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Dietary patterns and chronic diseases in a survey with adults in the Amazon

Padrões alimentares e doenças crônicas em inquérito com adultos na Amazônia

Abstract

Objective: To identify dietary patterns and verify the prevalence of chronic diseases according to these patterns in the population of Rio Branco, Acre. ***Method:*** This is a survey with 1,701 adults in the city of Rio Branco. The quantitative food frequency questionnaire (FFQ) and dietary patterns obtained by factor analysis were used. ***Results***: In the factor analysis, five patterns were identified: ultra-processed and sweet; fruits; traditional; greens and vegetables; and salads and condiments. The results suggest that the consumption of ultra-processed foods and sweets is more prevalent in men (58.6%; p-value: 0.004), aged between 18 and 39 years (64.4%; p-value: <0.001), with higher education (62.9%; p-value: 0.001), practitioners of physical activity (62.8%; p-value: <0.001), non-smokers (56.0%; p-value: 0.027) and patients with hypertriglyceridemia (43.7%; p-value: <0.001), hypercholesterolemia (45.2%; p-value: <0.001) and metabolic syndrome (42.9%; p-value: 0.012). ***Conclusion***: We emphasize the need to consolidate programs and actions focused on healthy food consumption, especially among young men, with higher education, aiming to reduce diseases such as hypertriglyceridemia, hypercholesterolemia and metabolic syndrome.

Keywords: Food consumption. Chronic disease. Adult. Factor analysis.

Resumo

Objetivo: Identificar os padrões alimentares e verificar a prevalência de doenças crônicas segundo esses padrões na população de Rio Branco, Acre. ***Método***: Trata-se de um inquérito com 1.701 adultos no município de Rio Branco. Utilizaram-se o questionário quantitativo de frequência alimentar (QFA) e os padrões alimentares obtidos por análise fatorial. ***Resultados***: Na análise fatorial, foram identificados cinco padrões: ultraprocessados e doces; frutas; tradicional; verduras e legumes; e saladas e condimentos. Os resultados sugerem que o consumo de ultraprocessados e doces é mais prevalente em homens (58,6%; p-valor: 0,004), na idade entre 18 a 39 anos (64,4%; p-valor: <0,001), com maior escolaridade (62,9%; p-valor: 0,001), praticantes de atividade física (62,8%; p-valor: <0,001), não fumantes (56,0%; p-valor: 0,027) e portadores de hipertrigliceridemia (43,7%; p-valor: <0,001), hipercolesterolemia (45,2%; p-valor: <0,001) e síndrome metabólica (42,9%; p-valor: 0,012). ***Conclusão***: Ressalta-se a necessidade de consolidar programas e ações com enfoque no consumo alimentar saudável, especialmente entre os homens, jovens, com maior escolaridade visando à redução de doenças como hipertrigliceridemia, hipercolesterolemia e síndrome metabólica.

Palavras-chave: Consumo de alimentos. Doença crônica. Adulto. Análise fatorial.

INTRODUCTION

Data from the World Health Organization (WHO) point to the relationship between diet and chronic non-communicable diseases (CNCDs), since some components of the diet can cause adverse effects on the body, increasing the risk of these diseases when consumed in inadequate intervals and amounts.[1] Food intake is variable and complex, with interactions between products and nutrients, and for this reason it is recognized that we should focus on the total diet and nutrient and food intake patterns. Dietary patterns are defined as the amount, variety, proportions and combinations of foods and beverages, as well as the frequency of consumption. Its analysis allows associating the usual diet and health conditions in the population.[2]

Unhealthy dietary patterns have a cumulative effect and contribute to the onset of disease. About half of American adults, approximately 117 million individuals, have one or more preventable chronic diseases, many of which are related to poor dietary patterns and physical inactivity.[2] In India, patterns of consumption of animal products were positively associated with the presence of cardiometabolic risk factors, even controlled for potentially confounding variables.[3] In Brazil, the processes of urbanization and globalization facilitated the spread of inappropriate eating habits, favoring the high prevalence of CNCD.[4]

Dietary habits influence several risk factors for CNCDs, including not only obesity and low-density lipoprotein cholesterol (LDL-c), but also physical activity levels, blood pressure (BP) and blood glucose levels.[3] Thus, diet is associated with the main risk factors for the onset of cardiovascular diseases (CVD).[5] Other factors include smoking, body weight, total cholesterol (TC) level, triglycerides (TG), reduced high-density lipoprotein cholesterol (HDL-C) level, age, male gender, and genetic factors.[6]

Dietary habits considered most harmful to health include: excessive intake of energy, sodium, saturated fatty acids (SFA), trans-unsaturated fatty acids and added sugar. Conversely, there is consumption of fruits, vegetables, legumes, nuts, whole grains and fish.[3] On the other hand, healthy diets play a dual role in preventing chronic diseases, as they reduce independent risk factors and favor agents that modify these factors.[7,8]

In this context, the WHO's global strategy for Food, Physical Activity and Health addresses the need to adapt world food standards, with an emphasis on reducing the consumption of foods with high energy, low nutrient content and high sodium content, saturated fats, trans fats and refined carbohydrates.[9]

In the Amazon region, there is a high consumption of meat and ultra-processed foods (soft drinks, cookies and ready meals) and low consumption of fruits and vegetables.[10] A study carried out in the interior of the state of Acre observed an excessive consumption of fried foods associated with high rates of overweight and obesity in the region.[11] The present study aims to identify dietary patterns in the population and verify the distribution of chronic diseases according to these patterns in the population of Rio Branco, Acre.

METHODS

This is a population survey carried out with individuals aged 18 years and over, in the city of Rio Branco, Acre. The data are part of the Study of Chronic Diseases project, carried out in 2014.[12]

In 2010, the capital of the state of Acre, Rio Branco, had a territorial unit of 8,834,942 km², with approximately 21,620 elderly people, most of whom live in the urban area (91.8%). In the same year, Rio Branco obtained the Municipal Human Development Index (IDHM) of 0.727.[9] The dimension that most

contributed to the municipality's IDHM was longevity, with an index of 0.798, followed by income (0.729) and education (0.661).

The research was structured in two independent samples: one for adults aged 18 to 59 years (Edoc-A) and another for elderly people aged 60 years and over (Edoc-I). In the matrix study, individuals with cognitive impairments that made it impossible to communicate or understand the questions were excluded from the research population. The sampling plans were selected in two stages, census sector and household, the first being common to both surveys. The selection of sectors was made with probability proportional to their number and that of private households in the 2010 Demographic Census (CD2010) of the Brazilian Institute of Geography and Statistics (IBGE). Households were selected by systematic sampling with random beginnings and different intervals per survey and in each sector, 11 households were selected by systematic sampling for Edoc-A and 73 households for Edoc-I.

The dependent variable of the study was food intake, assessed based on data from a previously validated quantitative food frequency questionnaire (FFQ).[13] The FFQ consists of 66 food items classified into 11 groups: soups and pasta, meat and fish, milk and dairy products, pulses and eggs, rice and tubers, vegetables, sauces and seasonings, fruits, drinks, breads and cookies, and sweets and desserts (Chart 1). The frequency of consumption was recorded by the number of times the food was consumed, per day, week, month or year and by the usual average portion of reference. Dietary interviews are related to the interviewee's usual eating habits within a year.

Chart 1. Characteristics of food groups

Food group	Products
Soups and Pasta	Soups, fried snacks, baked snacks, pasta, pizza and polenta
Meat and fish	Beef, pork, jerky, dried meat, bacon, sausage, cold cuts, chicken, hamburgers, nuggets, meatballs, fish and seafood
Milk and dairy products	Milk, yogurt and cheese
Legumes and eggs	Boiled egg, beans (carioca, purple, black and green), lentils, peas, chickpeas, soybeans, feijoada and tropeiro beans
Rice and tubers	White or brown rice, French fries or fried cassava, mayonnaise salad with vegetables, cassava flour, farofa, couscous, oatmeal and tapioca
Greens and vegetables	Lettuce, tomato, carrot, zucchini, eggplant, chayote, chard, arugula, watercress, endive, kale, cauliflower, broccoli and cabbage
Sauces and seasonings	Oil, olive oil or vinaigrette, mayonnaise, salad dressing, pâté, whipped cream, salt, condiments
Fruits	Orange, pineapple, tangerine, banana, apple, pear, melon, watermelon, papaya, guava, avocado
Beverages	Natural juice, industrialized juice, coffee or tea, soft drinks and beers
Breads and cookies	French bread, loaf of bread, wholemeal bread, sweet bread, toast, cookies, cakes, bread with butter or margarine, hot dogs and hamburgers.
Sweets and desserts	Chocolate, bonbon, brigadeiro, powdered chocolate, pies and puddings

The independent variables analyzed in this study included demographic and socioeconomic aspects (gender, age, race/skin color, education), health-related behaviors (physical activity, smoking, alcohol consumption), nutritional status (anthropometric data, weight, height, BMI, waist, hip, arm and calf circumferences, waist-hip ratio), laboratory tests (total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides and serum glucose) and blood pressure.

The interviews were carried out at home and included the application of a structured questionnaire, physical assessment and laboratory tests. In the physical assessment, the anthropometric data included the measurement of weight, height and waist, hip, arm and calf circumferences, all in duplicate, considering the averages of the measurements. The body mass index (BMI) was calculated by dividing weight (kg) by the square of height (m^2), later categorized, as well as waist circumference. The waist-hip ratio (WHR) was also considered, taking into account ACSM cut-off points.[14]

Biological material analyzes were performed in the same laboratory, to ensure the standardization of methods. Blood samples were obtained by collecting peripheral blood, with previous antisepsis of the antecubital fossa of the participants. The extracted serum was stored for biochemical measurement of triglycerides, total cholesterol and fractions: high-density lipoprotein (HDL) and low-density lipoprotein (LDL). For the analysis of serum glycemia, a 4 ml sample of blood was used, packed in a vacuum tube containing 2 mg/ml of sodium fluoride, centrifuged before the analysis. Serum glucose was measured by the glucose oxidase method (Labtest Diagnostica).

Blood pressure (BP) was measured according to the protocol recommended by the Brazilian Society of Cardiology, which recommends measurement 30 minutes or more after the last dose of caffeine ingested or cigarette smoked, with three measurements being made: one after five minutes of rest and two others at two-minute intervals.[15]

Systemic arterial hypertension (SAH) was defined as diastolic blood pressure (DBP) ≥ 90 mmHg, systolic blood pressure (SBP) ≥ 140 mmHg, and/or current use of antihypertensive medication. The presence of diabetes was defined according to the criteria of the American Diabetes Association (ADA): fasting plasma glucose ≥ 126 mg/dL or use of oral hypoglycemic agents or insulin. Dyslipidemia was defined by abnormal levels of one or more of the following blood lipid components: triglycerides ≥ 150 mg/dL, total cholesterol ≥ 200 mg/dL, LDL ≥ 160 mg/dL, HDL in men < 40 mg/dL and in women < 50 mg/dL, in addition to a history of medicine use to reduce these values. For individuals under 20 years of age, the cut-off points are: triglycerides ≥ 130 mg/dL, total cholesterol ≥ 170 mg/dL, LDL ≥ 130 mg/dL and HDL ≤ 45 mg/dL.[16]

For the diagnosis of metabolic syndrome (MS), the I Brazilian Guideline for the Diagnosis and Treatment of Metabolic Syndrome was used, according to which the presence of at least three of the following elements is required: waist diameter > 102 cm for men and > 88 cm for women; triglycerides ≥ 150 mg/dL; HDL < 40 mg/dL for men and < 50 mg/dL for women; SBP ≥ 130 mmHg, DBP ≥ 85 mmHg or use of antihypertensive medication; fasting glucose ≥ 110 mg/dL or use of hypoglycemic agents.[16]

To control the quality of the information, interviews and physical assessments were carried out in the pilot study.[12]

The sample weights were calculated as the inverse of the inclusion probabilities at each stage and were subsequently calibrated for population data by sex and age groups, using a post-stratification estimator, in order to deal with typical household survey biases and correct differential non-response. The population data used to calibrate the sample weights were estimated for July 1, 2014, using the linear trend method that IBGE applies in its population estimates by municipality. For more details on the EDOC sampling plan, calculation and calibration of sample and subsample weights, it is suggested to see the article by Amaral et al.[12]

Data analysis was performed using the Complex samples routines of the Statistical Package for the Social Sciences (SPSS), version 20.0, for Windows. The natural weight of the design, the sample selection layer, the primary sampling unit code (sector) and the calibrated weight were kept in the data files. Data were analyzed in a descriptive and exploratory way to assess the distribution and characterize the population studied. Qualitative variables were described in absolute

numbers and proportions. To analyze the differences between the categorical variables, Pearson's chi-square test was used. For quantitative variables, dispersion and trend analysis were used.

Dietary patterns were identified through factor analysis by principal components, in order to obtain groupings according to summary measures from the FFQ. In the present analysis, groups with *eingenvalues* > 1.5 were retained. The Kaiser-Meyer-Olkin (KMO) and Bartlett (Bartlett's test of sphericity, BTS) tests, which indicate the suitability of data for factor analysis, establish values close to 1.0 for KMO and p<0.001 for BTS as adequate. The components matrix was rotated using the Varimax rotation for better interpretation of factors ranging from –1 to +1, as these are correlations. Values less than 0.40 will not be displayed in the model. The significance level adopted was 5%. The patterns were analyzed in tertiles, the first T (T1) being the one with the lowest consumption and the third tertile (T3) the one with the highest consumption, and the statistical difference was evaluated using the Wald test.

The present study was approved by the Research Ethics Committee of the Federal University of Acre under opinion no. 518,531 of 01/30/2014, Presentation Certificate for Ethical Appreciation: 17543013.0.0000.5010. Study participants signed an informed consent form, guaranteeing the right to refuse and maintain the confidentiality of the informed data.

RESULTS

The sample consisted of 1,701 participants, corresponding to a total population of 235,318 adults. In the factor analysis, five dietary patterns called ultra-processed and sweets, fruits, traditional, vegetables and salads and condiments were identified, presenting the foods or groups that contributed to their composition with factor loads greater than 0.4 (Table 1). The KMO was 0.872 and the BTS obtained p<0.001, indicating that the correlations between the items were sufficient and adequate in the factor analysis.

Table1. Factorial matrix of adult dietary patterns in Rio Branco, Acre, 2014

Variables	Components[a]				
	Ultra-processed and sweets	Fruits	Traditional	Greens and vegetables	Salads and condiments
Pizza	0.629				
Processed meat	0.614				
Sandwich	0.552				
Fried cassava/potato	0.532				
Feijoada, tropeiro Beans	0.527				
Snacks	0.523				
Mayonnaise	0.521				
Cake	0.487				
Cheeses	0.484				
Pork	0.466				
Chocolates and Chocolate powder	0.461				
Desserts	0.460				
Pasta	0.454				
Cookies with filling	0.435				
Papaya		0.689			
Apple, pear		0.679			
Melon, watermelon		0.664			
Banana		0.603			

Table1. Factorial matrix of adult dietary patterns in Rio Branco, Acre, 2014

Variables	Components[a]				
	Ultra-processed and sweets	Fruits	Traditional	Greens and vegetables	Salads and condiments
Orange, Tangerine and Pineapple		0.601			
Guava, avocado Natural juice		0.517			
White or brown rice			0.738		
Milk and yogurt			0.650		
Coffee and tea			0.640		
Breads and toast			0.593		
Beans and lentils			0.568		
Sugar, honey and jam			0.507		
Flour, farofa			0.465		
Boiled greens				0.736	
Broccoli, Cauliflower, Cabbage				0.707	
Raw greens				0.693	
Vegetables				0.590	
Tomato					0.686
Lettuce					0.683
Carrot					0.612
Oil, olive oil, vinegar					0.521
Salt					0.518

[a a] Presented the absolute values of factor loads above 0.40.

According to the frequency analysis by tertile, in the "ultra-processed and sweet" pattern, the largest consumers were men, those with high school or higher education, practitioners of physical activity and non-smokers, with a downward trend being observed across the age groups surveyed ($p<0.05$). As for the "fruits" pattern, there was a statistically significant difference for education; those with higher education had a higher prevalence of consumption, as well as smokers and ex-smokers ($p<0.05$). In the "traditional" pattern, there was a difference with higher consumption between smokers and ex-smokers ($p<0.05$). Men and women also showed differences in the "vegetables and salads" pattern, with lower consumption also being observed at the extremes of the analyzed age groups, in addition to those with higher education and practitioners of physical activity ($p<0.05$) (Table 2).)

Table 2. Sociodemographic characteristics of the participants according to tertiles of the dietary patterns of adults of Rio Branco, Acre, 2014.

Variables/ dietary patterns	Ultra-processed and sweets (%)		Fruits (%)		Traditional (%)		Greens and vegetables (%)		Salads and condiments (%)	
	T1	T3	T1	T3	T1	T3	T1	T3	T1	T3
Sex										
Female	17.8	49.5	37.1	29.7	31.5	36.3	33.4	32.8	28.9	35.6
Male	11.1	58.6	34.4	32.3	34.0	30.5	44.0	26.4	29.0	34.0
p-value [a]	0.004		0.720		0.326		0.034		0.905	
Age										
18-39	7.8	64.4	37.3	29.2	35.6	31.4	43.0	26.3	29.3	34.8
40-59	19.0	41.7	33.7	33.6	25.6	38.6	30.1	36.2	25.3	35.7
60-79	45.1	21.8	33.0	34.8	34.1	32.5	32.9	34.9	34.6	34.3
80 and over	45.1	19.9	28.9	35.3	35.8	33.2	35.7	22.4	49.5	24.6
p-value [a]	<0.001		0.560		0.088		0.006		0.184	
Skin color										
White	10.5	56.2	31.9	34.6	37.4	27.8	39.1	25.8	30.5	35.0
Non-white	15.6	53.2	36.8	30.1	31.5	34.9	38.3	33.2	28.6	34.8
p-value [a]	0.287		0.439		0.395		0.221		0.853	
Education										
Up to elementary school	18.0	46.5	42.2	24.9	29.2	34.3	42.3	24.6	31.2	32.8
High school and higher	10.5	62.9	27.2	38.7	38.4	31.5	33.3	37.0	26.5	36.8
p-value [a]	0.001		0.001		0.057		0.013		0.482	
Physical activity										
Yes	8.2	62.8	32.6	34.7	36.1	30.0	30.4	37.9	24.5	41.5
No	17.7	49.9	37.1	29.5	30.9	35.1	42.0	25.9	31.2	31.4
p-value [a]	<0.001		0.343		0.432		0.020		0.050	
Smoking										
Non smoker	11.3	56.0	40.5	24.8	36.6	26.7	40.6	28.2	27.9	37.1
Smoker/ Ex-smoker	18.5	51.3	31.7	36.3	27.8	41.6	36.4	31.4	30.3	31.9
p-value [a]	0.027		0.025		0.001		0.561		0.360	

[a] All significance tests based on weighted data (Wald test). T1: first tertile; T3: third tertile.

In the "ultra-processed and sweet" pattern, the highest prevalence was observed in the upper tertile in those with hypertriglyceridemia, hypercholesterolemia and classified as having metabolic syndrome ($p<0.05$), being in the intermediate level between hypertensive and diabetic patients. In the "fruits" pattern, central obesity was more prevalent in the intermediate tertile. The other dietary patterns showed no difference regarding the presence of chronic diseases (Table 3).

Table 3. Prevalence by dietary patterns in tertiles of chronic diseases in adults of Rio Branco, Acre, 2014.

Variables/ dietary patterns		Ultra-processed and sweets	Fruits	Traditional	Greens and vegetables	Salads and condiments
Obesity	T1	16.5	33.2	32.4	31.2	27.9
	T2	34.4	35.4	33.3	37.1	38.9
	T3	49.0	31.4	34.4	31.7	33.3
p-value [a]		0.612	0.686	0.963	0.149	0.795
Central obesity	T1	21.2	29.6	30.2	33.9	29.6
	T2	37.3	38.3	32.7	37.3	36.8
	T3	41.5	32.1	37.1	28.8	33.6
p-value [a]		0.113	0.009	0.459	0.243	0.868
Arterial hypertension	T1	24.5	29.9	30.8	31.6	28.9
	T2	39.6	36.5	34.3	34.9	39.1
	T3	35.9	33.6	34.9	33.5	32.0
p-value [a]		<0.001	0.110	0.710	0.025	0.582
Diabetes	T1	32.7	35.1	42.3	40.2	22.6
	T2	38.0	29.1	26.3	23.7	26.7
	T3	29.3	35.8	31.4	36.1	50.7
p-value [a]		0.004	0.644	0.468	0.390	0.060
Hypertriglyceridemia	T1	21.2	31.4	31.3	34.0	27.0
	T2	35.1	39.6	31.2	30.7	36.9
	T3	43.7	29.0	37.5	35.2	36.0
p-value [a]		<0.001	0.068	0.352	0.067	0.878
Hypercholesterolemia	T1	20.1	37.4	34.2	38.2	23.6
	T2	34.7	34.4	30.7	31.6	37.8
	T3	45.2	28.2	35.2	30.2	38.6
p-value [a]		<0.001	0.786	0.497	0.985	0.222
Dyslipidemia	T1	16.1	35.1	33.6	38.4	27.1
	T2	32.5	35.7	31.5	31.9	36.2
	T3	51.3	29.3	34.8	29.7	36.7
p-value [a]		0.207	0.375	0.160	0.981	0.398
Metabolic syndrome	T1	21.8	35.7	33.4	32.9	27.3
	T2	35.3	33.2	29.6	33.3	42.0
	T3	42.9	31.1	37.0	33.8	30.8
p-value [a]		0.012	0.914	0.424	0.289	0.341

[a a] All significance tests based on weighted data (Wald test). T1: first tertile; T3: third tertile

DISCUSSION

The findings of this study point to the existence of five dietary patterns, identified as follows: ultra-processed and sweet; fruits; traditional; greens and vegetables; and salads and condiments. Among the biggest consumers of ultra-processed foods and sweets, there are mainly men, individuals aged between 18 and 39 years, with higher education, practitioners of physical activity, non-smokers and patients with hypertriglyceridemia, hypercholesterolemia and metabolic syndrome. Fruits are more consumed among participants with higher education, smokers and former smokers. Traditional diet is more prevalent in smokers and ex-smokers. As for vegetables, they are the foods most consumed by women, people aged between 40-59 years, with a higher level of education and practitioners of physical activity. Finally, salads and condiments are more consumed by practitioners of physical activity.

A prospective cohort study with 961 participants in some cities in Argentina, Chile and Uruguay found two main dietary patterns: the "prudent" pattern, rich in fruits, vegetables, fish and seafood, whole grains and low-fat dairy products; and the "western" pattern, which included eggs, pasta and cakes, pizzas, snacks and refined grains, as well as traditional foods from the region, including red meats. In this study, the dietary patterns of men and women were compared, relating them to serum lipid values, C-reactive protein and atherogenic proteins (apo A-I and B), finding an association between consumption of the "prudent" pattern with lower serum cholesterol and apo B in both sexes and with lower sensitivity to C-reactive protein in men.[17]

In southern Brazil, a study identified four main dietary patterns, defined as follows: healthy (fruits, vegetables and whole grains), traditional (rice, beans, pasta, potatoes and red meat), carbohydrates and refined sugars and fast food. Women and individuals with higher incomes were associated with a healthy dietary pattern, as well as individuals with advanced age showed an inverse association with traditional dietary patterns, carbohydrates and refined sugars, and fast food. Those with higher education were associated with the fast food pattern and inversely with the traditional pattern.[18] In Rio Grande do Sul, a higher probability of adherence to the risk pattern (ultra-processed foods) was also found among younger and more educated women.[19]

Women have often been associated with a healthier eating pattern, with higher consumption of fruits and vegetables than men, which can be explained by several factors.[18,20] Primarily, to the historical role played by them, related to the care of the family's health, through the selection and preparation of food.[20] In addition, women show greater concern with body weight control and often experience frustration regarding their own eating behavior, due to high social pressure for specific beauty standards. On the other hand, men prioritize the pleasure of eating more than their own physical appearance, in addition to perceiving themselves as healthier than women and avoiding seeking health care, including healthy eating practices and a more appropriate lifestyles.[21] The Amazon context should also be highlighted, in which meat consumption is associated with wealth and prosperity, as well as the idea that fruits and vegetables are important for women, children and the elderly.[22]

Another common point with some studies is the association between younger individuals and the consumption of ultra-processed foods, which can be justified by the important changes that occurred in this age group. Young adults experience starting college, leaving their parents' home and starting their work trajectory, situations that can impact their food choices.[23] Therefore, they tend to devote less time to cooking, consuming food that saves preparation time, which are often ultra-processed, in addition to eating outside the home. Older individuals tend to make healthy food choices due to the presence of chronic diseases that require better nutrition, such as diabetes and high blood pressure.[19,23]

Regarding the higher level of education being associated with the consumption of ultra-processed foods and sweets, the findings may involve a matter of cost, mainly. This dietary pattern may be a reflection of the country's level of development,[19] since individuals with higher education are more likely to have jobs with higher income, having, as a consequence, a greater possibility of choosing more expensive foods, while low-income individuals may be conditioned to a more accessible diet, associated with *in natura* and home-prepared foods.[4]

As for the consequences of this greater consumption of ultra-processed foods and sweets, their relationship and the increase in systemic blood pressure are widely known, as they are rich in sodium. This and other habits, such as high energy consumption associated with obesity, excessive consumption of alcoholic beverages and sedentary lifestyle, are directly associated with uncontrolled blood pressure.[24] The nutritional approach to BP reduction advocates, mainly, the reduction of sodium intake to 2g/day or sodium chloride to 5g/day, thus achieving a BP reduction between 2 and 8 mmHg.[25] Consumption of 100g a day of red meat, 50g a day of processed meat and 250ml of sugary drinks is associated with the risk of high blood pressure, as well as an inverse association with a daily consumption of 30g of whole grains, 100g of fruit, 28g of oilseeds and 200g of dairy products.[26]

Another morbidity known to be related to the consumption of ultra-processed foods is type 2 diabetes mellitus (T2DM). In general, this type of food, rich in sodium, energy, lipids and sugars, often with a high glycemic index, leads to an increase in adiposity and insulin resistance. In the NutriNet-Santé study, carried out in France between 2009 and 2019, a statistically significant association was found between the consumption of ultra-processed foods and the development of T2DM.[27]

The aforementioned insulin resistance contributes not only to chronic hyperglycemia, but also to the development of dyslipidemia, which is characterized by high levels of serum triglycerides, low levels of HDL-c (high-density lipoprotein) and LDL-c (low-density lipoprotein).[28] In addition, the high dietary intake of cholesterol, carbohydrates, saturated and trans fatty acids raises serum levels of cholesterol and triglycerides, and the Brazilian Association of Cardiology recommends the proper selection of these items for effective control of dyslipidemia.[16]

Characterized by concomitant high blood glucose, dyslipidemia, abdominal obesity and systemic arterial hypertension, the metabolic syndrome is the result of inadequate living standards and eating habits, such as a sedentary lifestyle and consumption of ultra-processed foods, the latter being reported in the literature as a risk factor for cardiovascular diseases and general mortality, which can be mitigated by changing eating habits.[29,30]

Among the limitations of the study are the choice of a retrospective method of dietary assessment, which can lead to recall errors, and the impossibility of establishing causality, typical of studies with a cross-sectional design. Another issue is the age of the participants, which covers only adults, not including children and adolescents, a portion of the population that is increasingly developing chronic diseases.

It is noteworthy that the data collection of this study predates the launch of the second edition of the Food Guide for the Brazilian Population, the Brazilian Cardioprotective Diet and other more recent programs and initiatives focused on healthy eating and chronic diseases. However, this study used a population sample of adults and elderly people from an Amazonian capital that has been gaining national prominence due to the high prevalence of overweight and obesity.

That said, we emphasize the need to consolidate food and nutrition programs and actions with a focus on healthy food consumption and prevention/control of existing chronic diseases, in addition to encouraging and supporting the inclusion of practices to promote adequate food in the work processes of health teams..

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