural juice	2.9
Vegetables	2.4
Oatmeal/Cereal	1.3
Nuts/Chestnut/Almonds	1.2
Processed foods	11.6
Bread roll	5.0
White cheese	2.3
Yellow cheese	1.7
Beer	1.4
Ultra-processed foods	22.7
Ultra-processed bread **	3.8
Sweets and treats ***	3.1
Cakes and sweet biscuits	2.7
Pizza and snacks	2.4
Soft drinks, processed juice and artificial juice	2.3
Sausage meet #	2.0
Crackers	1.1
Yogurt	0.8
Cream cheese	0.5
Cereal bars	0.4

* Including liver/offal, stomach/tripe;

** Including light bread, white/pita bread, sweet/homemade bread, whole grain/rye bread, Brazilian cheese bread;

*** Including ice cream, fruit popsicles, caramel/candy, gelatin, chocolate powder, chocolate/bonbons/sweets, pudding/mousse, jam/jelly;

Including sausage/chorizo/Vienna sausage, hamburger (beef), ham/mortadella/salami.

Our results differ from other studies that have shown that worse socioeconomic position indicators such as education, per capita household income, and occupational social class, often influence the increased consumption of specific ultra-processed foods, such as pies, sausages, pastries, ice cream [39] soft drinks [40,41], energy drinks, and processed juices [41]. Low socioeconomic position has been associated with increased consumption of food such as pasta, fried foods, sugar and fat, whereas high socioeconomic position has been associated with increased consumption of whole grains, lean meats, fish, low-fat dairy products, and fresh fruits and vegetables [28,42]. However, other aspects such as the typical food culture of different societies may also affect this. In countries where fruits and vegetables are a major part of the diet such as Greece, Portugal, and Spain, people with lower socioeconomic position usually consume more fruits and vegetables than people with higher socioeconomic position [43]. It is important to note that the process of choosing, purchasing, and consuming foods is driven by a complex combination of biological, social, and cultural interactions [31,44,45,46]. The determinants of dietary intake include individual characteristics such as nutritional knowledge and structural factors such as access points of purchase and food prices [47,48].

Table 4

Mean and interquartile range of the caloric contribution percentage of ultra-processed foods according to sociodemographic characteristics. ELSA-Brasil (2008-2010).

	Percentage caloric contribution of ultra-processed foods (kcal/day)	
	Mean	1st quartile-4th quartile
Sex		
Male	20.6 *	14.7-27.5
Female	23.0	16.7-29.9
Age group (years)		
35-44	24.8 *	18.6-31.5
45-54	22.2	16.3-29.0
55-64	20.0	14.1-26.7
65-74	19.5	13.5-26.4
Education		
Postgraduate	23.5 *	17.4-30.2
University degree	22.9	17.2-30.0
High school	21.0	15.1-27.9
Complete elementary school	19.0	13.3-25.7
Incomplete elementary school	17.2	11.5-24.1
Per capita family income		
5th quintile (upper)	23.6 *	17.2-31.0
4th quintile	23.0	17.1-30.1
3rd quintile	22.3	16.2-28.9
2nd quintile	21.0	15.0-28.1
1st quintile (lower)	19.7	13.8-25.8
Occupational social classes		
High	23.2 *	17.2-30.1
Middle	22.8	16.8-29.6
Lower-middle	21.1	14.8-28.2
Lower-high	20.5	14.2-27.2
Lower-low	19.2	13.4-25.6

* $p < 0.001$, Kruskal-Wallis test.

Our findings were similar to previous analyses that showed that higher per capita household income was associated with a higher contribution of ultra-processed foods to total food purchased by Brazilian households [17]. However, there were methodological differences between this study and the study by Martins et al. [17], for example: (1) estimates of food consumption based on food purchase are not the same as those based on the food frequency questionnaire; (2) the age range of the latter was wider (≥ 18 years) than that of ELSA-Brasil (35-74 years); and (3) the range of the Brazilian households income is much higher than the one used in this study, but our results point in the same direction.

To verify the consistency of the associations between socioeconomic position and consumption of ultra-processed foods, we have explored the association of ultra-processed food with different socioeconomic position indicators in our analysis. We did this because each socioeconomic position indicator has its own specificity, in spite of being highly correlated with each other. For instance, educational level influences the occupation and together they can determine the level of income [49]. The Spearman correlation (data not shown) between the socioeconomic position indicators used ranged from 56% to 76% ($p < 0.001$), a medium to high correlation. Simultaneous adjustment for the socioeconomic position indicators could violate the multicollinearity assumption and consequently lead to an underestimation of the estimated coefficients [50].

Table 5

Association between socioeconomic position indicators and caloric contribution percentage of ultra-processed foods. ELSA-Brasil (2008-2010).

	Percentage caloric contribution of ultra-processed foods	
	AMR crude (95%CI)	AMR adjusted * (95%CI)
Education		
Postgraduate	1.00	1.00
University degree	0.98 (0.96-1.00)	0.96 (0.94-0.97) **
High school	0.90 (0.89-0.92) **	0.88 (0.87-0.90) **
Complete elementary school	0.82 (0.80-0.84) **	0.84 (0.82-0.86) **
Incomplete elementary school	0.75 (0.73-0.78) **	0.80 (0.77-0.82) **
Per capita family income		
5th quintile (upper)	1.00	1.00
4th quintile	0.98 (0.96-0.99) ***	0.95 (0.93-0.98) **
3rd quintile	0.94 (0.91-0.96) **	0.90 (0.88-0.92) **
2nd quintile	0.89 (0.87-0.91) **	0.85 (0.83-0.87) **
1st quintile (lower)	0.83 (0.82_0.85) **	0.80 (0.79-0.83) **
Occupational social classes		
High	1.00	1.00
Middle	0.98 (0.96_1.00)	0.93 (0.92-0.95) **
Lower-middle	0.92 (0.90-0.93) **	0.88 (0.86-0.90) **
Lower- high	0.89 (0.87-0.92) **	0.88 (0.86-0.91) **

AMR: arithmetic mean ratios.

* Adjusted for gender and age;

** $p < 0.001$;

*** $p < 0.05$.

Even though eating patterns in Brazil have been strongly influenced by the food industry in the last twenty years [31,51], ultra-processed foods still have higher added value than less processed foods in the country [52,53]. Unlike the United Kingdom, where the cost of ultra-processed foods is on average 13% lower than the cost of unprocessed or minimally processed foods and processed foods together, ultra-processed foods are about 52% more expensive than both food groups in Brazil [54]. In addition, we believe that declining the prices of ultra-processed foods in Brazil would probably promote an increase in consumption among the poorer classes. The purchase of ultra-processed foods over the 2002/2003-2008/2009 period increased more among lower-income families than among higher-income families [17].

The strengths of this study include the analysis of individual food intake in a cohort of adults from different regions of Brazil using a validated food frequency questionnaire to measure food consumption over a 12-month period [24,25]. Reverse causality should not be a limitation to address the associations found, because consumption of ultra-processed foods is unlikely to lead to higher socio-economic position. One limitation of the study is our reliance on a FFQ containing more than 100 food items, as this may lead to overreporting [55]. Furthermore, the FFQ is not appropriate to report dietary intake according to the degree of food processing, which limited our ability and accuracy to classify some food items. In addition, the classification of foods according to processing level is new and susceptible to future updates and changes. This study included participants from six Brazilian states with stable jobs and higher education level and income than the Brazilian population.

Conclusions

Unprocessed or minimally processed foods were the ones that contributed the most to participants' daily calorie intake. Our results showed that ultra-processed food consumption ranged according to socioeconomic status and was higher among individuals with higher socioeconomic position, results that suggest a dose-response relationship for these associations.

Contributors

B. S. Simões, S. M. Barreto and L. Giatti contributed to study conception, data analysis and interpretation, manuscript drafting, critical manuscript revision for important intellectual content and final approval of the article. M. C. B. Molina, V. C. Luft, B. B. Duncan, M. I. Schmidt, L. O. Cardoso, and R. B. Levy contributed to data acquisition and critical manuscript revision for important intellectual content.

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Resumo

O estudo teve como objetivo estimar a contribuição dos alimentos ultraprocessados à ingestão calórica total e investigar se essa contribuição difere de acordo com nível socioeconômico. Analisamos os dados da linha de base do Estudo Longitudinal de Saúde do Adulto-Brasil *(ELSA-Brasil 2008-2010; N = 14.378) e os de ingestão alimentar, usando um questionário sobre frequência de consumo alimentar, em três categorias: alimentos não processados ou minimamente processados e ingredientes culinários processados, alimentos processados e alimentos ultraprocessados. Estimamos as associações entre nível socioeconômico (escolaridade, renda domiciliar* per capita *e classe social ocupacional) e o percentual da contribuição calórica dos ultraprocessados, usando modelos lineares generalizados, ajustados por idade e sexo. Os alimentos não processados ou minimamente processados e ingredientes culinários processados representaram 65,7% da ingestão calórica total, seguidos pelos ultraprocessados (22,7%). Depois dos ajustes, a contribuição dos ultraprocessados foi 20% mais baixa entre participantes com ensino fundamental incompleto, quando comparados aos indivíduos com pós-graduação. Quando comparados aos indivíduos das classes de renda mais alta, a contribuição calórica dos ultraprocessados foi 10%, 15% e 20% mais baixa entre aqueles pertencentes aos três quintis de renda mais baixos, respectivamente. Além disso, a contribuição calórica dos ultraprocessados foi 7%, 12%, 12% e 17% mais baixa entre os participantes da classe social ocupacional mais baixa, comparados aos das classes sociais mais altas. Os resultados sugerem que a contribuição calórica dos alimentos ultraprocessados é mais alta entre os indivíduos de nível socioeconômico mais alto, com gradiente de dose e resposta nas associações.*

Manipulação de Alimentos; Ingestão de Alimentos; Fatores Socioeconômicos; Estudo Multicêntrico

Resumen

El objetivo del estudio fue estimar la contribución de las comidas ultraprocesadas en la ingesta total calórica e investigar si difiere según el nivel socioeconómico. Analizamos datos de referencia, procedentes del Estudio Longitudinal Brasileño sobre Salud en la Edad Adulta *(ELSA-Brasil 2008-2010; N = 14.378) y datos de la ingesta nutricional, usando un cuestionario de frecuencia sobre comidas, asignándole tres categorías: comida sin procesar o mínimamente procesada e ingredientes culinarios procesados, comidas procesadas, y comidas ultraprocesadas. Medimos las asociaciones entre el nivel socioeconómico (educación, ingreso por hogar per cápita, y clase ocupacional social) y el porcentaje de la contribución calórica de la comida ultraprocesada, usando modelos de regresión lineal generalizada, ajustados por edad y sexo. Las comidas sin procesar o mínimamente procesadas con ingredientes culinarios procesados contribuyeron al 65,7% del total de la ingesta calórica, seguidos de la comida ultraprocesada (22,7%). Tras los ajustes, el porcentaje de la contribución calórica de la comida ultraprocesada fue un 20% menor entre los participantes con la escuela elemental incompleta, cuando se compararon con los postgraduados. Comparados con los individuos de las clases con ingresos superiores, la contribución calórica de las comidas ultraprocesadas fue un 10%, 15% y 20% menor entre quienes pertenecían a las tres categorías de ingresos más bajas, respectivamente. La contribución calórica de la comida ultraprocesada fue también un 7%, 12%, 12%, y 17% más baja entre los participantes en el nivel ocupacional social más bajo, comparados con aquellos de las clases sociales altas. Los resultados sugieren que la contribución calórica de la comida ultraprocesada es más alta entre quienes proceden de niveles socioeconómicos más altos con una relación dosis-respuesta para las asociaciones establecidas.*

Manipulación de Alimentos; Ingestión de Alimentos; Factores Socioeconómicos; Estudio Multicéntrico

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