Artículo Original / Original Article

The impact of consumption of ultra-processed foods on the nutritional status of adolescents

Impacto del consumo de alimentos ultraprocesados en el estado nutricional de adolescentes

ABSTRACT

Because of its composition, ultra-processed foods can contribute to excess weight. The objective of the study was to verify the association between the consumption of ultra-processed foods and overweight in adolescents. We conducted a cross-sectional study with 617 adolescents. Sociodemographic, anthropometric and food consumption data were evaluated. Linear regression analyses were used to verify the association. Ultra-processed foods presented higher proportions of carbohydrates, lipids and saturated fat in relation to the total diet consumed. However, this food group had a lower proportion of proteins and fibers. Intake of ultra-processed foods was more frequent in females and being overweight was positively associated with the ingestion of ultra-processed foods. The high consumption of ultra-processed foods can contribute to weight gain. Therefore, the reduction of consumption of ultra-processed foods should be encouraged to improve eating habits.

Keywords: Adolescents; Food consumption; Obesity; Ultra-processed foods.

RESUMEN

Debido a su composición, los alimentos ultraprocesados pueden contribuir al exceso de peso. El objetivo del estudio fue verificar la asociación entre el consumo de alimentos ultraprocesados y el sobrepeso en adolescentes. Estudio transversal con 617 adolescentes. Se evaluaron los datos sociodemográficos, antropométricos y de consumo de alimentos. Se usaron análisis de regresión lineal para verificar la asociación. Los alimentos ultraprocesados presentaron mayores proporciones de carbohidratos, lípidos y grasas saturadas en relación con la dieta total consumida. Sin embargo, este grupo de alimentos tenía una menor proporción de proteínas y fibras. La ingesta de ultraprocesados fue más frecuente en las mujeres y el sobrepeso se asoció positivamente con la ingestión de alimentos ultraprocesados. El alto consumo de alimentos ultraprocesados puede contribuir al aumento de peso. Por lo tanto, se debe fomentar la reducción del consumo de alimentos ultraprocesados

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para mejorar los hábitos alimenticios.

Palabras clave: Adolescentes; Alimentos ultraprocesados; Consumo de alimentos; Obesidad.

INTRODUCTION

The prevalence of overweight and obesity in children and adolescents has increased worldwide and reached alarming proportions, especially in industrialized countries. Obesity during childhood and adolescence becomes relevant since this obese population has a greater risk of being obese adults and developing comorbidities, such as diabetes and cardiovascular diseases¹.

Adolescence is the phase of life in which inadequate eating practices are observed. Many adolescents omit

meals, do not eat at fixed times and prefer foods rich in simple sugars and are hypercaloric, causing excess weight or obesity².

Currently, the consumption of unhealthy foods is heavily influenced by the media, via advertisements, and by the availability of ready-to-eat foods known as ultra-processed foods. These foods are products made from substances extracted from food or synthesized in laboratories (dyes, flavors, and other additives). They have large amounts of fat, sugar, and salt, a high energy density and low fiber content³. Ultra-processed foods, such as breakfast cereals, reconstituted meat products, soft drinks, cereal bars, fast food, among others, are extremely tasty and contain a wide variety of chemical additives⁴.

Some analyses of family budget surveys carried out in three countries (Canada, Brazil, Brazil and Chile⁶) and time series of food sales statistics in 79 countries⁷ showed a generalized trend of increased consumption of ultra-processed foods with high intensity in income countries average, such as Brazil⁸.

A systematic review showed positive associations between consumption of ultra-processed foods and body fat in the young population, that is, the higher consumption of these foods was related to higher percentages of body fat⁹. Portilho et al¹⁰ also showed that the consumption of these foods was associated with obesity in adults.

The increase in the consumption of ultra-processed foods has been considered one of the contributing factors in the increase in obesity and chronic disease prevalence. However, there are still few studies that demonstrate the association between overweight and high consumption of ultra-processed foods. Thus, this study aimed to verify the association between consumption of ultra-processed foods and overweight in adolescents.

MATERIALS AND METHODS

Characterization of the study

A cross-sectional study was done with adolescents aged 14 to 19 enrolled in the public and private education network of the city of Teresina-PI. The present study is part of a project entitled "Health in the School: A Situational Diagnosis of Secondary Schools", Federal University of Piauí-UFPI.

Sampling plan

The state education department distributes public schools through the Regional Education Management (GRE), however, private school distributions were made by the researchers, since they are not managed by the state public authority. The distribution of all 168 schools that were part of the population of schools to be sampled was determined using a list available for each GRE and locating the private schools on a map.

Simple random sampling was used to select schools. Initially, the schools were grouped by size: small (up to 115 students), medium (116–215 students), and large

(more than 215 students), depending on the number of students enrolled and frequent in high school, a criterion defined by the researcher and considered only for this study. The draw of a public school and a private school of each size in each area was chosen to avoid the possibility of agglomeration of schools in the same area of the city and of the same size. Thus, the municipality was organized in four geographic areas and for each area the same number of schools were drawn by size and management, totaling 12 public and 12 private schools, of which 6 were GRE schools.

The selection of adolescents was performed by proportional stratified probabilistic sampling¹¹. The Epi Info 6.04d program (Centers for Disease Control and Prevention, Atlanta, USA) was used to calculate the minimum required sample, considering the population of high school students of private and state public schools totaling 40,136, according to the 2014 School Census data¹², adopting a 95% confidence interval, incidence of 50% of the event (since several outcomes were investigated in a larger project and this value maximizes the sample), precision of 5%, design effect of 1.5 and significance level of 5%¹³. Thus, the minimum sample required was 571 adolescents from public and private schools. Considering possible losses, 10% was added to the sample size, so the final sample would consist of 628 adolescents.

The sample of schools that were selected was distributed in proportion to the number of adolescents per type of school administration and size, and the sample designated for each school that was selected was randomly assigned based on grade level, gender, and age.

The research was approved by the Research Ethics Committee of the Federal University of Piauí (No. 1,459,975) and the Secretary of Education and Culture of Piauí, in accordance with Resolution 466/2012 of the National Health Council¹⁴. Adolescents, parents and/or caregivers who agreed to participate in the study signed an informed consent form.

Anthropometric evaluation

Anthropometric data were obtained according to recommendations of Cameron¹⁵ and Jelliffe & Jelliffe¹⁶. An electronic scale (SECA®, model 803, Hamburg, Germany) with a precision of 100 g was used to weigh adolescents and height was measured using a stadiometer (SECA®, model mess band 206, Hamburg, Germany) with 0.1 cm precision. The Body Mass Index (BMI) was expressed as a Z score and classified according to the World Health Organization¹⁷.

Food consumption

Information on the food consumption of adolescents was obtained using a 24-hour food recall, which followed the guidelines of the multiple pass method¹⁸. A second 24h recall was measured in 40% of the population after

two months, in order to test intrapersonal variability¹⁹.

The amounts of energy, carbohydrates, proteins, lipids, saturated fatty acids and dietary fiber of the total diet and ultra-processed foods were calculated using Nutwin software (version 1.6.0.7 of the Health Informatics Department of the Federal University of São Paulo). Subsequently, the percentage of energy contribution (% Kcal) of ultra-processed food consumption was calculated in relation to the total energy value of the diet.

To classify food items reported according to their degree of processing, foods were categorized into 4 groups based on the classification proposed by Monteiro²¹. Group 1 contained unprocessed or minimally processed foods; group 2, processed foods used as ingredients of culinary preparations or by the food industry; group 3, processed foods; and group 4, foods or ultra-processed food products²².

However, the present study analyzed only the fourth group which consists of foods with industrial formulations typically made with five or more ingredients. Often, these ingredients include substances or additives used in the manufacture of processed foods like sugar, oils, fats, and salt, in addition to antioxidants, stabilizers, and preservatives. Typical examples of ultra-processed foods are soft drinks and powders for soft drinks, packet snacks, ice creams, chocolates, candies and sweets in general, hot-dogs, breads, biscuits, cakes and cereals among others²².

Nutrients were adjusted for intrapersonal variability using the statistical modeling technique of the Multiple Source Method (MSM) software (version 1.0.1, 2011, of the Department of Epidemiology of the German Institute of Human Nutrition Potsdam-Rehbrücke, Nuthetal, Brandenburg, Germany), which estimates usual consumption²³.

Statistical analysis

Statistical analysis was performed using the SPSS program (for Windows® version 20.0), where the descriptive analysis of the data was obtained by mean and standard deviation. To analyze the associations between the variables, chi-square test was used.

Data distribution was performed using the Kolmogorov-Smirnov test, for the comparison of means of the caloric contributions, the student t-test or Mann-Whitney test was used, according to the distribution of the variables.

The post-stratification weighting factor according to the type of school management and number of adolescents in the GRE of the respective school was considered during the variance estimates. The crude and adjusted linear trend models for gender, age, maternal schooling and school type were applied to estimate the association between the energy contribution (% Kcal) of the consumption of ultra-processed foods with the socio-demographic variables and the nutritional status of the adolescents. The level of significance was 5%.

RESULTS

The final sample consisted of 617 adolescents with a mean age of 16.6 years old. Table 1 shows the anthropometric and socioeconomic characteristics of the adolescents according to type of school. There was a higher prevalence of adolescents in the 17 to 19 age group, whose family income was less than two minimum wages, with a significant difference for public schools.

Table 2 shows the highest contribution of carbohydrates, total lipids and saturated fatty acids in the group of ultra-processed foods ($p < 0.001$), whereas a significantly lower proportion of proteins in this group was observed. In addition, the amount of fiber in the ultra-processed foods analyzed was significantly lower when compared to the mean fiber consumption in the total feed. This shows that as the consumption of ultra-processed foods increases, dietary fiber decreases, which in this study was below the 25 g/day recommended by the World Health Organization²⁴.

The consumption of ultra-processed foods was more frequent in female adolescents, 0.39% more in females compared to males. However, there was a higher consumption of ultra-processed foods among private school adolescents with higher family income, but this difference was not statistically significant. In addition, energy contribution was positively associated with overweight (0.11%) (Table 3).

DISCUSSION

The results of this study corroborate those of other research that shows the unfavorable nutritional profile of ultra-processed foods, highlighting the negative impact of these foods on food quality in the Brazilian population. When evaluating nutritional indicators of the food consumption of the population aged 10 years and over of the fraction of this consumption in relation to the in natural or minimally processed food groups, processed foods and ultraprocessed foods, there was an increase in the energy density of the diet and the sugar, saturated fat and trans fat contents, and there was also a decrease in fibers and potassium²⁵.

Steele et al²⁶ found that the levels of carbohydrates, saturated fats, and added sugars increased significantly with the dietary contribution of ultra-processed foods in a representative sample from the United States. They also found an inverse relationship between the dietary contribution of ultra-processed foods and the dietary content of proteins, fibers, vitamins A, C, D and E, zinc, potassium, phosphorus, magnesium and calcium. These results are similar to those of the present study, which confirm that the consumption of ultra-processed foods is directly related to the increase in the carbohydrate, lipid and saturated fatty acids content, and proved to be inversely associated with the fiber and protein content, demonstrating the potential harmful characteristics of these foods related to the increased risk of obesity, diabetes, cardiovascular diseases and some types of cancer²⁷.

Table 1. Adolescent characteristics, according to school type (n= 617).

Variables	School		p value	Total
	Private	Public		
	n (%)	n (%)		n (%)
Sample	226 (36.6)	391 (63.4)		617(100)
Sex			0.26	
Boys	103 (16.7)	160 (25.9)		263 (42.6)
Girls	123 (19.9)	231 (37.5)		354 (57.4)
Age (years)			0.00	
14 a 16	123 (19.9)	170 (27.6)		293 (47.5)
17 a 19	103 (16.7)	221 (35.8)		324 (52.5)
Family income			0.00	
< 2	93 (15.1)	343 (55.6)		436 (70.7)
≥ 2	133 (21.5)	48 (7.8)		181 (29.3)
Nutritional status			0.19	
Thinness	9 (1.5)	11 (1.8)		20 (3.3)
Normal weight	172 (27.9)	324 (52.4)		496 (80.3)
Pre-obese	34 (5.6)	39 (6.3)		73 (11.9)
Obesity	11 (1.8)	17 (2.7)		28 (4.5)

The differences between the groups were analyzed by the chi-square test.

Table 2. Caloric contribution, macronutrients, dietary fibers and saturated fats from ultra-processed foods and total adolescents diet.

	Ultra-processed foods		Total diet		P*
	Total (n= 617)		Total (n= 617)		
	Mean	SE	Mean	SE	
Kcal/day/person	501	9,60	2053	97	0,001
Carbohydrates (%)	55,0	0,60	49,4	0,20	0,001
Proteins (%)	7,0	0,10	19,6	0,10	0,001
Lipids (%)	43,0	0,50	36,1	0,40	0,001
Fiber (g)	1,9	0,05	18,9	0,30	0,001
SFA (%)	13,0	0,20	11,5	0,07	0,001

SE: Standard error; SFA: Saturated fatty acids. * Student's t test, $p < 0,05$.

Table 3. Crude and adjusted analysis of energy consumption (% kcal/day) of ultra-processed food consumption, according to sex, socio-demographic characteristics and nutritional status of adolescents.

Ultra-processed food consumption (% kcal/day)				
		Crude analysis		Adjusted analysis
Variables	%	p	ß†	IC95%
Sex	0,00*			
Boys	23,0		Ref.	
Girls	25,5		0,39	7,3; 12,4
School		0,16*		
Public	23,9		Ref.	
Private	25,2		-0,06	-3,50; 0,40
Family income		0,20*		
< 2	24,1		Ref.	
≥ 2	25,3		-0,01	-2,60; 2,10
BMI		0,00**		
< 24,9	24,4		Ref.	
≥ 25,0	24,6		0,11	10,9; 3,94

BMI: Body mass index; * Student's t test; ** Mann Whitney Test; † Linear trend test.

The amount of energy consumed is of concern because of the possibility of a positive energy balance, which may lead to weight gain, although this hypothesis has not been addressed because of the cross-sectional nature of the analysis²⁸. The excessive participation of free sugars in the diet also increases the risk of excessive weight gain and obesity, in addition to increasing the incidence of dental caries. High levels of saturated fats increase morbidity and mortality from cardiovascular diseases. On the other hand, insufficient fiber intake increases the risk of diabetes, cardiovascular diseases, various cancers (colon, rectum, and breast) and obesity²⁵.

Prospective studies were conducted to evaluate the relationship between dietary components and obesity. An analysis of the 3 American cohorts, Health Study, Nurses' Health Study II, and Health Professionals Follow-Up Study, showed that the consumption of foods such as sweets, desserts, processed meats, chips and sugary drinks were associated with weight gain in adults in the United States²⁹. However, only recently has the relationship between the consumption of foods grouped according to their degree of processing (for example, ultra-processed foods) and overweight³⁰ been analyzed.

Canella et al³¹ carried out a representative study with Brazilians in which adjusted linear regression coefficients indicated that domestic availability of ultra-processed products

was positively associated with mean BMI and prevalence of overweight and obesity, while the products were not associated with these results. In addition, people in the top quartile of household consumption of ultra-processed products, compared to those in the lower quartile were 37% more likely to be obese. These results resemble that of this research. In addition, it was verified that the consumption of ultra-processed was higher for girls, similar to what had been observed by Bielemann et al²⁸.

Recent ecological and cross-sectional studies on ultra-processed food consumption and the risk of overweight and obesity have also highlighted the association between high consumption of ultra-processed foods and obesity among adolescents and adults^{25,31,32}.

According to Mendonça et al³⁰, the consumption of ultra-processed foods can increase the risk of overweight by increasing the total intake of calories, sugars and fats, providing an inadequate ratio of nutrients potentially involved in the genesis of body fat accumulation. A cross-sectional survey conducted in the United States with data from NHANES 2009-2010 highlighted that ultra-processed foods accounted for 57.9% of energy intake and that approximately 90% of this value was derived from added sugars³³.

Ultra-processed foods are more energy dense and have more fat, sugar, and sodium than fresh, minimally processed foods and cooking ingredients (such as oils, sugar,

and salt). In addition, the sale and consumption of ultra-processed products has rapidly increased worldwide^{34,35}. Therefore, there is reason to believe that the consumption of processed and ultra-processed products may play a role in the development of chronic diseases³⁶. The increase in rates of overweight and chronic noncommunicable diseases is due to the reversal of eating patterns, among other factors. This reversal is characterized by the substitution of traditional foods for highly processed and ready-to-eat foods and beverages³⁷.

Some limitations of this research are due to its cross-sectional nature, which limits the findings to associations. Therefore, it is necessary to conduct longitudinal studies that verify a causal relationship between the consumption of ultra-processed foods and excess weight. Some errors can also be identified in the use of the 24-hour food recall in adolescents, since the variance ratio for nutrient consumption in this population was twice as high as in adults, due, in part, to errors in reports about consumption (over or underreporting) and forgetting some items³⁸. Therefore, in order to minimize these errors, two reminders were used. The first one applied in the entire population and the second in 40% of the same, to correct intrapersonal variability¹⁹. In addition, nutrients were also adjusted according to intrapersonal variability.

Considering the caloric contribution of ultra-processed foods in the diet, especially in the diet of adolescents, it is a population that stands out for having a high consumption of this type of food, which has a higher contribution of carbohydrates, lipids and saturated fatty acids. On the other hand, lower concentration of proteins and fibers may be associated with overweight, as was seen in this study. We reiterate the need for research that formulates interventions to promote better food choices by minimizing the consumption of ultra-processed foods.

CONCLUSION

The results of this study show a higher caloric contribution of carbohydrates, lipids and saturated fatty acids of ultra-processed foods, as well as a lower concentration of protein and fibers. Due to this composition, it is believed that this type of food can contribute to weight gain. Therefore, the reduction of the consumption of ultra-processed foods should be encouraged through interventions that stimulate the reduction in the consumption of these foods.

REFERENCES

1. Keller A, Torre SBD. Sugar-Sweetened Beverages and Obesity among Children and Adolescents: A Review of Systematic Literature Reviews. *Child Obes* 2015; 11(4): 338-346.
2. Jaima PC, Duran AC, Sarti FM, Lock K. Investigating environmental determinants of diet, physical activity, and overweight among adults in Sao Paulo, Brazil. *J Urban Health*. 2011; 88(3): 567-581.
3. Monteiro CA, Cannon G, Levy R, Moubarac JC, Jaime P, Martins AP et al. NOVA. The star shines bright. [Food classification. Public health] *World Nutrition. J World Public Health Nutr*

- 2016; 7: 28-38.
4. Moubarac JC, Martins AP, Claro RM, Levy RB, Cannon G, Monteiro C. Consumption of ultra-processed foods and likely impact on human health. Evidence from Canada. *Public Health Nutr* 2013; 16: 2240-2248.
5. Martins APB, Levy RB, Claro RM, Moubarac JC, Monteiro CA. Increased contribution of ultra-processed food products in the Brazilian diet (1987-2009). *Rev Saude Publica* 2013; 47(4): 656-665.
6. Crovetto MM, Uauy R. Evolución del gasto en alimentos procesados en la población del Gran Santiago en los últimos 20 años. *Rev Med Chil* 2012; 140(3): 305.
7. Moodie R, Stuckler D, Monteiro C, Sheron N, Neal B, Thamarangsi T, et al. Profits and pandemics: prevention of harmful effects of tobacco, alcohol, and ultra processed food and drink industries. *Lancet* 2013; 381(9867): 670-679.
8. Louzada MLC, Baraldi LG, Steele EM, Martins AP, Canella DS, Moubarac JC, et al. Consumption of ultra-processed foods and obesity in Brazilian adolescents and adults. *Prev Med* 2015; 81: 9-15.
9. Costa CS, Del-Ponte B, Assunção MCF, Santos IS. Consumption of ultra-processed foods and body fat during childhood and adolescence: a systematic review. *Public Health Nutrition* 2017; 21(1): 148-159.
10. Portilho F, Castañeda M, Castro IRR. A alimentação no contexto contemporâneo: consumo, ação política e sustentabilidade. *Ciênc Saúde Coletiva* 2011; 16(1): 99-106.
11. Luiz ES, Torres TG, Hagnanini MMF. Planejamento amostral. In: Luiz RR, Costa AJL, Nadanovsky P. *Epidemiologia e bioestatística na pesquisa odontológica*. São Paulo: Atheneu, 2005.
12. Brasil. Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira [INEP]. Educação Básica. Censo Escolar. 2014. <http://www.dataescolabrasil.inep.gov.br/dataEscolaBrasil/home.seam>.
13. Armitage P. Statistical method in medical research. New York: John Wiley and Sons, 1981.
14. Ministério da Saúde (Brasil). Resolução nº 466/12. Conselho Nacional de Pesquisa com Seres Humanos. *Diário Oficial da União*. 2012 13 jun [acesso 2016 mar 17]; (12):59; Seção 1. http://bvsms.saude.gov.br/bvs/saudelegis/cns/2013/res0466_12_12_2012.html.
15. Cameron N. Anthropometric Measurements. In: Cameron N, ed *The measurement of human growth*, London: Croom Helm 1984: 56-99.
16. Jelliffe DB, Jelliffe EFP. Anthropometry: major measurements. In: Jelliffe DB, Jelliffe EFP. *Community nutritional assessment with special reference to less technically developed countries*, 2nd ed. London: Oxford University Press 1989: 68-105.
17. WHO Multicentre Growth Reference Study Group. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for height and body mass index-for-age: methods and development. Geneva: World Health Organization; 2007.
18. Moshfegh AJ, Rhodes DG, Baer DJ, Murayi T, Clemens JC, Rumpler WV. The US Department of Agriculture Automated Multiple-Pass Method reduces bias in the collection of energy intakes. *Am J Clin Nutr* 2008; 88(2): 324-332.
19. 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(7): 1015-1020.
20. The Multiple Source Method (MSM). <https://msm.dife.de>

- Monteiro CA, Levy RB, Claro RM, Castro IRR, Cannon G. A new classification of foods based on the extent and purpose of their processing. *Cad Saude Publica* 2010; 26(11): 2039-2049.
21. Monteiro CA, Cannon G, Levy R, Moubarac JC, Jaime P, Martins AP, Canella D, Louzada M, Parra D, Ricardo C, et al. Food classification. *Public Health. J World Public Health Nutr* 2016; 7: 28-38.
22. The Multiple Source Method (MSM). Disponível online: <https://msm.dife.de> (acesso em 20 janeiro 2017).
23. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Report of a WHO consultation. Geneva: World Health Organization; 2003.
24. Louzada MLC, Martins APB, Canella DS, Baraldi LG, Levy RB, Claro RB, et al Alimentos ultraprocesados e perfil nutricional da dieta no Brasil. *Rev Saúde Pública* 2015; 49: 38.
25. Steele EM, Popkin BM, Swinburn B, Monteiro CA. The share of ultra-processed foods and the overall nutritional quality of diets in the US: evidence from a nationally representative cross-sectional study. *Popul Health Metr* 2017; 14; 15(1): 6.
26. Louzada MLC, 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(1): 94-102.
27. Bielemann RM, Motta JVS, Minten GC, Horta BL, Gigante DP. Consumo de alimentos ultraprocesados e impacto na dieta de adultos jovens. *Rev Saúde Pública* 2015; 49: 28.
28. Mozaffarian D, Hao T, Rimm EB, Willett WC, Hu FB. Changes in diet and lifestyle and long-term weight gain in women and men. *N Engl J Med* 2011; 364: 2392-2404.
29. Mendonça RD, Pimenta AM, Gea A, de la Fuente-Arrillaga C, Martinez-Gonzalez MA, Lopes AC. Ultraprocessed food consumption and risk of overweight and obesity: the University of Navarra Follow-Up (SUN) cohort study. *Am J Clin Nutr* 2016; 104(5): 1433-1440.
30. Canella DS, Levy RB, Martins APB, Claro RM, Moubarac JC, Baraldi LG, Cannon G, Monteiro CA. Ultra-processed food products and obesity in Brazilian households (2008–2009). *PLoS One* 2014;9: e92752.
31. Juul F, Hemmingsson E. Trends in consumption of ultra-processed foods and obesity in Sweden between 1960 and 2010. *Public Health Nutr* 2015; 18: 3096-3107.
32. Martínez Steele E, Baraldi LG, Louzada MLC, Moubarac JC, Mozaffarian D, Monteiro CA. Ultra-processed foods and added sugars in the US diet: evidence from a nationally representative cross-sectional study. *BMJ Open* 2016; 6: e009892.
33. Monteiro CA, Levy RB, Claro RM, de Castro IR, Cannon G. Increasing consumption of ultra-processed foods and likely impact on human health: evidence from Brazil. *Public Health Nutr* 2011 Jan; 14(1): 5e13.
34. Moubarac J-C, Batal M, Martins AP, Claro R, Levy RB, Cannon G, et al. Processed and ultra-processed food products: consumption trends in Canada from 1938 to 2011. *Can J Diet Pract Res* 2014; 75(1): 15-21.
35. Rauber F, Campagnolo PD, Hoffman DJ, Vitolo MR. Consumption of ultra-processed food products and its effects on children's lipid profiles: a longitudinal study. *Nutr Metab Cardiovasc Dis* 2015; 25(1): 116-122.
36. Sparrenberger K, Friedrich RR, Schiffner MD, Schuch I, Wagner MB. Ultra-processed food consumption in children from a Basic Health Unit. *J Pediatr (Rio J)* 2015; 91(6): 535-542.
38. Livingstone MB, Robson PJ, Wallace JM. Issues in dietary intake assessment of children and adolescents. *Br J Nutr* 2004. 92 (suppl 2): S213-S222. <https://doi.org/10.1079/BJN20041169>.