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Consumption of ultra-processed foods among adolescents, adults and the elderly in a capital city of Northeastern Brazil

Consumo de alimentos ultraprocesados por adolescentes, adultos y ancianos en una ciudad capital del noreste de Brasil

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ABSTRACT

Ultra-processed foods are industrial products that contain an unbalanced nutritional composition, contributing to a high intake of calories, sugars, fats and sodium. The aim of this study was to evaluate the consumption of ultra-processed foods among adolescents, adults and the elderly. In the city of Teresina, Piauí, adolescents (10 to 19 years old), adults (20 to 59 years old) and elderly persons (≥ 60 years old) were interviewed. The 24-hour food recall was used to assess food consumption with subsequent replication in 40% of the sample. Analysis of variance (ANOVA) with Bonferroni's post-hoc test was used to verify the data, and the value of $p < 0.05$ was adopted as significant. It was observed that adolescents who consumed a greater amount of ultra-processed foods (2nd and 3rd tertile) consumed significantly less grains and legumes. Among adults, it was observed that the tertiles with higher consumption of ultra-processed foods had significantly lower consumption of grains, meat, fruits, vegetables, legumes and eggs. Among the elderly, in the tertiles with higher consumption of ultra-processed foods, there was significantly lower consumption of grains and meat. We conclude that higher consumption of ultra-processed foods contributed to a lower consumption of unprocessed or minimally processed foods.

Keywords: Adolescent; Adult; Elderly; Food consumption; Industrial food.

RESUMEN

Los alimentos ultraprocesados son productos industriales que contienen una composición nutricional desbalanceada,

contribuyendo a un elevado de calorías, azúcares, grasas y sodio. El objetivo de este estudio fue evaluar el consumo de alimentos ultraprocesados de adolescentes, adultos y ancianos. En la ciudad de Teresina, Piauí, se entrevistó a adolescentes (10 a 19 años), adultos (20 a 59 años) y ancianos (≥ 60 años). Una encuesta recordatoria de 24 h se utilizó para evaluar el consumo de alimentos con una repetición posterior en el 40% de la muestra. Se utilizó el análisis de varianza (ANOVA) con la prueba post-hoc de Bonferroni para comparar los datos y se aceptó como significativo el valor de $p < 0.05$. Se observó que los adolescentes que consumían una mayor cantidad de alimentos ultraprocesados (2° y 3° tercil) consumían significativamente menos cereales y legumbres. Entre los adultos, se observó que los terciles con mayor consumo de alimentos ultraprocesados tenían significativamente menor consumo de cereales, carne, frutas, verduras, legumbres y huevos. Entre los ancianos, en los terciles con mayor consumo de alimentos ultraprocesados, hubo un consumo significativamente menor de granos y carne. Se concluye que el mayor consumo de alimentos ultraprocesados contribuyó al menor consumo de alimentos no procesados o mínimamente procesados.

Palabras clave: Adolescente; Adulto; Anciano; Alimentos industrializados; Consumo de alimentos.

INTRODUCTION

The social and economic transformations that stem from the globalization of markets and the process of industrialization, urbanization and economic growth are factors responsible for changes in both the lifestyle and diet of the population. The nutrition transition process has shown a positive association with the increased appearance of diseases associated with the consumption of high energy dense foods, which are deficient in micronutrients^{1,2}.

From this perspective, a new line of research has emerged, focused on the degree of food processing, with ultra-processed foods as the main object of study. In order to better investigate the relationship between the consumption of processed and ultra-processed foods and their effects on health, it is necessary to classify them according to the degree of processing. Thus, several types of classification arise, such as the NOVA system, which is the most studied and used method. The NOVA classification allows foods to be classified according to the "nature, extent, purpose and degree of industrial processing" to which they are subject. This system defines four groups: Group 1, unprocessed or minimally processed foods; Group 2, culinary ingredients; Group 3, processed foods; and Group 4, ultra-processed foods^{3,4,5}.

Ultra-processed foods (UPF) are industrial formulations, and most often they are manufactured from industrial ingredients and various additives used to add desirable sensory properties. UPFs have an unbalanced nutritional composition and are deficient in micronutrients when compared to unprocessed or minimally processed foods, which, in turn, are the basis for a nutritionally adequate diet^{6,7,8,9,10,11,12}.

The substitution of homemade and natural foods for processed and ultra-processed foods results in a high-energy density diet, high in fat, sugar and sodium, determining the imbalance in the supply of nutrients and causing excess calorie intake, which is associated with diet quality deficiency, excess body weight and the emergence of chronic non-communicable diseases (NCDs)^{10,11,12,13,14,15}.

Considering the negative impact of UPF on diet, the Guia Alimentar da População Brasileira (Food Guide for

the Brazilian Population) recommends that such products be avoided, whereas the consumption of unprocessed or minimally processed foods and culinary preparations be prioritized, forming the basis of the diet^{3,6,7,8}.

Assessment of food consumption is an essential method for identifying the profile of food consumption in a population, as well as assessing dietary adequacies and inadequacies. Description of UPF food consumption in different age groups in population studies is still unusual. Consequently, this study provides important data on the characteristics and differences in the consumption of UPF by age group in a city of Northeastern Brazil, in which, based on the Pesquisa de Orçamentos Familiares - POF (Survey of Family Budgets), there is a higher consumption of unprocessed foods and lower consumption of UPF compared with other regions of Brazil¹⁶. From this perspective, the study allows us to understand which foods are consumed more or less frequently among age groups.

Such studies can be important for directing actions toward food and nutrition education that promote an adequate, healthy diet for the population. In this perspective, this study aimed to assess UPF consumption by adolescents, adults and elderly persons in a capital city of Northeastern Brazil.

METHODS

Data come from the Inquérito de Saúde no Piauí – ISAD-PI (Health Survey of Piauí), a cross-sectional population-based study regarding the representative sample of the city of Teresina, for analysis of living conditions and health status of the urban population, through visits to private households. For the study, all individuals residing in private households were eligible, except those with any disabilities or incapacities that might make it impossible to carry out the research.

Teresina was chosen as it is the capital of the State of Piauí and the city with the highest population density. In addition, the aforementioned city has a campus of the Federal University of Piauí, the institution responsible for data collection, which made logistics possible¹⁷. Complex probabilistic sampling was performed, in clusters, in two stages: census sectors and households, based on census data

from the Instituto Brasileiro de Geografia e Estatística – IBGE (Brazilian Institute of Geography and Statistics)¹⁸.

In order to calculate the sample size, the size of the population of Teresina (767,557 inhabitants) was considered, given that the city has 210,093 private households, the average number of individuals in each age group per household was calculated (age groups chosen for the study for both sexes were: children under 2 years; children aged 3 to 4 years; children aged 5 to 9 years; adolescents aged 10 to 14 years; adolescents aged 15 to 19; adults aged 20 to 59 years and the elderly over 60).

Since the distribution of sample means can be approximated through a normal distribution if $n > 30$ and the population has any distribution, in order to allow at least 30 individuals of each age group to participate in the sample, the number of households required to reach the minimum sample for each age group was calculated. Hence, the largest sample size in number of households was for females in the 3-4-year-old age group, with an estimated required total of 578 households in Teresina. The final sample size for this study was adjusted using $n = n_0/0.90$, assuming a response rate of 90%, resulting in $n = 642$ households.

Considering the number of individuals expected for each age group based on the estimated number of households (578), studies were conducted by simulating the behavior of the 95% confidence interval (95% CI) and the coefficient of variation of the standard error of the $Cv-p^*$ proportion for estimates of the proportion (p^*) ranging from 10% to 70%, according to age group, sex and respective sample sizes. The expected number of individuals was considered satisfactory, as it allowed estimates of the proportion with $Cv-p^*$ around 20%.

For this study, following the same sampling plan, adolescents, adults and the elderly, from 50% of the households included in the total sample, were systematically selected, forming a representative sub-sample of this population for obtaining a 24-h dietary recall.

The final sample occurred randomly in all strata considered for the sampling, without bias due to differential losses, with respect to sex and age. This study was approved by the Comitê de Ética e Pesquisa (Ethics and Research Committee), under Parecer number 2.552.426.

Demographic (age and sex), socioeconomic (income, occupation, education background and marital status) and food consumption per 24-h Dietary Recall (24HR) data were collected. The collection of demographic, socioeconomic and lifestyle data was performed utilizing structured questionnaires applied by trained interviewers using Epicollect 5® application^{19,20,21} on mobile devices.

Assessment of Food Consumption

Food consumption among adolescents, adults and the elderly was obtained through a 24-hour dietary recall (24HR), using the multiple-pass method²². A second 24HR was conducted in 40% of the population, after an interval of two months, making use of the same procedures that were used during the

first interview, in order to correct for intrapersonal variability. The replication rate was chosen based on the research by Verly et al.²³, where it can be observed that conducting a second 24HR in 40% of the sample did not represent a loss of precision for estimating food consumption, regardless of sample size.

Cooking measurements reported by respondents were transformed into grams (g) or milliliters (mL) using the Tabela para Avaliação de Consumo Alimentar em Medidas Caseiras (Table for Food Consumption Evaluation in Home Measurements), based on the study by Pinheiro et al.²⁴. Energy intake was estimated based on the Tabela Brasileira de Composição de Alimentos (Brazilian Table of Food Composition)²⁵, Tabela de Composição Nutricional dos Alimentos Consumidos no Brasil (Table of Nutritional Composition of Foods Consumed in Brazil)¹⁵ and Tabela de Composição de Alimentos: Suporte para Decisão Nutricional (Food Composition Table: Support for Nutritional Decision)²⁶.

Recipes were standardized and for preparations in which usual consumption of sugar was reported and the interviewee was unable to quantify the addition, the addition of 5 g of sugar was standardized for each 100 mL of coffee, coffee with milk (whole, semi-skimmed and skimmed milk) and tea, and 10 g of sugar for each 100 mL of juices and smoothies¹⁵. Consumption in grams of unprocessed or minimally processed food group was adjusted to 1000 kcal. Food intake data included consumption of food supplements.

Food items reported were categorized according to the NOVA food classification based on the extent and purpose of processing in four groups: unprocessed or minimally processed foods, processed culinary ingredients, processed foods and ultra-processed foods. Furthermore, within the groups from the NOVA classification, subdivisions were made into smaller groups, according to the types of food⁶. Culinary ingredients were included in culinary preparations in the unprocessed or minimally processed food group.

Statistical analysis

For variables that had missing values, it was decided to perform data imputation using the Predictive Mean Matching method, with the percentage of imputed data not exceeding 20%. There was no data weighting, since the probability of the selection of the sample was equiprobabilistic.

All analyses were performed using the survey module of Stata software (version 14), considering the complex sample so that the results obtained could be representative of the total population of the city of Teresina and the value of $p < 0.05$ was adopted as significant. Analyses were performed separately for each age group, adolescents, adults and elderly.

In order to characterize the consumption of unprocessed or minimally processed, processed and ultra-processed food groups, data were presented in mean calorie intake (kcal/d) and percentage (%) of consumption referring to total energy value (TEV), by age group. Consumption of unprocessed or minimally processed foods was compared with tertiles of % of UPF consumption, using analysis of variance (ANOVA) with the Bonferroni post-hoc test.

RESULTS

The final sample consisted of 617 subjects, of which 120 were adolescents (19.4%), 365 were adults (59.2%) and 132 were elderly (21.4%) (Table 1). A higher proportion of female subjects was found, among adolescents (56.7%), adults (67.1%) and the elderly (65.9%).

Table 2 describes total energy intake (Kcal/d) as well as absolute (kcal/d) and relative (%) caloric contribution of unprocessed, processed and ultra-processed foods according to age group. It is noted that the unprocessed food group had the highest contribution to caloric intake among the participants. However, significant percentages of UPF intake were observed.

The age group that had the highest share of unprocessed or minimally processed foods in the diet was the elderly, with an intake of 1123.1 kcal/d (71.8%), out of a total of 1578 kcal/d. Followed by adults, whose intake was 1269.0 kcal/d (66.5%), out of a total energy of 1918 kcal/d. The share of unprocessed food consumption was lower among adolescents, only 63.3% of total calories ingested (Table 2).

Among unprocessed or minimally processed foods, a pattern of relative consumption where the highest energy intake among adolescents, adults and elderly was: meat and poultry (20.2%, 19.0%, 9.0% respectively), rice (15.5% 13.1%, 12.8% respectively), other grains (9.2%,

9.3%, 11.5% respectively) and milk (4.4%, 4.7%, 8.7% respectively).

Adolescents had a higher share of UPF consumption (26.4%) in the diet, followed by adults (20.9%) and the elderly (17.5%). In all age groups, we observed high consumption of foods from the cakes/cookies (biscuits), breads/toast, other UPF and sweets groups (Table 2).

Table 3 shows total energy intake (Kcal/d), as well as the contribution of unprocessed foods, in percentage and grams of food, according to tertiles of UPF consumption, by age group. There were no significant differences in total energy intake (kcal/d), according to tertiles of UPF consumption. However, significant differences were found in the percentage consumption of unprocessed foods, according to tertiles of UPF consumption, indicating that the higher the consumption of UPF, the lower the contribution of unprocessed food consumption (Table 3).

Adolescents in the 2nd and 3rd tertile of UPF consumed significantly fewer grains and legumes when compared to adolescents in the 1st tertile of UPF. Among adults, it was observed that those in higher tertiles of UPF consumption had significantly lower consumption of grains, meat, fruits, vegetables, legumes, and eggs. Elderly persons in higher tertiles of UPF consumption had significantly lower consumption of grains and meat (Table 3).

Table 1. Demographic, socioeconomic, anthropometric characteristics and lifestyle, by age group. ISAD-PI-CAPITAL-2019.

Variables	Adolescents		Adults		Elderly	
	n	%	n	%	n	%
Age group	120	19.4	365	59.2	132	21.4
Sex						
Male	52	43.3	120	32.9	45	34.1
Female	68	56.7	245	67.1	87	65.9
Family income †						
<2MW	91	75.8	229	62.9	73	55.7
>2MW	29	24.2	135	37.1	58	44.2
Employed						
Yes	5	4.2	219	60.2	35	26.7
No	115	95.8	145	39.8	96	73.3
Marital status						
Married	5	6.0	216	59.5	74	56.5
Single/widowed	78	93.9	147	40.5	57	43.5
Education						
0 to <11 years	69	57.5	88	24.1	91	68.9
≥12 and ≤14 years	41	34.1	161	44.1	24	18.2
>14 years	10	8.3	116	31.8	17	12.9

ISAD-PI-CAPITAL - Inquérito de Saúde do Piauí - Capital (Health Survey of Piauí – Capital), † Minimum wage (MW) reference equivalent to R\$ 998.00 based on the year 2019. Source: ISAD-PI-CAPITAL-2019.

Table 2. Total energy intake (Kcal/d), caloric intake, absolute (kcal/d) and relative (%) caloric contribution of foods, according to the degree of processing, by age group. ISAD-PI-CAPITAL-2019.

Total energy intake(Kcal/d)	Adolescents	Adults	Elderly
	1931 Kcal (%)	1918 Kcal (%)	1578 Kcal (%)
Unprocessed or minimally processed foods	1204.3 (63.3)	1269.0 (66.5)	1123.1 (71.8)
Meat and poultry	389.1 (20.2)	372.8 (19.0)	319.4 (19.0)
Rice	282.6 (15.5)	233.9 (13.1)	188.9 (12.8)
Other grains	161.2 (9.2)	195.1 (9.3)	160.1 (11.5)
Milk	84.3 (4.4)	81.4 (4.7)	131.7 (8.7)
*Other unprocessed or minimally processed foods	87.79 (3.8)	108.0 (5.8)	72.4 (4.3)
Fruits and vegetables	38.0 (2.0)	58.0 (3.5)	82.5 (5.3)
Juice	67.9 (3.2)	59.2 (2.5)	64.4 (3.5)
Eggs	30.0 (2.0)	44.5 (2.6)	31.0 (1.9)
Legumes	27.5 (1.4)	55.1 (3.5)	46.2 (5.3)
Fish/seafood	19.6 (0.8)	33.9 (1.8)	18.4 (1.1)
Roots and tubers	15.1 (0.7)	26.0 (1.2)	7.9 (0.7)
Processed foods	59.2 (3.0)	75.8 (3.9)	40.3 (2.6)
Pão francês (French bread)	37.8 (1.7)	34.5 (2.1)	23.1 (1.7)
Cheese	16.7 (0.9)	12.7 (0.7)	7.1 (0.3)
**Other processed foods	4.7 (0.3)	28.6 (1.1)	10.1 (0.6)
Ultra-processed foods	524.1 (26.4)	414.2 (20.9)	276.3 (17.5)
Cakes and cookies	163.9 (7.8)	154.2 (8.0)	115.8 (7.3)
Breads and toast	94.2 (4.8)	62.6 (3.4)	73.0 (4.6)
***Other ultra-processed foods	72.4 (3.5)	58.8 (2.7)	23.9 (1.5)
Sweets	51.1 (2.4)	12.7 (0.6)	23.6 (1.5)
Fast foods	48.1 (2.7)	48.3 (2.2)	15.8 (1.0)
Sausages	38.6 (2.0)	31.7 (1.8)	8.9 (0.6)
Sugary drinks	27.7 (1.5)	31.6 (1.4)	12.8 (0.8)
Milk drinks	28.1 (1.7)	14.3 (0.6)	2.5 (0.2)

ISAD-PI-CAPITAL-2019 - Inquérito de Saúde no Piauí- Capital (Health Survey of Piauí - Capital) *Other unprocessed or minimally processed foods: tapioca, tea, coffee, 100% natural cocoa powder, sugar cane juice, other foods and culinary preparations; **Other processed foods: Canned or bottled vegetables, legumes or grains, salted or sugared cashew nuts and peanuts, fish pickled in oil or water and salt (canned fish), and fruit in syrup, fermented alcoholic beverages; ***Other ultra-processed foods: savory packaged snacks, instant noodles, artificial sweeteners, hydrogenated vegetable fat, distilled alcoholic beverages, food supplements, others. Kcal/d: kilocalories per day.

Table 3. Total energy intake (Kcal/d), contribution of unprocessed foods, in percentage and in grams, according to tertiles of UFP consumption, by age group. ISAD, 2018-2019.

Food Group (g or mL/100 kcal)	% Ultra-processed			p value
	First tertile	Second tertile	Third tertile	
Adolescents				
Total Energy (kcal/d)	1821	1849	2040	0.397
Unprocessed foods (%)	81,8 ^c	71,2 ^b	49,2 ^a	<0.001
Rice (g)	137.0	133.4	97.6	0.056
Meat (g)	96.4	102.2	66.2	0.081
Other grains (g)	88,8 ^c	53,1 ^{ba}	31.6 ^{ab}	<0.001
Other unprocessed or minimally processed foods (g)	65.2	69.4	44.7	0.349
Fruits and vegetables (g)	45.4	53.0	24.1	0.221
Juices (ml)	37.6	58.5	53.3	0.641
Milk (ml)	31.5	15.5	14.2	0.191
Legumes (g)	32,4 ^c	11,7 ^{bd}	11,4 ^{ad}	0.007
Eggs (g)	17.3	9.0	5.7	0.265
Fish/seafood (g)	5.0	10.8	0.0	0.056
Roots and tubers (g)	3.5	4.2	6.6	0.734
Adults				
Total Energy (kcal/d)	1844	1955	1956	0.640
Unprocessed foods (%)	81,6 ^c	68,9 ^b	47,9 ^a	<0.001
Rice (g)	124,5 ^c	98,6 ^{bd}	75,1 ^{ad}	<0.001
Other unprocessed or minimally processed foods* (g)	116.4	125.2	93.1	0.143
Meat (g)	96,8 ^c	90,3 ^b	47,2 ^a	<0.001
Fruits and vegetables (g)	92,0 ^c	52,7 ^a	67,8 ^{ba}	0.035
Other grains (g)	61.6 ^{ca}	56.0 ^b	37.4 ^a	0.026
Juices (mL)	54.2	49.9	34.8	0,273
Legumes (g)	39,7 ^c	29,4 ^{ba}	20,8 ^a	0.017
Milk (mL)	35.1	22.6	26.0	0.561
Eggs (g)	17,5 ^c	9,6 ^{bd}	9,0 ^{ad}	0.008
Fish / seafood (g)	11.5	17.2	8.2	0.294
Roots and tubers (g)	9.0	10.4	11.8	0.825
Elderly				
Total Energy (kcal/d)	1522	1633	1613	0.777
Unprocessed foods (%)	83,5 ^c	72,1 ^b	52,3 ^a	<0.001
Other unprocessed or minimally processed foods (g)	129.6	106.5	120.3	0.713
Rice (g)	115,1 ^c	99,7 ^{ba}	66,8 ^a	0.005
Other grains (g)	108,8 ^c	42,6 ^{bd}	36,8 ^{ad}	<0.001
Fruits and vegetables (g)	97.9	127.6	62.5	0.162
Meat (g)	85,5 ^b	90,8 ^c	51,3 ^a	0.032
Milk (mL)	66.0	68.7	42.2	0.454
Juices (mL)	58.1	55.3	56.6	0.992
egumes (g)	43.0	22.9	94.9	0.212
Eggs (g)	12.3	5.2	8.3	0.221
Roots and tubers (g)	10.1	2.5	14.4	0.545
Fish/seafood (g)	6.5	16.0	4.9	0.377

ANOVA with Bonferroni post-hoc test. ISAD-PI-CAPITAL-2019 - Inquérito de Saúde no Piauí- Capital (Health Survey of Piauí - Capital).

*Other unprocessed or minimally processed foods: Tapioca, tea, coffee, 100% natural cocoa powder, sugar cane juice, among other foods and culinary preparations. Source: ISAD-PI-CAPITAL-2019. Kcal/d: kilocalories per day; g: grams; mL: milligrams.

DISCUSSION

In this study, unprocessed foods had a greater contribution to the total energy intake of diet when compared to UPF in all age groups studied. Higher consumption of unprocessed foods is frequently seen in countries such as Brazil, Chile, Colombia and Mexico. In these countries, unprocessed and minimally processed foods are still the basis of population diet and UPF consumption corresponds to about 20 to 30% of the total energy intake of diet, with values close to those found in this study^{16,27,28,29}.

In a study conducted in Brazil¹⁶, about 49.5% of calories available for consumption in Brazilian households came from unprocessed or minimally processed foods, 9.8% from processed foods and 18.4% from UPF. Among unprocessed or minimally processed foods, rice accounted for 15.6% of total calories, followed by milk with 5.0%, meat and poultry with 4.6% and beans with 4.3%.

It was also found that UPF intake showed an important contribution to the total energy value of the studied population, being higher among adolescents (26.4%) and lower among the elderly (17.5%). Some studies have shown that there is a tendency for the percentage of UPF consumption in the diet of the Brazilian population to increase. UPFs have high energy density, an excess of sugars, total and saturated fats, sodium and low fiber when compared to unprocessed or minimally processed foods. In addition to the negative impact on the nutritional quality of diets, UPF consumption has been related to excess body weight and the appearance of NCDs^{6,8,12}.

High UPF consumption among adolescents, in comparison to the consumption among adults and elderly, found in this study (Tables 2 and 4), corroborates the temporal trends in the consumption profiles of the Brazilian population^{1,10,30,31}. Similarly, Costa et al.³¹ verified the consumption of UPF in a population of 101.755 Brazilian adolescent students. It was observed that daily consumption of at least one UPF group was reported by 39.7% (95% CI: 39.2-40.3) of respondents.

Higher UPF consumption among adolescents may relate to how frequently they eat out, skip meals or substitute them for industrialized preparations that are easily accessible, such as "fast foods". Identifying changes in dietary patterns during adolescence is important, since the individual develops greater autonomy over making decisions about eating behavior at this stage, which may negatively influence their lifestyle if that continues into adulthood, affecting the aging process. Therefore, nutritional education actions aimed at preventing NCDs and promoting a healthier life, directed toward this age group have a fundamental role in forming the basis for a nutritionally adequate diet^{1,32}.

UPF consumption among adults can be analyzed as a consequence of modernization and urbanization, factors such as globalization, the fast pace of life, purchasing power, the media and the work of women outside the home are factors that contributed to a negative change in the lifestyle of the population, with greater exposure to a wide variety and diversity of UPFs and reduction of the consumption of fruits and vegetables^{8,12,14,28}.

Among the elderly, lower UPF consumption was noted, when compared to the other age groups of the study. In parallel, elderly persons had a higher consumption of unprocessed foods, with a lower intake of meat and poultry and a higher consumption of milk and fruit/vegetables compared to adolescents and adults. A reason for this may be related to tooth loss that is associated with the act of chewing food, leading to a preference for pasty, soft food. Moreover, it is noteworthy that in this age group there is a tendency to consume a healthier diet, for reasons related to the prevention or control of NCDs^{33,34}.

In all age groups we observed high consumption of foods from the groups of cakes/cookies (biscuits), breads/toast, other UPF and treats (Table 2). In Brazil, according to household consumption data in the year 2017-2018, among UPFs, there was an emphasis on cold cuts/sausages (2.5%), cookies/sweets (2.1%), savory cookies (1.8%), margarine (1.8%), cakes/sweet pies (1.5%), breads (1.3%) and sweets in general (1.3%)¹⁹.

High consumption of these foods was also observed by Louzada (13), with emphasis on the consumption of cakes, pies and cookies (biscuits) (3.0% of daily calories), fast foods (2.9%), carbonated soft drinks and powdered drink mixes (2.6%), sandwich bread, burger and hot dog buns (2.4%), and sweets (2.2%), besides crackers, savory packaged snacks, sausages, ready or semi-ready meals and sweetened milk drinks.

Therefore, an emphasis is placed on the importance of identifying the UPFs that are most consumed by the population so that it is possible to direct specific actions and campaigns of food education, according to age group, that discourage the consumption of UPFs and encourage adequate food intake of unprocessed or minimally processed foods, which in turn offer a nutritionally balanced diet, given the amount of fiber, vitamins, minerals and bioactive compounds in these foods. In addition, these foods improve quality of life, longevity and also contribute to the development of more sustainable food systems^{6,8,9,10,30,32,35}.

Some limitations should be considered when interpreting the results found, concerning the 24-hour Dietary Recall method (24HR), as this method essentially depends on the memory of respondents. Although the interview was conducted by trained interviewers, it is known that there may be underreporting or recall bias by the participants. In studies of dietary intake assessment, several factors can affect the quality of information, including sex, age, level of education, the individual being concerned with social approval and individual perception of healthy eating habits³⁶.

Among the strengths of this study, it is worth noting that through this work it is possible to know the consumption profiles of the population by age group. Hence, there is an opportunity to expand public policies for elaborating the implementation of programs and projects about diet, and the promotion of strategic actions for nutritional education that aim at an adequate, balanced and healthy diet, in pursuit of autonomy over dietary choices, as well as promoting and

protecting population health and the possibility of full human development and growth, with quality of life and longevity.

CONCLUSION

In the studied population, the unprocessed food group had the highest total energy contribution to the diet; however, UPF consumption also showed an important contribution. The highest caloric contribution of UPF consumption was observed among adolescents, followed by adults and the elderly. In all age groups, it was seen that there was an emphasis on the consumption of foods from the cakes/cookies, breads/toast, sweets and other ultra-processed food groups. The higher intake of ultra-processed foods showed a significant contribution to the total energy value of the diet, also contributing to the lower consumption of some subgroups of unprocessed or minimally processed foods among adolescents, adults and the elderly.

UPF consumption is undoubtedly a public health issue, which has a major negative impact on population health. Thus, we highlight the importance of expanding public policies for elaborating the implementation of programs and projects about diet, the encouragement of food monitoring, as well as, food and nutrition strategic actions that encourage a healthier lifestyle in order to prevent the emergence of diseases and promote population quality of life.

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REFERENCES

- Santos JC, Carvalho DMA, Pinho L. Consumption of ultra-processed foods by adolescents. *Adolesc Saude*. 2019; 16: 56-63.
- Santos GG, Farias GO, Coutinho A, Guimarães DA. Obesity and adolescence: An analysis of studies published in the *Revista Brasileira de Atividade Física & Saúde*. *Corpoconsciencia* 2016; 20: 57-71.
- Ministry of Health. Food Guide for the Brazilian Population. 2a. ed. Brasília: Ministério da Saúde; 2014.
- Gibney M, Forde C, Mullally D, Gibney E. Ultra-processed foods in human health: A critical appraisal. *Am J Clin Nutr*. 2017; 106: 717-724.
- Monteiro CA, Cannon G, Moubarac JC, Levy RB, Louzada MLC, Jaime PC. The UN Decade of Nutrition, the NOVA food classification and the trouble with ultra-processing. *Public Health Nutr*. 2018; 21: 5-17.
- Monteiro CA, Cannon G, Levy R, Moubarac J-C, Jaime P, Martins AP, et al. NOVA. The star shines bright. *World Nutr J*. 2016; 7: 28-40.
- Moubarac J-C, Parra DC, Cannon G, Monteiro CA. Food classification systems based on food processing: Significance and implications for policies and actions: A systematic literature review and assessment. *Curr Obes Rep*. 2014; 3: 256-272.
- Louzada ML da C, Martins APB, Canella DS, Baraldi LG, Levy RB, Claro RM, et al. Impact of ultra-processed foods on micronutrient content in the Brazilian diet. *Rev Saude Publica*. 2015; 49: 1-8.
- Louzada ML da C, Martins APB, Canella DS, Baraldi LG, Levy RB, Claro RM, et al. Ultra-processed foods and the nutritional dietary profile in Brazil. *Rev Saude Publica*. 2015; 49: 1-11.
- Louzada ML da C, Baraldi LG, Steele EM, Martins APB, Canella DS, Moubarac JC, et al. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. *Prev Med*. 2015; 81: 1-15.
- Monteiro CA, Moubarac JC, Cannon G, Ng SW, Popkin B. Ultra-processed products are becoming dominant in the global food system. *Obes Rev*. 2013; 14: 21-28.
- Oliveira ELAD, Melo LM, Graciliano NG, Almeida AAS, Maia DERS, Araujo JO, et al. Consumo de alimentos ultraprocessados nos lanches de servidores do HUPAA da UFAL, Maceió, Alagoas. *Gep News*. 2018; 4: 25-34.
- Moubarac JC, Batal M, Louzada ML, Martinez Steele E, Monteiro CA. Consumption of ultra-processed foods predicts diet quality in Canada. *J Appet*. 2017; 108: 512-520.
- Juul F, Martinez-Steele E, Parekh N, Monteiro CA, Chang VW. Ultra-processed food consumption and excess weight among US adults. *Br J Nutr*. 2018; 120: 90-100.
- Brazilian Institute of Geography and Statistics. Ministry of Health. Household Budget Survey (HBS), 2008-2009: Table of Nutritional Composition of Foods Consumed in Brazil. Brasília: Ministry of Health; 2011. <https://biblioteca.ibge.gov.br/visualizacao/livros/liv50002.pdf>.
- Brazilian Institute of Geography and Statistics. Ministry of Health. Household Budget Survey (HBS), 2017-2018; 2019. <https://biblioteca.ibge.gov.br/visualizacao/livros/liv101670.pdf>.
- Instituto Brasileiro de Geografia e Estatística - IBGE. IBGE | Cidades@ | Piauí | Panorama; 2021. <https://cidades.ibge.gov.br/brasil/pi/panorama>.
- Brazilian Institute of Geography and Statistics. Ministry of Health. Household Budget Survey (HBS) 2008-2009: anthropometry and nutritional status of children, adolescents and adults in Brazil. Brasília: Ministry of Health; 2010. <https://biblioteca.ibge.gov.br/visualizacao/livros/liv45419.pdf>.
- Mara R, Dirce F, Marchioni ML. Manual for the Assessment of Food Consumption in Population Studies: The Experience of the Health Survey in São Paulo. (HS); 2012, p.197.
- Imperial College London. <https://www.imperial.ac.uk/people/d.aanensen>.
- Conway JM, Ingwersen LA, Vinyard BT, Moshfegh AJ. Effectiveness of the US Department of Agriculture 5-step multiple-pass method in assessing food intake in obese and nonobese women. *Am J Clin Nutr*. 2003; 77: 1171-1178.
- Moshfegh AJ, Rhodes DG, Baer DJ, Muravi T, Clemens JC, Rumpler WV, et al. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. *Am J Clin Nutr*. 2008; 88: 324-332.
- Verly-Júnior E, Castro MA, Fisberg RM, Marchioni DML. Precision of usual food intake estimates according to the percentage of individuals with a second dietary measurement. *J Acad Nutr Diet*. 2012; 122: 1015-1020.
- Pinheiro ABV, Lacerda EM de A, Benzecry EH, Gomes MC da S, Costa VM. Table for Assessment of Food Consumption in Home Measures. 4th edition. São Paulo: Atheneu; 2005.
- BTFC. Brazilian Table of Food Composition – BTFC. 4th edition. Expanded and Revised Edition. Campinas: NEPA-UNICAMP; 2011.
- Philippe ST. Food Composition Table: Support for Nutritional Decision. 6th edition. São Paulo: Manole; 2018.
- Cediel G, Reyes M, Da Costa Louzada ML, Martinez Steele E, Monteiro CA, Corvalán C, et al. Ultra-processed foods and

- added sugars in the Chilean diet (2010). *Public Health Nutr.* 2018; 21: 125-133.
28. Da Costa Louzada ML, Ricardo CZ, Steele EM, Levy RB, Cannon G, Monteiro CA. The share of ultra-processed foods determines the overall nutritional quality of diets in Brazil. *Public Health Nutr.* 2018; 21:94-102.
 29. Marrón-Ponce JA, Sánchez-Pimienta TG, Da Costa Louzada ML, Batis C. Energy contribution of NOVA food groups and sociodemographic determinants of ultra-processed food consumption in the Mexican population. *Public Health Nutr.* 2018; 21: 87-93.
 30. Souza AM, Barufaldi LA, De Azevedo Abreu G, Giannini DT, De Oliveira CL, Dos Santos MM, et al. ERICA: Intake of macro and micronutrients of Brazilian adolescents. *Rev Saude Publica.* 2016; 50: 1-15.
 31. Costa C dos S, Flores TR, Wendt A, Neves RG, Assunção MCF, Santos IS. Sedentary behavior and consumption of ultra-processed foods by Brazilian adolescents: Brazilian National School Health Survey (PeNSE), 2015 *Cad Saúde Pública.* 2018; 34: 1-15.
 32. D'avila GL, Silva DAS, Vasconcelos FAG. Association between dietary intake, physical activity, socioeconomic factors and body fat percentage among schoolchildren. *Cienc Saúde Colet.* 2016; 2: 1071-1081.
 33. Petry J, Lopes AC, Cassol K, Petry J, Lopes AC, Cassol K. Autoperception of food conditions of elderly dental prosthetic users. *CoDAS.* 2019; 31: 1-9.
 34. Medeiros SL de, Pontes MP de B, Magalhães Jr. HV. Self-perception of chewing ability in elderly. *Rev Bras Geriatr Gerontol.* 2014; 17: 807-817.
 35. Mescoloto SB, Caivano S, Duarte MH, Domene SMA. Ingestão alimentar entre universitários: alimentos protetores versus alimentos ultraprocessados. *Demetra.* 2017; 12: 979-992.
 36. Ferreira-Nunes PM, Papini SJ, Corrente JE. Eating patterns and nutrient intake for older people: Analysis with different methodological approaches. *Cienc Saude Colet.* 2018; 23: 4085-4094.