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CHRONIC DISEASES: IMPLICATIONS
FOR PUBLIC POLICY

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The prevalence of obesity, diabetes and other noncommunicable diseases (NCDs) related to inadequate nutrition has increased worldwide, with special intensity in low- and middle-income countries (OMS, 2011). In Brazil, NCDs accounted for 72% of the causes of deaths in 2007 (Schmidt et al., 2011). In 2013, self-reported data from Vigitel (Risk and Protective Factors Surveillance System for Chronic Diseases by Telephone Interviews) showed, in the Brazilian adult population, the prevalence of overweight in 50.8% of people, obesity in 17.5%, diabetes in 6.9% and hypertension in 24.1% (Brasil, 2014a). This scenario has been driven, among other factors, by dramatic changes in production, distribution and consumption systems around the world (Popkin, 2006). These changes are characterized mainly by the gradual weakening of traditional eating patterns, based on raw or minimally processed food, and by the increased supply and access to ultra-processed food (Ludwig, 2011; Monteiro, 2009; Monteiro; Cannon, 2012; Monteiro et al., 2010; Moodie et al., 2013).

WHAT ARE ULTRA-PROCESSED FOOD?

Food processing is now the main element of the global food system and the determining factor to explain the relationship between food intake and health conditions of the population. However, the predominance of studies focused exclusively on the evaluation of the nutritional diet profile and the lack of assessments of the effects of industrial food processing limit our ability to monitor changes in eating patterns and their relationship to the rise of obesity and NCDs in the world.

The division of food only in unprocessed and processed does not have much use, since the vast majority of food is processed in some way. For a correct evaluation of the effects of food processing on health, it is necessary to identify the extent and goals of each type of food processing and how it affects the use of food.

FOOD CLASSIFICATION ACCORDING TO THE EXTENT AND PURPOSE OF INDUSTRIAL PROCESSING

Four food categories, determined by the type of processing used prior to its acquisition defined in this classification (Brasil, 2014b; Monteiro et al., 2012):

- Raw or minimally processed food;
- Culinary ingredients;
- Processed food;
- Ultra-processed food.

Raw of minimally processed food

Raw food are those obtained directly from plants or animals (such as leaves and fruit or eggs and milk) and purchased for consumption without having undergone any change after leaving nature. The acquisition of raw food is limited to a few varieties, such as fruits, vegetables, roots, tubers and eggs. Yet it is common that even these foods undergo any change before being purchased, such as cleaning, removal of inedible parts and cooling.

Minimally processed food are raw food which, prior to its acquisition, underwent cleaning, removal of inedible or unwanted parts, drying, packaging, pasteurization, cooling, freezing, fermentation and other processes that do not add any substance to the original food. Minimal processes increase the duration of raw food, preserving them and making them suitable for storage. They can also shorten the steps of preparation to ease your digestion or make the food more palatable. Some food commonly subjected to these processes are cereals, pulses, milk and meat. Processes

such as milling and refining, used in the production of flour and pasta, are also minimal.

Culinary ingredients

Vegetable oils (such as soybean, corn, sunflower and olive oil), fats (like butter and coconut fat), salt and sugar are food products manufactured by the industry by extracting substances existent in raw food or, in the case of salt, present in nature. These products are used for seasoning and cooking raw or minimally processed food and are rarely eaten alone.

Processed food

Processed food are manufactured products made essentially by adding salt or sugar (and eventually oil or vinegar) to a raw or minimally processed food. Processed foods are those who have suffered relatively simple modifications in order to extend the life of raw or minimally processed food and often to make them more palatable. Processed food, in general, is recognized as modified versions of the original food. Examples include canned vegetables, cereals, legumes and fish, fruit in syrup, salted meats (beef jerky, bacon, ham), cheese and bread made with wheat flour, water and salt (and yeast used to ferment the flour).

Ultra-processed food

Ultra-processed food are industrial formulations ready for consumption and made entirely or mainly out of substances extracted from food (oils, fats, sugar, starch, protein), derived from constituents of food (hydrogenated fats, modified starch) or synthesized in the laboratory based on organic materials (colorants, flavorings, flavor enhancers and several additives used to provide the products appealing sensory properties). Ultra-processed food usually have few (if any) amount of raw or minimally processed food in its composition. Ultra-processed food include sweet and savory cookies, chips, cereal bars, breakfast cereals, sweets in general, ice cream, fast food, instant noodles, various types of ready or semi-ready dishes, soft drinks, artificial juices, energy and milk drinks. Breads and other baked products are considered ultra-processed when, besides wheat flour, yeast, water and salt, the ingredients include subs-

tances such as hydrogenated vegetable shortening, sugar, starch, whey, emulsifiers and other additives.

ULTRA-PROCESSED FOOD AND CHRONIC DISEASES

Numerous characteristics related to composition, form of presentation and consumption patterns of ultra-processed food are problematic and contribute for them to become potential risk factors for obesity, diabetes and other NCDs

Population studies that have directly evaluated the association between consumption of ultra-processed food and morbimortality are still few because of the recent definition of this category of food. However, previous studies in Brazil indicate significant associations between the consumption of ultra-processed food with metabolic syndrome among adolescents (Tavares et al., 2012), dyslipidemia among children (Rauber et al., 2015) and obesity in all ages (Canella et al., 2014). A study based on a survey about food intake conducted in 2008-2009 on a representative sample of the Brazilian population of adolescents and adults showed that the 20% top consumers of ultra-processed food had about twice more chances to have obesity compared to those individuals in the lower fifth (Louzada et al., 2015a).

In the US, results of three cohort studies showed an association between weight gain and consumption of various ultra-processed food, such as potato chips, cookies, chips, sugary drinks and sausages (Mozaffarian et al., 2011). In addition, a study of 15 years of follow-up showed that the frequency of fast food consumption among young adults was directly associated with changes in body weight and insulin resistance (Pereira et al., 2005). Regarding sugary drinks, consistent evidence describe its role in the etiology of obesity and other NCDs (Hu; Malik, 2010; Woodward-Lopez; Kao; Ritchie, 2011). A study based on food-purchasing patterns for home in the UK explored the potential impact of reducing ultra-processed food consumption in the mortality from cardiovascular diseases in the country. In a scenario where all consumption of ultra-processed food is replaced by raw or minimally processed food, culinary ingredients and

processed food, the mortality from cardiovascular diseases would be 10% lower than expected and about 20,000 deaths could be prevented until 2030 (Moreira et al., 2015).

These results are corroborated by the analysis of sales statistics of ultra-processed food and its relation to the occurrence of obesity in Latin America. A study showed a strong association between the volume of ultra-processed food sale per capita and the prevalence of obesity among adults. In addition, the increase in sales of ultra-processed food between 2000 and 2009 was directly associated with the increase in average body mass index of the adult population in the same period. Countries like Bolivia and Peru, where sales of ultra-processed food are small and traditional food is still prevalent, have the lowest average body mass index. Mexico and Chile, where sales of ultra-processed food are high, have the highest body mass index values (OPAS, 2014).

Ultra-processed food are convenient, practical and portable. Generally, they are designed to be consumed anywhere - in front of TV, in the workplace or in transportation – and do not require the use of plates and cutlery. Most of the time, they are sold as snacks, drinks or ready or semi-ready dishes for consumption and can easily replace made-to-order meals, that use raw or minimally processed food. Besides, processing techniques, high amounts of sugar, salt and fats and the use of additives such as flavor enhancers and texturizing agents make them hyperpalatable. Thus, they can damage the endogenous processes that signal satiety, control the appetite and cause excessive consumption and mindless eating (Ludwig, 2011; Ogden et al., 2013).

Ultra-processed food have an unfavorable nutritional profile and impact negatively on the nutritional quality of food. Studies based on a survey about food consumption conducted in 2008-2009 in a representative sample of the Brazilian population of adolescents and adults showed that, on average, ultra-processed food have more saturated fat, trans fat and sugar free and lower fiber content when compared to raw or minimally processed food, even when considering the combination of these foods with culinary ingredients like salt, sugar, oils and fats. Increased participation of ultra-processed food on daily diet was associated with the increased use of saturated fat, trans fat and sugar free and inversely

associated with fiber content and protein. Only the 20% bottom Brazilian consumers of these food follow a diet that meets (or are close to) the recommendations of the World Health Organization for the prevention of NCDs (Louzada et al., 2015b).

Results equally unfavorable to ultra-processed food were found when evaluating the micronutrients content of Brazilian diet. Increased consumption of ultra-processed food showed an association, in an inverse and significant way, to the diet content regarding vitamins B12, D, E, niacin, pyridoxine, copper, iron, phosphorus, magnesium, potassium, selenium and zinc. The opposite was observed only with calcium, thiamine and riboflavin (Louzada et al., 2015c).

For possessing small amounts of water and fiber and large amounts of fat and sugar, ultra-processed food have high energy density and glyce-mic load. In solid form, its energy density may range from 2.5 kcal per gram of food, in case of certain breads, to about 5 kcal per gram, in the case of most cookies and chips. Analysis of the Brazilian survey about food consumption conducted in 2008-2009 showed that the set of ultra-processed food has 2.5 times more energy per gram than the set of raw or minimally processed food and the culinary preparations based on these foods (Louzada et al., 2015b). This is particularly relevant when considering that individuals regulate food intake mostly through the amount of food consumed other than the total calories and that the energy density is inversely proportional to the diet quality and directly related to the energy intake and weight gain (ROLLS, 2009). Similarly, the high glyce-mic load of these food increases insulin secretion, which can promote weight gain by diverting nutrients from the oxidation in skeletal muscle to storage it as fat (Ludwig, 2002). Furthermore, ultra-processed food can induce glucose intolerance, insulin resistance, cellular dysfunctions and inflammation, increasing the risk of developing the metabolic syndrome and diabetes (Schulze et al., 2004).

Food additives with cosmetic function, such as emulsifiers, thickeners and dyes, are widely use in the production of ultra-processed food to make them as or more attractive than food and the culinary preparations that replace them. Without those additives, products would be unpalatable. Although law permits their use, the evidences that these additives are

far from being considered harmless are growing. A recent review study suggests that the increased consumption of substances like emulsifiers, surfactants, organic solvents, microbial transglutaminase and nanoparticles may be associated with increased prevalence of autoimmune diseases during the past decades. The hypothesis is based on the fact that these substances damage intestinal protection mechanisms against external antigens and thus increase the risk of autoimmune diseases (Lerner; Matthias, 2015). Experimental study showed that mice that received low concentrations of emulsifiers commonly used by the industry – carboxymethyl cellulose and polysorbate 80 - showed alterations of the intestinal flora leading to inflammation, weight gain and metabolic syndrome (Chassaing et al., 2015). Non-caloric artificial sweeteners, originally developed to reduce calorie intake and blood glucose, are also associated with damages to the intestinal flora and the increase of glucose intolerance in mice and humans (Suez et al., 2014)

Ultra-processed drinks such as soft drinks and artificial juices have specific characteristics. Its consumption is associated with weight gain due to incomplete compensatory reduction in energy consumption in meals subsequent to fluid intake (Dimeglio; Mattes, 2000). Some compounds present in the formulation, such as advanced glycation end products, generated in the process of caramelization of cola beverages, can also affect pathophysiological pathways related to type 2 diabetes and metabolic syndrome (Uribarri et al., 2007).

The set of unfavorable characteristics of ultra-processed food is amplified by an aggressive and sophisticated marketing, which makes those products desired and ubiquitous and modify social norms, especially among vulnerable consumers, like children (Mallarino et al., 2013). Many marketing strategies of these products rely on unfounded health claims. In middle- and low-income countries, direct and specific marketing to lower-income communities is quite frequently, helping ultra-processed food industries, mostly transnational corporations, to penetrate rapidly in emerging markets.

IMPLICATIONS FOR PUBLIC POLICY

Evidences and considerations made previously claim that the design of public policy to control NCDs in Brazil seeks to prevent the replacement of raw or minimally processed food and its culinary preparations by ultra-processed food. This becomes important when one observes that, since the 1990s, sales of ultra-processed food are intensely expanding in Brazil and, in general, in all middle-income countries (Monteiro et al., 2013). Research on food-purchasing patterns for home in Brazil's metropolitan areas, between 1987-1988 and 2008-2009, indicate systematic increases in the participation of ultra-processed food in all food purchases of Brazilian households and concomitant reduction in the share of raw or minimally processed food and culinary ingredients, such as oils, fats and sugar (Martins et al., 2013).

Although people obviously have great responsibility for their food choices, it is essential to recognize that the food environment affects those choices, which may hinder the adoption of a healthy diet. Therefore, it is important that public policies cover both information and education actions of individuals and promote environments that encourage healthy eating.

Institutionalization of actions to promote healthy eating

The success of public policies aimed at promoting healthy eating goes necessarily through the recognition of the conflict of interest inherent in the relationship between ultra-processed food market and public health agencies. Industry self-regulatory actions and public-private partnerships have proved to be very ineffective and often serve as marketing strategies of companies (Stuckler; Nestle, 2012). Therefore, the plan to tackle NCDs must begin by strengthening the state's regulatory capacity in the field of food production and commercialization.

Food guides

Currently, most food guides makes recommendations aimed exclusively to adequate nutrients intake and disregard other food consumption characteristics that influence the health conditions of the population.

Tackling NCDs requires a paradigm shift on what is healthy eating and the reformulation of local food guides

The importance of a new approach is very clear in the recent publication of the Ministry of Health: the new edition of the Food Guide for the Brazilian Population (Brasil, 2014b). The basic guide recommendations include the encouragement of regular consumption of a wide variety of raw or minimally processed food, the moderate use of culinary ingredients for the preparation of meals and limiting the consumption of processed food. The guide also emphasizes the importance of avoiding the consumption of ultra-processed food. The golden rule is simple:

Prefer raw or minimally processed food and culinary preparations rather than ultra-processed food. In other words, opt for water, milk and fruits instead of soft drinks, milk drinks and filled cookies; do not replace made-to-order meals (broths, soups, salads, sauces, rice and beans, pasta, vegetable stews, *farofas* and pies) for products that dispense food preparation (canned soups, instant noodles, frozen dishes, sandwiches, cold cuts and sausages, mayonnaise and processed sauces, cake mixes); and stick with homemade desserts, dismissing the industrialized ones (Ibid., p. 47, free translation).

The guide also offers dining models for breakfast, lunch and dinner derived from actual meals selected from those practiced by Brazilians belonging to the lower fifth of the population that least consumes ultra-processed food, including men and women, adolescents and adults and people living in urban or rural areas from various regions. Additional recommendations on the act of eating and table sharing include eating mindfully, in appropriate places and whenever possible with company. The final chapter discusses the obstacles that may hinder the adoption of the guide's recommendations, including information, supply, cost, time, lack of culinary skills and advertising, and proposes individual and group actions necessary to overcome these obstacles.

Promotion, protection and support actions for breastfeeding and complementary healthy eating

The eating habits early in life are determinants of dietary habits and health conditions of adult life. Thus, actions that encourage the practice

of breastfeeding and the introduction of a complementary diet based on raw or minimally processed food and discourage the use of ultra-processed food - including infant formula and manufactured baby foods – are extremely relevant. These strategies, part of the National Breastfeeding Policy, include, for example, mass campaigns for promoting breastfeeding, prohibiting the marketing of infant formula and the regulation of advertising of other products intended for children, legislation on maternity leave and breastfeeding in the workplace and participation in the Baby-Friendly Hospital program.

In Brazil, the Food Guide for Children Under the Age of Two also features a more traditional approach to food, but also encourages the consumption of raw and minimally processed food and alert to the consumption of some ultra-processed food. Among its recommendations is the encouragement of exclusive breastfeeding up to six months and, after that age, the consumption of different culinary preparations based on regional ingredients. The guide also recommends avoiding sugar, coffee, canned food, fried foods, soft drinks, candies, snacks and other sweets in the early years of life (Brasil, 2013). The Brazilian Breastfeeding and Feeding Strategy enables primary care professionals to the guide's content, promoting healthy eating in childhood under the National Health System.

Promoting healthy eating at school

Concrete evidence demonstrate the effectiveness of interventions in school to promote healthy eating and physical activity (Lobelo et al., 2013). Actions to ensure children's access to meals based on raw or minimally processed food and restricting the supply of ultra-processed food have a potential protective effect against NCDs. Among these actions, we highlight the establishment of guidelines for national school feeding programs, the regulation of food sold in schools and the prohibition of food marketing at school. The Brazilian school feeding program has advanced a lot in this direction and today its guidelines prohibit the purchase of soft drinks and other sugary drinks, limit the purchase of processed foods and require that at least 30% of the school budget is used to buy food from family farming.

Regulations of the advertising of ultra-processed food for children

Abundant evidence shows that children and adolescents are especially vulnerable to food advertising (James, 2011). Because of this, they are prime targets of the ultra-processed food industry. International organizations like the World Health Organization and the Pan American Health Organization strongly recommend that initiatives to reduce the consumption of ultra-processed food go through, necessarily, the regulation of food advertising.

In 2006, the Brazilian Health Surveillance Agency published a proposal for the regulation of advertising of foods high in sugar, sodium, saturated fat and trans fat. The document was prepared with broad participation of the society and the final text was published on June 15, 2012. The resolution, however, was challenged in court by different sectors and associations (most related to the food industry) and was suspended by federal prosecutors.

Fiscal policies

Tax subsidies and food taxation are effective and sustainable strategies to modify dietary intake (Mozaffarian; Rogoff; Ludwig, 2014). Some studies indicate that the protection of agriculture, subsidies for the production of fruits and vegetables and taxing soft drinks and snacks with high energy density promote diet quality and reduce the risk of obesity and cardiovascular disease (Eyles et al., 2012; Thow; Downs; Jan, 2014). In Brazil, a study demonstrated that increasing the price of sugary drinks by 1% would cause a decrease in the consumption of calories from these drinks by 0.85% (Claro et al., 2012).

Nevertheless, the creation of tax policies to raise the cost of ultra-processed food and the effectiveness of tax subsidies for family farming in Brazil and in all Latin America are hindered by policies that favor the uncontrolled market opening for transnational food, fostering agribusiness and the lobby of the food industry.

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