FOOD AND HEALTH:

THE SCIENTIFIC EVIDENCE INFORMING THE *DIETARY GUIDELINES FOR THE BRAZILIAN POPULATION*

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I dedicate this book to the women in science
(past and present), who have changed the
course of knowledge production in Brazil
and in the world.

We thank Neha Khandpur for the kindly
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Contents

1 | Introdution

The *Dietary Guidelines for the Brazilian Population* is an official document from the Ministry of Health of Brazil that addresses the principles and recommendations of an adequate and healthy diet for the Brazilian population, and is a tool to guide food and nutritional education actions and health programs and policies in the Unified Health System (SUS) and in other sectors.

The *Guideline*'s recommendations are summarized in 10 steps:

1. Make natural or minimally processed foods the basis of the diet.
2. Use oils, fats, salt, and sugar in small amounts when seasoning and cooking natural or minimally processed foods and to create culinary preparations.
3. Limit consumption of processed foods.
4. Avoid consumption of ultra-processed foods.
5. Eat regularly and carefully in appropriate environments and, whenever possible, in company.
6. Shop in places that offer a variety of natural or minimally processed foods

7. Develop, exercise and share cooking skills.
8. Plan your time to make food and eating important in your life
9. Out of home, prefer places that serve freshly made meals
10. Be wary of food advertising and marketing

The proposal of the *Guideline*'s recommendations was based on the most robust scientific evidence and the latest knowledge from the food and nutrition field. However, given the various dimensions of food and the complex relation between those dimensions and the health and well-being of people, one of its five principles was to consider information from different sources of knowledge in the formulation of the recommendations. Disciplines of health, nutrition, and food sciences as well as social, behavioral and environmental sciences informed the recommendations. The results from different experimental, clinical and populational studies were used, as well as the results of natural experiments implicit in the process of selecting food patterns developed and transmitted over generations. Particularly important were the studies that analyzed the characteristics of the Brazilian food intake? based on the data collected by the 2008-2009 Family Budget Survey (POF 2008-2009), and the additional analyses carried specifically so that the recommendations of the *Guidelines* would represent the actual food practices of the Brazilian population. The 2008-2009 POF evaluated, for the first time? , the food intake? of a sample of over 30 thousand Brazilians, aged 10 years or older, and representative of all the country's regions, its urban and rural areas, and its socioeconomic strata.

In seeking to make content accessible to the entire population, the *Guideline* did not, however, set out to provide an exhaustive description of the evidence used in its making, nor to present a long list of references at the end of the document.

The purpose of this book is to present the scientific evidence that supported the development of the 2014 *Dietary Guidelines for the Brazilian Population*.

2 | Food and health: a broad overview

In order to guide the development of the recommendations on healthy food choices, a comprehensive overview of health that considers dimensions that go beyond the biological field is indispensable. Although it has now reached some consensus, this idea evolved through generations, influenced by social, economic, political, and cultural contexts of each period. Even today, the exact definition of health is in dispute.

FROM THE BEGINNING OF CIVILIZATION TO THE MODERN AGE

In ancient times, men used supernatural phenomena to explain everything that happened to them, and good health tended to be seen as a reward for good behavior (LOURENÇO et al., 2012).

The scientific concept of health arose when the Greek civilization sought a rational explanation for diseases based on empirical observation, and not by magical and supernatural elements (LOURENÇO et al., 2012). In this context, Hippocrates, the father of

Western medicine wrote the text "The sacred disease" that says "The so-called sacred disease is not, in my opinion, more divine or more sacred than any other disease; it has a natural cause and its allegedly divine cause reflects the human ignorance" (SCLIAR, 2007).

During the Middle Ages, considered a time of regression by many authors, the understanding of health and diseases was strongly influenced by Christianity. The Christian religion reinforced the conception of disease as a result of sin, and healing as a matter of faith. The care of the sick was in large part handed over to religious orders (LOURENÇO et al., 2012; SCLIAR, 2007).

The Modern Age was marked mainly by an opposition to the indisputable compliance with magistral authority and religious dogmatism of the previous period. Capitalism emerged, with the intensification of production, the increase in the demand for labor and the growth of the suburbs. The human body, claimed as means of production, became the object of policies, regulations and rules that aimed at monitoring the factory workers' health. From that, the miasmatic theory emerged, which relates infectious diseases and epidemic outbreaks to inadequate sanitary conditions (LOURENÇO et al., 2012; BUSS e FILHO, 2007).

Health in the Modern Age

In the modern age, many advances have been made in the health area. The microscope, discovered in the seventeenth century, gained importance, and Louis Pasteur discovered the existence of microorganisms that cause diseases. Previously unknown etiological factors were identified, vaccines were developed, and diseases were prevented and cured (SCLIAR, 2007). In the last decades of the nineteenth century, with the extraordinary development of microbiology and physiopathology, the biomedical paradigm was strengthened, giving priority to curative and hospital-centered efforts? rather than socio-political and environmental approaches. This paradigm oriented most of the research and technological production of the following years and favored the development of health as the search for a "normal biological status". Characterized by the emphasis on the biological and individual aspects and the mechanist approach, this model began to fragment the body into systems, organs, tissues, and cells, structuring an increasingly specialized knowledge about each organic function (BUSS and FILHO, 2007). At that time, the study of the cholera outbreak in London, conducted by the English doctor, John Snow, resulted in the origin of epidemiology, the study of population and its phenomena (SCLIAR, 2007).

Despite the hegemony of the biomedical model, the tension between the various health-diseasemodels were present throughout the twentieth century. At the end of the Second World War, international cooperation across several countries led to the creation of the World Health Organization (WHO) in 1948. In its inception document, health was described as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (LOURENÇO et al., 2012). This brought a pioneering concept, which expanded health beyond the disease-centered approach. However, it brought technical criticism that health would be an unattainable ideal, and political criticism, that the concept would allow abuses by the State, which would intervene in the lives of citizens. Today, some scholars no longer consider this concept satisfactory (SEGRE e FERRAZ, 1997; SCLIAR, 2007).

Health as a right and the expanded concept

In the second half of the twentieth century, the evolution of the health concept and the deepening of the discussion about the social determinants followed.

At the Global Conference on Primary Health Care, held in Alma-Ata, Republic of Kazakhstan, in September 1978, health was recognized for the first time as a right, and primary care as the main strategy for its guarantee (LOURENÇO et al., 2012). At the VIII National Health Conference, held in Brasilia in 1986, the expanded concept of health was adopted in Brazil (MINISTRY OF HEALTH, 1986):

> Health is the result of the conditions of food, housing, education, income, environment, labor, transportation, employment, leisure, freedom, access to and possession of land and access to health services (....), result of the social organization of production, which can generate large inequalities in living standards (Ibid, p. 4).

With the creation of the Unified Health System (SUS) in Brazil — the result of intense civil society mobilization —health is now recognized as a right of citizenship and a duty of the State. Based on the principles of universality, equity, and completeness, SUS reaffirms health as a value and a fundamental human right, legitimized by social justice (SCLIAR, 2007; LOURENÇO et al., 2012).

Also in 1986, the first International Conference on Health Promotion, held in Ottawa, Canada, emphasized that health is a reflection not only of physical or genetic aspects, but of the social, economic, political, and cultural context, and consequently has a close relationship with the conditions of housing, education and food, income, peace, social justice, and equity.

Over the next 30 years, WHO continued to promote several international conferences to reflect on the evolution of theory and practices in health. At the III Global Conference on Health Promotion, in Sundsvall, Sweden, in 1991, it was stated that health promotion would be strictly linked to the conservation of natural resources and thus the "environmentalism" was placed on the health agenda. From the IV Global Conference on Health Promotion, held in Jakarta, Indonesia, in 1997, onwards, the absolute influence of the neoliberal progress, the globalization of the economy, and the technological development in living and working conditions and their importance to health promotion was recognized

Thus, health is definitely conceived as a social product, which extrapolates the health sector and points to intersectoral articulation. From this standpoint, comes the proposal of "health in all policies", the theme of the VIII Global Conference on Health Promotion, held in 2013 in Helsinki, Finland, which aimed to contribute to the implementation of joint and articulated actions that would expand the human development.

In Brazil, the National Policy on Health Promotion, as well as the National Policy on Food and Nutrition, attest to the impossibility of the health sector to respond alone to the complexity of health determinants and proposes constructing strategies across different sectors (MINISTRY OF HEALTH, 2012; MINISTRY OF HEALTH, 2014a).

The recognition of the social determinants of the health-disease process revived the interest in the term quality of life. The term covers many meanings, which reflects knowledge, experiences, and values of individuals and collectives across time and spaces and is, therefore, a social construct with the mark of cultural relativity (MINAYO et al., 2000).

From the beginning of the 1990s, the studies on quality of life were intensified and two aspects of its concept were consolidated: subjectivity and multidimensionality. The subjectivity refers to a person's perception of their state of health and about the non-medical aspects of their life context, that is, how the individual himself assesses his or her situation in each dimension related to the quality of life. The consensus regarding multidimensionality refers to the recognition that quality of life is composed of different spheres, such as physical, affective, and cognitive conditions, relationships and social roles, and aspects related to the surrounding environment (SEIDL and ZANNON, 2004).

In the mid-1990s, WHO established a Quality of Life Group (WHOQOL Group) to conduct quality-of-life assessment studies from a cross-cultural perspective. Quality of life was then defined as "an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns". In terms of health, quality of life has become more relevant with the increase in the occurrence of chronic diseases and is often defined as the person's perception about the impact of health problems on their daily life and their physical, psychological, and social capacities (FLECK, 2000).

The comprehension of quality of life is abstract and may involve very interesting perspectives, such as health as it relates to happiness. Bhutan was the first country in the world to define happiness as a State policy. Its concept of happiness, however, is broader than that commonly adopted. The philosophy of "gross national happiness" has several dimensions: it is holistic, recognizing the individual's spiritual, material, physical, and social needs, values balanced progress, sees happiness as a collective phenomenon, and is, at the same time, ecologically sustainable when seeking welfare for present and future generations, and equitable, when aiming at a fair distribution of the elements that lead to well-being. Health is recognized as a prerequisite for economic and spiritual development and as a mean to achieve the "gross national happiness". As a result, this idea significantly influenced the country's health system, so that its Constitution states that "the State should provide free access to basic public health services" (SITHEY et al., 2015). In July 2011, the General Assembly of the United Nations (UN) adopted a historical resolution: the member countries were invited to measure the happiness of their people and use the result in the orientation of public policies. In April 2012, the first UN summit on happiness and well-being took place, culminating in the publication of the *World Happiness Report 2013* (UN, 2013).

FOOD IS MORE THAN NUTRIENT INGESTION

Hippocrates, 25 centuries ago, already knew the relationship between food and health, when he said "Let food be your medicine and medicine be your food", consecrated as a great motto of medicine. It was only in the eighteenth century, however, that the Frenchman Antoine Lavoisier, singled out as one of the creators of nutrition, established the foundations of chemistry and developed the first studies on the relation between respirationand the metabolism of food. During the nineteenth century, studies to isolate protein were intensified, culminating, at the beginning of the twentieth century, in the discovery of vitamins. Until the end of the twentieth century, 45 substances, among them vitamins, minerals, amino acids, and fatty acids, had already been isolated and identified as essential nutrients. The discovery of the treatments for pellagra, beriberi, scurvy, rickets, and xeropthalmia are examples of the important repercussion of these discoveries (CARPENTER, 2003a; b; c; d).

For a long time, food was considered as a simple nutrient transfer system. Some studies, however, started to show that isolated nutrients were not enough to explain the wholerelationship between food and health (SCRINIS, 2013). The benefits of breast milk, for example, were not mimicked in formulas that sought to reproduce its nutritional composition. The protective effect of fruits and vegetables against coronary diseases was also not obtained with interventions based on the ingestion of nutrient supplements that isolate substances present in the matrix of those foods (OMENN et al., 1996; JACOBS et al., 2000; CASTILHO and BARROS FILHO, 2012). Moreover, obesity and chronic diseases associated with food intake began to increase exponentially without individual nutrients being consistently related to these health problems (ALPERS et al., 2014).

From this, the idea that food components act synergistically in the organism was strengthened. It was assumed that food is a complex and non-random combination of compounds developed under intense biological and evolutionary control. It has been shown that its effect on health is not only due to the sum of the functions of its nutrients, but also due to the interaction between the nutrients and with other non-nutrient components (MESSINA et al., 2001; JACOBS and STEFEN, 2003; JACOBS et al., 2009; JACOBS and TAPSELL, 2013; JACOBS and ORLICH, 2014; HUHN et al., 2015).

In addition, studies have suggested that combining foods with one another also does not occur at random and that the traditional patterns of food consumption are the results of evolutionary and cultural experiences (JACOBS and TAPSELL, 2013).

Thus, food patterns — such as the traditional Mediterranean or Japanese patterns— would have health effects not due to the individual foods, but because of the way those foods are combined, prepared, and consumed (TRICHOPOILOU and LAGIOU, 1997; LEE et al., 2002). More recently, other studies have shown that the circumstances involved in the act of eating — location, stress level, social interaction — are determinants of the amount and quality of consumed food (COHEN and FARLEY, 2008).

The evolution of the health concept has naturally boosted the view of nutrition beyond the biological field. Science has begun to recognize that the symbolic, emotional, and historical values of food and its culinary preparations are also important for health (MINTZ and DU BOIS, 2002).

However, despite these insights, most dietary guidelines still have a limited view of how food is related to health and present recommendations that aim exclusively at the adequacy of nutrient consumption. In general, they present food as mere nutrient carriers and disregard the effects of food processing, meals and modes of eating, and the cultural dimensions of food. Moreover, the systems in which foods are produced, processed and supplied affect the population's health through its impact on society and the environment. Food systems can be both social and environmentally sustainable, promoting justice and protecting life and the environment, as they can cause inequity or detrimentally effect natural resources and biodiversity (FAO, 2010). Nonetheless, the relationship between food, social development, and the environmental sustainability of food systems is often underestimated in dietary guidelines.

The *Dietary Guidelines for the Brazilian Population*'s recommendations were formulated with a comprehensive view of the concept of food and aimed to promote sustainability at the personal, cultural, economic, political, and environmental level. As a nutritional policy on public health, the *Guideline* proposes to be in conformity with all other policies which affect the human being and the planet and in particular to protect and reinforce the culture and food system based on natural or minimally processed foods.

In Brazil, food was recognized as a human right in 2006 from an expanded concept of healthy eating (CONSEA, 2007), which served as a guiding force for the concept adopted by the *Guideline*:

> Adequate and healthy food is a basic human right which involves guaranteeing permanent and regular access in a socially fair manner to a food practice appropriate to the biological and social aspects of the individual and which must be: in accordance with all special dietary needs; referenced by the food culture and the dimension of gender, race, and ethnicity; accessible from a physical and financial point of view; harmonious in quantity and quality, attending to the principles of variety, balance, moderation, and pleasure; and based on appropriate and sustainable productive practices (Ibid, p. 8).

Thus, the *Guideline* recognizes the intersectoral character of promoting healthy eating and its intersectional role between health, and food and nutrition security fields.

In 2015, the UN presented to its member States the proposal for the Sustainable Development Goals (SDGs), which guide global development beyond the deadline for achieving Millennium Development

Goals (MDGs). While the MDGs prioritized undernutrition, SDGs emphasize the need to ban all forms of malnutrition and the importance of investing in improving the food system. The second goal of the SDGs is: "End hunger, achieve food security and promote sustainable agriculture" (HAWKES and POPKIN, 2015).

Lastly, the *Dietary Guidelines for the Brazilian Population* reiterates its commitment to promote healthy eating habits by encouraging people's autonomy in producing and choosing food. It encourages practices that increase self-care and conversations/discussions with health professionals and managers, respecting choice, differences, and dialogue

3 | The evolution of health conditions in Brazil

"Brazil is not for beginners", Tom Jobim used to say. As remembered by Victora et al. (2011a), nothing is truer when it comes to public health. The commitment to the development and improvement of Brazilian life requires sensitivity and a deep regardfor the complex social, cultural, political, and economic issues of a country as big as a continent, full of contradictions and inequalities, and in constant transition. It is very common, however, that the conventional dietary guidelines do not answer to all changes in food supply and in the population's health patterns. The *Dietary Guidelines for the Brazilian Population* is prepared to be in tune with the evolution of Brazilian life conditions.

The demographic transition is one of the structural phenomena that contributes to the complexity of public health in Brazil. The drop in mortality and the declining fertility rates, observed since the second half of the twentieth century, has led to significant changes in the Brazilian population age structure: from a predominantly young country to one whose population aged 60 years or older is at 10.8% and growing (VASCONCELOS and GOMES, 2012).

Significant changes in the mortality and morbidity profiles are also observed, highlighting the marked drop in mortality by infectious and parasitic diseases, and the emergence of chronic non-communicable diseases (CNCDs) and of accidents and violence. In 2015, 75.8% of deaths in Brazil were attributed to CNCDs and only 12.4% to infectious, maternal, and neonatal diseases (MALTA et al., 2017). This distribution contrasts with that of 1930 when infectious diseases accounted for about 50% of deaths in Brazilian cities (SCHMIDT et al., 2011). Accidents and violence were the cause of 14.8% of deaths in 1990, dropping to 11.8% in 2015 (MALTA et al., 2017).

Recent changes in the social determinants of health which include an increase in family income, decrease in economic disparities, increasing urbanization, and greater access to basic sanitation and basic education, in addition to a vigorous reform movement in the health sector, have had a significant impact on health conditions and population inequalities (VICOTRA et al., 2011a).

The report "The State of Food Insecurity in the World 2014" published by FAO reveals that Brazil has significantly reduced hunger and malnutrition in the last few years, achieving the first Millennium Development Goal (MDG) (FAO, 2014), and that the indicators of infant and neonatal mortality have improved significantly. The mortality in children under 5 years old has dropped from 52.5/1,000 live births in 1990 to 17/1,000 in 2015, which represents a 67.6% decrease (FRANÇA et al., 2017), and differences between regions and income groups were also minimized (VICTORA et al., 2011b).

From 1974 to 2007, the prevalence of malnutrition in children under 5 years old went from 37.1% to 7.1%. The socioeconomic inequities have significantly decreased: the prevalence of malnutrition dropped from 59% to 11.2% among the poorest of the population and from 12.1% to 3.3% among the richest. The decrease was particularly marked in the last 10 years (MONTEIRO et al., 2010).

From 1996 onwards, a decrease in mortality due to CNDC was observed mainly due to the reduction in the occurrence of cardiovascular and respiratory diseases, although the same drop in mortality due to diabetes and some types of cancer was not observed. The CNDCs are the main cause of death in Brazil and greatly reduce people's quality of life, have high costs for the health system. In addition, obesity, hypertension, and diabetes are becoming increasingly serious public health issues (SCHMIDT et al., 2011).

Analyses of household surveys conducted by the Brazilian Institute of Geography and Statistics (IBGE) in the last three decades have shown continuous increases in the prevalence? of obesity and overweight in all income classes and age groups from the age of 5 years old (IBGE, 2010). In agreement with the household data, the Surveillance System for Risk and Protective Factors for Chronic Diseases (Vigitel) estimated, through self-reported data of adults from the 26 capitals of the Brazilian states and the Federal District (DF), that the prevalence of overweight and obesity increased by almost one percentage point per year between 2006 to 2013 (MINISTRY OF HEALTH, 2014b).

The 2013 National Health Survey (PNS) assessed Brazilian adults from all over the country and estimated a prevalence of overweight of 57.3% and obesity of 17.5% in male participants and a prevalence of overweight of 59.8% and obesity of 25.2% in the female participants (MINISTRY OF HEALTH, 2015a). The 2013 PNS has also estimated that 6.2% of the population aged 18 years or older reported having received a medical diagnosis of diabetes, equivalent to a contingency of 9.1 million people (MINISTRY OF HEALTH, 2015b). In the State capitals and the Federal District, the frequency of adults who reported the medical diagnosis of diabetes increased by an average of 0.2 percentage points per year between 2006 to 2013 (MINISTRY OF HEALTH, 2014b). With direct measurement, the 2013 PNS estimated that 22.3% of adults have high blood pressure: 19.5% among females and 25.3% among males (MINISTRY OF HEALTH, 2015a). Vigitel estimated that 24.1% of the adult population reported having received the hypertension diagnosis in 2013 and showed discrete variations in the period from 2006 to 2013 (MINISTRY OF HEALTH, 2014b).

Regarding the immediate determinants of the population's health conditions, Brazil presents a mixture of advances and setbacks.

Breastfeeding practices have improved significantly over the last decades. National surveys have reported a significant increase in the median duration of breastfeeding from 2.5 months in 1974 to 14 months in 2006-2007, remaining stable until 2013 (VENANCIO et al., 2013; BOCCOLINI et al., 2007). Interviews with a probabilistic sample of mothers who accompanied their children on national immunization days in 1999 and 2008 in the 26 State capitals and the DF corroborated these data. The prevalence of exclusive breastfeeding in infants from zero to 4 months increased from 35.5% in 1999 to 51.2% in 2008. Approximately 40% of infants from 9 to 12 months received breastmilk in 1999, in comparison to 58.7% in 2008. The median duration of breastfeeding has increased from 10 to 11.2 months from 1999 to 2008 (MINISTRY OF HEALTH, 2009).

The fight against smoking also presents a successful trajectory in Brazil. In the last decades, there was a marked drop in the prevalence of tobacco users where the prevalence in adults went from 34.8% in 1989 to 22.4% in 2003 (MONTEIRO et al., 2007) and the total prevalence was 15% (21.9 million people) in 2013 (MINISTRY OF HEALTH, 2015a).

In 2013, almost a third of the Brazilian adult population was active[1] (31.9%) and less than a quarter were active in their free time[2] (22.5%). The proportion of adults classified as insufficiently active was 46% and 28.9% reported having watched television for three or more hours daily (MINISTRY OF HEALTH, 2015a). Between 2009 and 2013, Vigitel estimated that the proportion of adults who were active in their free time increased by 2.2 percentage points for males and 5.3

1 Displacement for usual activities, such as work or school, whether for him/herself or to take another person, by bicycle or walking, and that takes at least 30 minutes a day on the round trip.

2 Being active corresponds to 150 minutes per week of physical activity of mild or moderate intensity or to at least 75 minutes of physical activity of vigorous intensity.

percentage points for females, while the proportion of active adults in transportation decreased 5.4 percentage points for males and 4.6 percentage points for females (MINISTRY OF HEALTH, 2014b).

The 2013 PNS estimated a frequency of 13.7% of alcoholism in the last 30 days,[3] three times more in males (21.6%) than in females (6.6%) (MINISTRY OF HEALTH, 2015a). The Vigitel data reported that the frequency of alcoholism remained stable in the last 8 years but driving after alcohol consumption had significantly reduced (MINISTRY OF HEALTH, 2014b).

DISTRIBUTION AND EVOLUTION OF FOOD CONSUMPTION IN BRAZIL

The distinct changes in the food consumption patterns of the population are particularly relevant, considering that there was a rapid substitution of the natural or minimally processed food and culinary ingredients for ultra-processed foods.[4] Food sale statistics show that, since the 1990s, the sales of ultra-processed foods have been growing in Brazil and, in general, in all middle-income countries (MONTEIRO et al., 2013).

Household food acquisition surveys conducted in the country's metropolitan regions show a similar growth trend: the relative share

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3 Ingestion of 4 or more doses in the case of female subjects or 5 or more doses in case of male subjects, on the same occasion, within the last 30 days.

4 Chapter 4 has the detailed definition of food groups.

of calories from ultra-processed foods increased from 10.7% in 1987-1988 to 21.3% in 2008-2009 (Figure 1). Among the ultra-processed foods that had the greatest growth in consumption, the most notable were sausages and other processed meats, processed candies, and soft drinks.

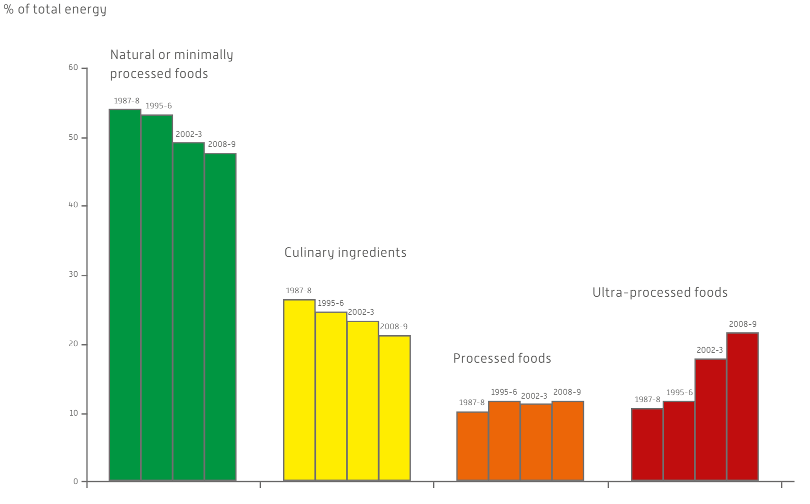

FIGURE 1 | Percentage contribution of natural or minimally processed foods, culinary ingredients, processed foods, and ultra-processed foods in the calories acquired per household in metropolitan regions of Brazil, in the periods 1987-1988, 1995-1996, 2002-2003 and 2008-2009.

The natural or minimally processed foods whose acquisition decreased were rice and beans. Among the culinary ingredients, there was a significant drop in the purchase of sugar and vegetable oils.

Despite the evidence of a strong tendency to increase consumption of ultra-processed foods, the 2008-2009 Family Budget Surveys (POF) showed that natural or minimally processed foods and culinary preparations made with these foods still comprised, in terms of total calories consumed, almost two-thirds of the Brazilians diet (Table 1). Together, rice and beans were responsible for more than one-fifth (21.6%) of energy consumed throughout the day. Other natural or minimally processed foods relevant in the Brazilian diet were red meats and poultry, fruits, cereals other than rice, and milk, each contributing at least 4% of the total daily energy. With less energy contribution, there were roots and tubers, coffee and tea, fish, vegetables, and eggs.

Among the culinary ingredients, the main components were table sugar, with 7.3% of the calories, followed by vegetable oils, with 7%. Among the processed foods, the main contribution to the total energy supply was the baguette (7.8% of daily calories), followed by cheeses, processed meats, and preserved fruits and vegetables.

Among the ultra-processed foods, the principle sources of energy were ready meals (3.8% of daily calories), soft drinks (1.7% of daily calories), sausages (1.6% of daily calories), cakes, pies and sweet biscuits (1.5% of daily calories), and dairy drinks (1.5% of daily calories).

TABLE 1 Means of absolute and relative consumption of natural or minimally processed foods, culinary ingredients, processed foods, and ultra-processed foods by the Brazilian population aged 10 years or older, between 2008 and 2009.

Groups	Average energy consumed	
	Absolute (kcal/day)	Relative (% of energy)
Natural/minimally processed	1068.9	55
Meats and poultry	266.3	13.3
Rice	220.9	11.6
Other cereals	88	4.4
Milk	32.8	1.8
Roots and tubers	63.7	3
Eggs	21.6	1.2
Legumes	191.5	10
Fishes and sea food	27.3	1.3
Natural fruits and juices	95.4	5
Vegetables	22.4	1.4
Other natural or minimally processed foods	39	2
Processed culinary ingredients	326.4	16.5
Table sugar	140	7.3
Vegetable oils	137.3	7
Animal fats	33.2	1.6
Other processed culinary ingredients	15.9	0.6
Processed	198.3	10
Baguettes	146.6	7.8
Processed cheeses	21.5	1
Ham and other salted, smoked or canned meat or fish	23.7	1
Vegetables and other preserved foods	6.5	0.3
Ultra-processed	388.6	19.6
Ultra-processed bread	25.6	1.4
Cakes, cookies, and pies	37	1.5
Soft drinks	35.6	1.7
Ultra-processed cheeses	1.2	0
Sausages	34.2	1.6
Dairy drinks	31.3	1.5
Salty biscuits	41.7	2
Candies	48.3	2
Ready meals	79.6	3.8
Other ultra-processed beverages	18.7	0.9
Other ultra-processed foods	35.4	1.7
Total	**1982.2**	**100**

Source: adapted from Louzada et al., 2015a.

4 | Real versus ultra-processed foods: the epidemiological studies

For the elaboration of dietary guidelines, classification systems to categorize foods are essential. Conventional categories group foods according to their nutrient profile. For example, fresh meats and products processed from meats with added salt belong to the same category because they are both protein sources. Also, because they are carbohydrates sources, rice or wheat grains, cereal flours, bread, breakfast cereals, cereal bars, and other products with added sugar, fats, and additives are grouped together. These categories were of fundamental importance at a time when most food-related diseases were caused by energy and nutrients deficiencies. However, this type of classification is becoming obsolete due to the epidemiological scenario dominated by chronic diseases, the quick development of food science and technology, the increased access and range of food products available for consumption, the penetration of large transnational corporations into traditional food systems, and the changes in the epidemiological profile (MONTEIRO et al., 2012; LUDWIG, 2011).

Although there is a consensus that industrial food processing is crucial to explain the relationship between food intake and the population's health conditions, the absence of a clear definition and the limited evaluation of its effects limit the ability to assess its relationship with the increase in obesity and CNCDs in the world (FAO, 2015).

The division of food only into unprocessed and processed or industrialized foods is not very useful since the vast majority of foods are processed in some way. In addition, many kinds of processing are harmless, beneficial or even crucial and play a central role in human evolution. For a correct evaluation of the effects of food processing on health, it is necessary to identify the extent and objectives of each type of processing.

Some classifications categorize foods in relation to the characteristics of industrial processing (SARTORI, 2013; MOUBARAC et al., 2014; POTI et al., 2015). Despite the great potential of application, these classifications present limitations that include the lack of precise definition of what is industrial processing, the lack of definition of each category's concept, the incomplete distinction between domestic and industrial processing, and its limited application in epidemiological studies (MOUBARAC et al., 2014).

THE NEW FOOD CLASSIFICATION AND THE DIETARY GUIDELINES FOR THE BRAZILIAN POPULATION

The *Dietary Guidelines for the Brazilian Population* classifies foods according to the extent and purpose of the processing that took place before its acquisition, preparation, and consumption by individuals. This food classification is called NOVA (a name and not an acronym) and understands food processing as physical, biological, and chemical processes that take place after the food is harvested or, more generally, after the food is separated from nature and before it is submitted to culinary preparation or before its consumption. Therefore, procedures employed in the culinary preparation of food in domestic kitchens or in commercial or institutional restaurants, including the disposal of inedible parts, fractionation, freezing, refrigeration, cooking, seasoning, and food combination with other foods, are not taken into account by the NOVA classification.

The theoretical basis and characterization of food groups defined in this classification were proposed by the team of researches from the Center for Epidemiological Research in Nutrition and Health and described for the first time in 2009 (MONTEIRO et al., 2010). Since then, the NOVA classification has been detailed and improved (MONTEIRO et al., 2014; MINISTRY OF HEALTH, 2014c; MONTEIRO et al., 2012, MONTEIRO et al., 2018a; MONTEIRO et al., 2019).

The NOVA classification divides food into four groups:

- Group 1 – Natural or minimally processed foods.
- Group 2 – Processed culinary ingredients.

- Group 3 – Processed foods.
- Group 4 – Ultra-processed foods.

Group 1 – Natural or minimally processed foods

The first group of the NOVA classification includes natural and minimally processed foods.

Natural foods are edible parts of plants (seeds, fruits, leaves, stems, roots) or animals (muscles, viscera, eggs, milk), mushrooms, algae, as well as water right after its separation from nature.

Minimally processed foods are natural foods subject to processes such as removal of inedible or undesirable parts, drying, dehydration, grinding or milling, fractionation, roasting, cooking with water only, pasteurizing, cooling or freezing, packaging, vacuum packaging, non-alcoholic fermentation, and other processes which do not involve the addition of substances such as salt, sugar, oils or fats to the natural foods.

The main purpose of processing used in the production of group 1 foods is to increase the duration of natural foods, allowing its storage for longer. Other purposes include facilitating or diversifying the culinary preparation of foods, such as the removal of inedible parts, fractionation, and grinding; and to modify its flavor, as in the roasting of coffee beans or tea leaves and in the fermentation of milk for the production of yogurts.

Typical examples of group 1 foods: legumes, vegetables, fruits, potatoes, cassava and other roots and tubers, natural or packed, fractionated, chilled or frozen; white, brown or parboiled rice, in bulk or packed; maize or corn on the cob, wheat grains, and other cereals; beans of all colors, lentil, chickpeas, and other legumes; fresh or frozen mushrooms; dried fruits, fruit juices, and pasteurized fruit juices not containing added sugar or other substances or additives; nuts, peanuts, and other oilseed without salt or sugar; cloves, cinnamon, spices in general, and fresh or dried herbs; cassava, maize or wheat flour, and fresh or dried pasta made with these flours and water; beef, pork, poultry, and fish, fresh, chilled or frozen; fresh, chilled or frozen seafood; pasteurized or powdered milk, yogurt (with no addition of sugar or other substances); eggs, herbal teas; coffee made from grain; and drinking water.

Also classified in group 1 are items of food consumption composed of two or more foods of this group, such as cereal granola, nuts, and dried fruits, provided no sugar, honey, oils or fats are added. The *Guideline* recommends that natural or minimally processed foods should be the basis of a diet.

Group 2 – Processed culinary ingredients

The second group of the NOVA classification is composed of the processed culinary ingredients and includes substances extracted directly from group 1 foods or nature and consumed as items of culinary preparations. The processes involved in extracting these substances are pressing, milling, spraying, drying, and refining.

The purpose of group 2 processing is to create products used in home kitchens or restaurants to season and cook group 1 foods to prepare salty and sweet foods, soups, salads, pickles, homemade bread, desserts, beverages, and culinary preparations in general.

Ingredients classified as group 2 are rarely consumed in the absence of group 1 foods. Examples of group 2 foods: cooking salt extracted from mines or sea water; sugar and molasses extracted from sugar cane or beats; honey extracted from hive combs; oils and fats extracted from foods of vegetable or animal origin, such as soy or olive oil, butter, cream, and lard; starch extracted from corn or other plants.

Also classified in group 2 are the products composed of two substances belonging to the group (e.g., butter with salt). Vinegar obtained by the acetic fermentation of alcohol from wines and other alcoholic beverages are also classified in group 2 due to the similarity of use with other substances belonging to the group. The *Guideline* recommends that oils, fats, salt, and sugar should be used in small amounts when seasoning and cooking foods and making culinary preparations.

Group 3 – Processed foods

The third group from NOVA classification is processed foods, which includes products made with the addition of salt or sugar and optionally oil, vinegar or other substances from group 2 to a group 1 food, consisting mostly of products with two or three ingredients. The processes involved in the making of these products encompass many methods of preservation and cooking, and, in the case of cheeses and bread, non-alcoholic fermentation.

The purpose of the processing underlying the manufacture of processed foods is to increase the duration of natural or minimally processed foods or to modify its flavor, similar to the purpose of the processing used in the manufacture of group 1 foods.

Typical examples of processed foods: tinned vegetables, cereals or legumes, nuts with added salt or sugar, salted meats, fish preserved in oil or water and salt, fruits in syrup, cheeses, and bread. The *Guideline* recommends limiting the consumption of processed foods.

Group 4 – Ultra-processed foods

The fourth group of the NOVA classification is ultra-processed foods, consisting of formulations of ingredients, most of exclusively industrial use, that result from a series of industrial processes. The processes used in the manufacture of ultra-processed foods involve several steps and different industries. It begins with the fractionation of whole foods into substances that include sugars, oils and fats, proteins, starches, and fibers. These substances are often obtained from a few foods of vegetable origin whose cultivation has a high yield (corn, wheat, soybean, sugar cane, and beet) and the purification or milling of animal carcasses, usually from intense cattle raising. Some of these substances are then subjected to hydrolysis, hydrogenation or other chemical modifications. Subsequent processes involve the combining of modified substances with other unmodified ones by means of industrial techniques, such as extrusion, molding, and pre-frying. There are ingredients which are present only in ultra-processed foods, i.e. substances not usual in culinary preparations or additives whose function is to simulate sensory attributes of group 1 foods or culinary preparations of those foods or, still, to mask undesirable sensory aspects in the final product. Moreover, in the ultra-processed foods, foods from group 1 represent a reduced proportion or are not even present in the ingredient list. The processes end with sophisticated packages, usually made from synthetic materials. Sugars, oils and fats, and salt used to manufacture processed foods are often ingredients of ultra-processed foods. Additives that increase the duration of the products, protect the original properties and prevent the proliferation of microorganisms can be used in processed and ultra-processed foods, as well as in processed culinary ingredients and, rarely, in minimally processed foods.

Ingredients present only in ultra-processed foods include casein, lactose, whey, gluten, soluble or insoluble fiber, "mechanically separated meats", fructose, hydrogenated or interesterified oils, protein hydrolysates, soy protein isolate, maltodextrin, dextrose, invert sugar, concentrated juice, high fructose corn syrup, and other sources of protein, carbohydrate or fat that are not group 1 or 3 foods, nor are group 2 ingredients. Additives identified only in ultra-processed foods include flavorings, flavor enhancers, colorants, emulsifiers, sweeteners, thickeners, defoamers, bulking agents, carbonating agents, foaming agents, and glazes.

The main purpose of ultra-processing is to create industrial products to eat or drink which require only heating and that are able to replace both natural or minimally processed foods that are ready for consumption (such as fruits and nuts, milk, and water) as well as meals, beverages, desserts, and culinary preparations in general. Common attributes of ultra-processed foods are hyperpalatability, sophisticated and attractive packaging, aggressive advertisement directed particularly to children and adolescents, health claims, high profitability, and control by transnational corporations.

Typical examples of ultra-processed foods: soft drinks and powdered juices; snack foods; ice cream, chocolate, candies, and sweets in general; bread loaf, and hot-dog or hamburger buns; sweet bread, snack cakes, and cake mixes; morning cereals and cereal bars; energy drinks, chocolate drinks, and fruit-flavored drinks; freeze-dried broths flavored with meat, chicken or vegetables, etc.; mayonnaise and other ready to eat sauces; infant formulas and other baby products; slimming products and meal substitutes; ready-to-heat frozen products, such as pies, pasta, and pre-prepared pizza; meat, poultry or fish extracts such as nuggets, sausage, hamburger, and other reconstituted meat products; instant soup, pasta, and desserts; processed sausages; among others. The *Guideline* recommends that they be avoided.

Numerous characteristics related to the composition, presentation and mode of consumption of ultra-processed foods are problematic and contribute to the potential risk factors for obesity, diabetes, and other chronic noncommunicable diseases (CNDCs).

Table 2 summarizes the literature that used the NOVA classification in food categorizing and evaluated the potential impact of ultra-processed food consumption on health conditions. It is important to consider that, at the time of writing the *Guideline*, some evidence was already published or in the process of being published, but a few new studies were subsequently released, corroborating the initial hypotheses.

TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes.

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and the impact on the nutritional quality of food			
Estudos brasileiros			
Monteiro et al., 2011	13,848 households in 11 metropolitan regions in Brazil	To explore the impact of ultra-processed foods on the overall quality of diet in Brazil between 2002 and 2003.	Ultra-processed foods showed more energy density, added sugar, saturated fat and sodium, and less fiber compared to other foods.
Barcelos et al., 2014	307 children aged from 7 to 8 years, from São Leopoldo, RS, Brazil	To evaluate the influence of ultra-processed foods in the energy and nutrient intake.	The consumption of ultra-processed foods was related to higher energy, fat, and sodium and lower protein and fiber intake.
Bielemann et al., 2015	4,202 young adults from Pelotas, RS, Brazil	To evaluate the influence of ultra-processed foods in the nutrient intake.	The consumption of ultra-processed foods was directly associated with the consumption of fats, cholesterol, sodium, iron, calcium, and calories and negatively associated with the consumption of carbohydrates, proteins and fibers
Louzada et al., 2015a	32,898 Brazilian adolescents and adults	To evaluate the impact of ultra-processed foods on the diet's nutritional profile between 2008 and 2009.	The consumption of ultra-processed foods was associated with higher energy density, higher total, saturated and trans fat, and sugar content and lower fiber and protein content.
Louzada et al., 2015b	32,898 Brazilian adolescents and adults	To evaluate the impact of ultra-processed foods on the micronutrient content in food between 2008 and 2009.	The consumption of ultra-processed foods was inversely associated with the vitamins B12, D, E, niacin and pyridoxine and copper, iron, phosphorus, magnesium, selenium, and zinc levels.
Longo-Silva et al., 2015	636 nursery children in the neighborhood of Santo Amaro, city of São Paulo, SP, Brazil	To analyze the nutritional composition of ultra-processed foods according to the nutritional classification tool Traffic Light Labelling, adapted to Brazilian norms and recommendations.	All foods were classified as red for saturated fat and sodium, and 50% had a red classification for total fat.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and the impact on the nutritional quality of food			
Studies from other countries			
Moubarac et al., 2013b	5,643 Canadian households	To evaluate the association between the household acquisition of ultra-processed foods and the dietary quality in Canada in 2001.	The ultra-processed foods showed more energy density, fats, free sugar, and sodium than all other foods.
Crovetto et al., 2014	10,096 Chilean households	To explore the impact of ultra-processed foods on the overall quality of diet in Chile between 2006 and 2007.	The set of processed and ultra-processed foods showed a higher percentage of carbohydrates, free sugars and higher density than the set of non-processed or minimally processed foods. The opposite was observed for fiber density.
Luiten et al., 2015	Large supermarkets of Auckland, New Zeland	To assess the nutritional profile of supermarket products according to the type of industrial processing.	Ultra-processed foods represented 84% of available products on supermarkets in 2011 and 83% in 2013 and showed worse nutritional profile compared to other foods.
Adams e White, 2015	2,174 British individuals aged 18 years or older	To describe the nutritional content of foods classified according to the degree of processing and the nutritional content of diets with different consumption degrees of these foods.	Non-processed or minimally processed foods showed higher protein and lower energy density, sodium, saturated fat, and free sugar compared to processed culinary ingredients, processed and ultra-processed foods. Diets with higher participation of ultra-processed foods have a less healthy nutritional profile.
Steele et al., 2016	9,317 North Americans, aged 1 year or older	To evaluate the impact of ultra-processed foods on the added sugar content in food.	The consumption of ultra-processed foods was linearly associated with the added sugar content in the diet. The last quintile of ultra-processed consumption showed three times as many individuals with added sugar consumption, more than 10% of total calories compared to the first quintile.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and the impact on the nutritional quality of food			
Studies from other countries			
Steele et al., 2018	9,042 North Americans, aged 2 years or older	To evaluate the relationship between the caloric contribution of ultra-processed foods, the relative and absolute protein consumption and energy intake.	The results showed an inverse relationship between the quintiles of consumption of ultra-processed foods and the protein density of the diet. They were also associated with an increase in total energy consumption, while the absolute protein intake remained relatively constant.
Latasa et al., 2018	2,012, 33,730 e 22,116 Spanish households in the years 1990, 2000 and 2010	To evaluate the association between the household acquisition of ultra-processed foods and the added sugar consumption in Spain between 1990 and 2010.	The percentage of ultra-processed foods in total purchases increased and was associated with the increase in added sugar consumption between 1990 and 2010.
Batal et al., 2018	3,700 individuals from first nations aged 19 years or older from the West and Central regions of Canada	To evaluate the association between the consumption of ultra-processed foods and the diet's nutritional quality.	The consumption of ultra-processed foods was directly associated with the energy, carbohydrate, free sugar, saturated fat, sodium, calcium, and vitamin C intake and inversely associated with protein, fiber, potassium, iron and vitamin A intake.
O'Halloran et al., 2018	35 meals from 7 nurseries attended by Australian children aged 1 to 5 years	To quantify the contribution of foods, categorized according to industrial processing characteristics, to the total sodium of meals.	Ultra-processed foods provided 40% of the sodium consumed, while processed foods provided 35%, minimally processed 23% and culinary ingredients 2%.
Cediel et al., 2018	4,920 Chileans aged 2 years or older	To evaluate the impact of ultra-processed foods on the added sugar content in food.	The increase of 5 pp in the caloric contribution of ultra-processed foods was associated with the 1% increase in the sugar content of the diet. The last quantile of ultra-processed consumption showed three times as many individuals with added sugar consumption, more than 10% of total calories compared to the first quintile.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and the impact on the nutritional quality of food			
Studies from other countries			
Rauber et al., 2018	9,364 people over 1 year and a half old	To evaluate the impact of ultra-processed foods on the consumption of nutrients associated with the risk of chronic noncommunicable diseases (CNDC).	The consumption of ultra-processed foods was associated with higher consumption of free sugar, total fat, saturated fat and sodium and lower consumption of protein, fiber, and potassium.
Vandevijvere, et al., 2018	3,083 Belgians aged 15 years or older in 2004 and 3.146 aged from 3 to 64 years between 2014 and 2015	To evaluate the impact of ultra-processed foods consumption on the diet's quality.	The consumption of ultra-processed foods was associated with the excessive consumption of sodium and saturated fat.
Parra et al., 2019	38,643 Colombians aged from 1 to 64 years in 2005	To evaluate the impact of ultra-processed foods consumption on the nutritional profile of the diet.	The consumption of ultra-processed foods was associated with a higher energy density of the diet, higher consumption of total and saturated fat and free sugar and lower consumption of fibers.
Ultra-processed foods and health outcomes			
Brazilian studies			
Tavares et al., 2011	210 adolescents from Niterói, RJ, Brazil	To evaluate the association between the consumption of ultra-processed foods and metabolic syndrome.	The consumption of ultra-processed foods was associated with the occurrence of metabolic syndrome.
Canella et al., 2014	190,159 Brazilians	To analyze the association between household availability of ultra-processed foods and the prevalence of obesity in Brazil between 2008 and 20019.	The household availability of ultra-processed foods was directly associated with the prevalence of overweight and obesity.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and health outcomes			
Brazilian studies			
Louzada et al., 2015c	30,243 Brazilian adults and adolescents	To analyze the association between consumption of ultra-processed foods and obesity.	Individuals in the higher quintile of ultra-processed consumption had a higher body mass index and greater chances of being obese compared to those in the lowest quintile.
Cruz et al., 2016	12,902 Brazilian civil servants	To investigate whether high consumption of ultra-processed foods is associated with an increase in C-reactive protein levels.	After all adjustments, the increased consumption of ultra-processed foods remained independently associated with a 6% increase in the arithmetic mean of C-reactive protein.
Melo et al., 2017	249 Brazilian adolescents	To evaluate the consumption of minimally processed, processed and ultra-processed foods and its association with overweight, increased waist circumference, and high blood pressure.	The consumption of minimally processed foods was inversely associated with overweight.
Silva et al., 2018	8,977 Brazilian adults aged from 35 to 64 years	To analyze the association between the consumption of ultra-processed foods, body mass index (BMI) and waist circumference.	Individuals in the last quartile of consumption of ultra-processed foods had a higher body mass index, greater waist circumference and greater chances of being overweight and obese.
Melo et al., 2018	109,104 Brazilian adolescents	To evaluate the association between the consumption of ultra-processed foods and the occurrence of asthma and wheezing.	Individuals in the last quintile of consumption of ultra-processed foods had 27% and 42% more chances of developing asthma and wheezing, respectively.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and health outcomes			
Studies from other countries			
OPAS, 2015	13 Latin American countries	To evaluate the association between obesity indicators and ultra-processed foods sales between 2000 and 2013.	The increase in sales of ultra-processed foods was directly associated with the increase in the mean body mass index (BMI) of the adult population.
Adams e White, 2015	2,174 British individuals aged 18 years or older	To evaluate the association between body mass index (BMI) and consumption of foods classified according to the degree of processing.	The consumption of processed culinary ingredients was inversely associated with the body mass index (BMI). There was no significant association with the other food groups.
Moreira et al., 2015	6,000 households in the United Kingdom	To analyze the potential reduction in mortality associated with reduced consumption of ultra-processed foods in the United Kingdom.	Halving ultra-processed intake could result in about 20 fewer deaths associated with cardiovascular diseases in the year of 2030.
Mendonça et al., 2016	8,451 middle-aged Spaniards	To evaluate the association between the consumption of ultra-processed foods and the risk of overweight/obesity in a Spanish cohort.	Participants in the highest quartile of consumption of ultra-processed foods had a higher risk of developing overweight/obesity compared to those in the lowest quartile of consumption.
Mendonça et al., 2016	14,790 middle-aged Spaniards	To evaluate the association between the consumption of ultra-processed foods and the risk of hypertension.	Participants in the highest tercile of consumption of ultra-processed foods were at higher risk of developing hypertension than those in the lowest tercile.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and health outcomes			
Studies from other countries			
Steele et al., 2016	2.692 Americans aged 6 years or older	To evaluate the association between the consumption of ultra-processed foods and the urinary phytoestrogen concentration.	Urinary concentrations of enterodiol and enterolactone were inversely associated with the consumption of ultra-processed foods.
Nasreddine et al., 2018	302 Lebanese adults	To evaluate the association between dietary patters derived from natural or minimally processed, processed and ultra-processed foods in cardiovascular risk factors.	Participants in the highest quartile of consumption of minimally processed and processed foods had lower chances of developing metabolic syndrome, hyperglycemia, and low HDL cholesterol.
Julia et al., 2018	74,470 French adults	To evaluate the association between the consumption of ultra-processed foods and sociodemographic factors.	Higher consumption of ultra-processed foods was associated with a higher occurrence of overweight and obesity.
Monteiro et al., 2018b	Households from 19 European countries	To evaluate the association between the household acquisition of food and the prevalence of obesity in adults.	Each one percentual point increase in household availability of ultra-processed foods resulted in an 0.25 percentual point increase in the prevalence of obesity.
Fiolet et al., 2018	104,980 French adults	To evaluate the association between the consumption of ultra-processed foods and the incidence of breast, prostate and colon cancer.	The consumption of ultra-processed foods was associated with a higher risk of cancer in general and breast cancer.
Juul et al., 2018	5,977 American adults aged from 20 to 64 years	To evaluate the association between the consumption of ultra-processed foods and obesity indicators.	The consumption of ultra-processed foods was associated with a higher body mass index (BMI), greater waist circumference, risk of overweight and obesity, and abdominal obesity.

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TABLE 2 Description of epidemiological studies that evaluated the impact of ultra-processed foods on the nutritional quality of food and health outcomes. *(follow-up)*

Author	Subjects under study	Purpose of the study	Main conclusions
Ultra-processed foods and health outcomes			
Studies from other countries			
Schnabel et al., 2018	158,361 French adults	To evaluate the association between the consumption of ultra-processed foods and functional gastrointestinal disorders.	Higher consumption of ultra-processed foods was associated with a greater occurrence of irritable bowel syndrome.
Schnabel et al., 2019	4,.551 French adults aged 45 years or older	To evaluate the association between the consumption of ultra-processed foods and all-cause mortality.	The 10% increase in the share of ultra-processed foods in the diet is associated with the 14% increase in the risk of all-cause mortality.
Hall et al., 2019	20 adults with a mean age of 31.2 years	To evaluate, in a randomized clinical trial, the effect of ultra-processed food consumption on energy intake and weight.	Participants gained on average 0.8 ± 0.3 kg of weight during the two weeks of ultra-processed foods diet and lost on average 1.1 ± 0.3 kg of weight during the diet composed of other food groups.

ULTRA-PROCESSED FOODS AND HEALTH OUTCOMES

Dietary and household food acquisition surveys and food sales statistics from several countries have shown the association between the consumption of ultra-processed foods and various detrimental effects, such as: metabolic syndrome in adolescents and adults (TAVARES et al., 2012; LAVIGNE-ROBICHAUD et al., 2018), overweight and obesity in all ages (CANELLA et al., 2014; LOUZADA et al., 2015b; SILVA et al., 2018; OPAS, 2015; MENDONÇA et al., 2016; MONTEIRO et al., 2018b; JUUL et al., 2018; NARDOCCI et al., 2018), high total and LDL cholesterol in children (RAUBER et al., 2015), death due to cardiovascular diseases and stroke at all ages (MOREIRA et al., 2015; MOREIRA et al., 2018) and all-cause deaths in adults (SCHNABEL et al., 2019), asthma and wheezing in adolescents (MELO et al., 2018), hypertension in adults (MENDONÇA et al., 2017), adiposity among neonates, linked to maternal consumption (ROHATGI et al., 2017), low serum concentrations of enterodiol and enterolactone in all ages (STEELE and MONTEIRO, 2017), cancer in general and breast cancer in adults (FIOLET et al., 2018), and functional gastrointestinal disorders in adults (SCHNABEL et al., 2018).

In Brazil, the analysis of the individual food consumption data of the 2008-2009 Family Budget Survey (POF) has shown an association between the consumption of ultra-processed foods and obesity in adolescents and adults (LOUZADA et al., 2015c). After adjustments for sociodemographic characteristics, smoking, and physical activities, the consumption of ultra-processed foods was associated with a higher body mass index (BMI) mean and higher prevalence of overweight and obesity (Table 3).

TABLE 3 The association between the consumption of ultra-processed foods (% of total energy), body mass index (BMI) and occurrence of obesity and overweight in the Brazilian population aged 10 years or older, between 2008 and 2009.

	Quintiles of ultra-processed food consumption (of total energy)[a]									
	1 (≤ 13%)	2 (14 a 22%)		3 (23 a 31%)		4 (32 a 43%)		5 (≥ 44%)		Tendency P
Difference of means (CI 95%) in BMI (kg/m²)										
Gross	0. 0 (Ref.)	0. 28	(0. 03,0. 52)	0. 19	(-0. 07,0. 44)	0. 12	(-0. 14,0. 38)	-0. 53	(-0. 79,-0. 27)	< 0,001
Multivariate[b]	0. 0 (Ref.)	0. 33	(0. 10,0. 56)	0. 51	(0. 25,0. 76)	0. 69	(0. 37,1. 00)	0. 94	(0. 42,1. 47)	< 0,001
Multivariate + other dietary components[c]	0. 0 (Ref.)	0. 33	(0. 10,0. 56)	0. 51	(0. 25,0. n)	0. 69	(0. 38,1. 00)	0. 95	(0. 43,1. 48)	< 0,001
Odds ratio (CI 95%) for occurrence of overweight[d]										
Gross	1. 0 (Ref.)	1. 27	(1. 08,1. 50)	1.27	(1. 06,1. 52)	1. 26	(1. 05,1. 49)	1. 16	(0. 97,1. 40)	0,18
Multivariate[b]	1. 0 (Ref.) 1. 0 (Ref.)	1. 3	(1. 09,1. 54)	1. 43	(1. 17,1. 76)	1. 58	(1. 22,2. 05)	1. 98	(1. 26,3. 12)	< 0,001
Multivariate + other dietary components[c]	1. 0 (Ref.)	1. 29	(1. 09,1. 54)	1. 43	(1. 16,1. 75)	1. 57	(1. 22,2. 03)	1. 97	(1. 26,3. 09)	< 0,001
Odds ratio (CI 95%) for occurrence of overweight[e]										
Gross	1. 0 (Ref.)	1. 1	(0. 98,1. 22)	1. 1	(0. 98,1. 23)	1. 07	(0. 95,1. 20)	0. 93	(0. 82,1. 05)	0,2
Multivariate[b]	1. 0 (Ref.)	1. 1	(0. 98,1. 24)	1. 17	(1. 02,1. 35)	1. 21	(1. 02,1. 43)	1. 26	(0. 95,1. 69)	0,02
Multivariate + other dietary components[c]	1. 0 (Ref.)	1. 1	(0. 98,1. 24)	1. 17	(1. 02,1. 35)	1. 21	(1. 02,1. 43)	1. 27	(0. 95,1. 69)	0,02

Ref.: reference; BMI: body mass index; CI: confidence interval.
All analyzes considered the complexity of the sample.
Adjusted for age (natural log), gender (male/female), ethnicity (White, African-descendent and others), region, (North, Northeast, South, Southeast and Central-West), urbanity (urban/rural), smoking (yes/no), physical activity (min/week), quintiles of study years (age and gender specific), household income per capita (natural log), and interaction between gender and income.
Covariable in the multivariate model and consumption of fruits, vegetables, and beans (each as a % of total energy from non-processed foods).
Z-Scores of BMI-for-age ≥ +2 for individuals between 10 and 19 years old (Onis et al., 2007) and BMI ≥ 30 kg/m2 for individuals ≥ 20 years old (WHO, 1995).
Z-Scores of BMI-for-age ≥ +1 for individuals between 10 and 19 years old (Onis et al., 2007) and BMI ≥ 25 kg/m2 for individuals ≥ 20 years old (WHO, 1995).
Source: adapted from LOUZADA et al., 2015c.

Compared to those in the first quintile of consumption of ultra-processed foods, the mean BMI was 0.94 kg/m^2 higher among those in the upper quintile (CI 95% = 0.42; 1.47). The adjusted odds ratio (adjusted OR) for the presence of obesity and overweight was, respectively, 1.98 (CI 95% = 1.23; 3.12) and 1.26 (CI 95% = 0.95; 1.69) in the highest quintile of consumption of ultra-processed foods. The additional adjustment for fruit, vegetables, and beans consumption in the non-processed portion of the diet had little effect on those estimates (Table 3).

When the analyzes of the 2008-2009 POF were repeated with stratification by subgroups, there was a significant gender-related change in effect. There was a significant association between the consumption of ultra-processed foods and obesity indicators for females , but not for the male. The females in the highest quintile of consumption of ultra-processed foods had, on average, a BMI that was 1.13 kg/m^2 higher than those in the lowest quintile (CI 95% = 0.38; 1; 87). The odds ratio (OR) for obesity presence was 1.96 among female individuals in the highest quintile of consumption of ultra-processed foods (CI 95% = 1.09; 3.56). Our hypothesis is that confounding factors not measured or measured with error may, in part, explain the absence of effect among males. Previous studies conducted in Brazil described higher levels of physical activities and smoking among men (MALTA et al., 2011a). Since it is well established that both characteristics are inversely correlated with BMI, the lack of adequate control can bias the results towards zero. Increasing evidence suggests that women are more predisposed to adverse metabolic effects from carbohydrate-rich and quick-digestible foods than men, which can explain the higher effects of ultra-processed foods on adiposity in females subjects (MIRRAHIMI et al., 2014). Differences in the mechanisms of coping with stress among men and women may also be a possible cause for the different outcomes between them. Previous studies demonstrated that perceived stress was an important predictor of both diet quality and the adiposity and that the females are particularly susceptible to perceived stress (DE VRIENDT et al., 2012; ISASI et al., 2015; NASTASKIN et al., 2015). In addition, a population-based study showed that there are different socioeconomic factors for the occurrence of obesity in men and women, increasing the complexity of controlling for these variables in the analyses of determinants of obesity (MONTEIRO et al., 2008).

In Brazilian adults evaluated on the ELSA-Brazil study, the percentage of energy contribution from ultra-processed foods was also correlated with a higher BMI, greater waist circumference, and greater chances of overweight and obesity presence (SILVA et al., 2018). In American and Canadian adults, the consumption of ultra-processed foods was associated with a higher BMI, greater waist circumference, risk of overweight and obesity, and abdominal obesity (JUUL et al., 2018; NAR- DOCCI et al., 2018).

Longitudinal studies conducted in high-income countries have shown important impacts of the consumption of ultra-processed foods on the risk of chronic diseases. In Spain, in a cohort study with a follow-up period of about 9 years, the consumption of ultra-processed foods was linked to indicators of body weight and high blood pressure (MENDONÇA et al., 2016), with individuals in the highest quartile of consumption of ultra-processed foods were more at risk of developing overweight/obesity (adjusted hazard ratio: 1.26; IC 95% = 1.10; 1.45, tendency p = 0.001) compared to those in the lowest quartile of consumption (MENDONÇA et al., 2016). In France, a follow-up study with over 100,000 adults demonstrated that a 10% increase in the share of ultra-processed foods in the diet had a 12% increase in the cumulative risk of developing cancer (FIOLET et al., 2018) and 14% in the risk of all-cause deaths (SCHNABEL et al., 2019).

A randomized clinical trial investigated the effect of ultra-processed foods consumption on energy intake and weight of 20 adults with a mean age of 31.2 years. The subjects were randomized to receive diets composed only of ultra-processed foods or only other foods by 2 weeks, immediately followed by the alternate diet also for 2 weeks. The meals were designed to have an equal number of calories, energy density, macronutrients, water, sodium, and fiber. The energy intake was higher in the ultra-processed diet (508 ± 106 kcal/day; p = 0.0001), with higher carbohydrates (280 ± 54 kcal/day; p < 0.0001) and fats (230 ± 53 kcal/day; p = 0.0004) intake, but not proteins (–2 ± 12 kcal/day; p = 0.85). Participants gained, on average, 0.8 ± 0.3 kg of weight (p = 0.01) during the two weeks of ultra-processed diet, and lost, on average, 1,1 ± 0,3 kg (p = 0.001) during the diet composed of other foods (HALL et al., 2019).

POTENTIAL MECHANISMS THAT EXPLAIN THE ASSOCIATION BETWEEN THE CONSUMPTION OF ULTRAPROCESSED FOODS AND HEALTH OUTCOMES

Ultra-processed foods show an unfavorable nutritional profile and negatively impact the nutritional quality of food. In general, they have a higher energy density, more free sugar, more total, saturated and trans fats, and less fiber compared to all other foods. This was documented by studies conducted in Brazil and different countries using data from surveys of food purchases (CROVETTO et al., 2014; MONTEIRO et al., 2011; MOUBARAC et al., 2013b; LATASA et al., 2018), individual food consumption surveys (BARCELOS et al., 2014; BIELEMANN et al., 2015; LOUZADA et al., 2015a and 2015b; ADAMS and WHITE, 2015; LONGO-SILVA et al., 2015; STEELE et al., 2016; RAUBER et al., 2018; PARRA et al., 2019), and analysis of products available in supermarkets (LUITEN et al., 2015).

Analyzes of the individual food consumption data of the 2008-2009 POF documented the unfavorable nutritional profile of ultra-processed foods and their largely negative impact on the quality of food in the Brazilian population.

Table 4 shows the food consumption fractions related to natural or minimally processed foods and their culinary preparations (which includes group 2 culinary ingredients) and ultra-processed foods. Compared to natural or minimally processed foods, the fraction related to ultra-processed foods presents 2.5 times more energy per gram, twice more free sugar, 1.5 times more fats in general and saturated fats, and 8 times more trans fats, in addition to lower levels of fiber (3 times lower), proteins (twice lower), and potassium (2.5 times lower).

TABLE 4 Mean nutritional indicators of the fraction of consumption of natural or minimally processed and ultra-processed foods by the Brazilian population aged 10 years or older, between 2008 and 2009.

	Fraction of food consumption	
Indicator	**Natural or minimally processed foods**	**Ultra-processed foods**
Total energy (kcal/day)	**1,275.5**	**423.4**
Percentage contribution to the total energy of:		
Proteins	19.5	8.6
Carbohydrates	55.6	54.4
Free sugar	13.5	29.2
Total fat	24.8	37.0
Saturated fat	8.4	12.0
Trans fat	0.6	5.0
Energy density (kcal/g)[a]	1.4	3.7
Fiber density (g/1,000 kcal)	13.4	4.5
Sodium density (g/1,000 kcal)	1.7	1.4
Potassium density (mg/1,000 kcal)	1,583.7	604.6

[a] Only the solid fraction of the food.
Source: adapted from Louzada et al., 2015a.

Table 5 compares fractions of food consumption between processed and ultra-processed foods. In comparison with processed foods, the ultra-processed ones have more energy density, higher levels of free sugar, general, saturated and trans fats, and lower levels of protein and fibers, although the potassium level is similar in both. The sodium levels are particularly high in processed foods: 2.5 g/1,000 kcal versus 1.4 g in ultra-processed and 1.7 g in minimally processed foods and its culinary preparations.

TABLE 5 Mean nutritional indicators of the fraction of consumption of processed and ultra-processed foods by the Brazilian population aged 10 years or older, between 2008 and 2009.

Indicator	Fraction of food consumption: Processed foods	Fraction of food consumption: Ultra-processed foods
Total energy (kcal/day)	**167.1**	**423.4**
Percentage contribution to the total energy of:		
Proteins	15.7	8.6
Carbohydrates	63.7	54.4
Free sugar	0.6	29.2
Total fat	20.6	37
Saturated fat	9.5	12
Trans fat	1.2	5
Energy density (kcal/g)[a]	2.9	3.7
Fiber density (g/1,000 kcal)	6.5	4.5
Sodium density (g/1,000 kcal)	2.5	1.4
Potassium density (mg/1,000 kcal)	584.1	604.6

[a] Only the solid fraction of the food.
Source: adapted from Louzada et al., 2015a.

Table 6 presents indicators of the diet's nutritional profile for the five strata of the population corresponding to increasing quintiles of the energy consumption of ultra-processed foods.

TABLE 6 Mean nutritional indicators of the food consumption correspondent to quintiles of consumption of ultra-processed foods, considering strata of the Brazilian population aged 10 years or older, between 2008 and 2009.

Indicator	Quintiles of consumption of ultra-processed foods (% of total energy)				
	Q1	Q2	Q3	Q4	Q5
Total energy (kcal/day)	**1,707.9**	**1,794.4**	**1,841**	**1,920.4**	**2,066.8***
Energy density (kcal/g)	**1.5**	**1.5**	**1.6**	**1.7**	**1.9***
Percentage contribution to the total energy of:					
Proteins	19.3	18.2	17.3	16.3	14.8*
Carbohydrates	56.7	56.5	56.2	56.1	55.6*
Free sugar	10.9	13.1	15	17.6	20.2*
Total fat	23.8	25.4	26.8	28.1	30.4*
Saturated fat	7.9	8.5	9.1	10	11.5*
Trans fat	0.8	1.3	1.5	1.7	1.9*
Fiber density (g/1,000 kcal)	13	11.9	11.3	10.3	8.9*
Sodium density (g/1,000 kcal)	1.9	1.8	1.7	1.7	1.6*
Potassium density (mg/1,000 kcal)	1,414.2	1,347.8	1,309.7	1,230.6	1,074.6*

* p < 0,05 for the linear trend of the indicator's variation according to quintiles of consumption of ultra-processed foods.
Source: adapted from Louzada et al., 2015a.

The energy density of the diet and the relative content of free sugar and general, saturated and trans fats increases significantly as the contribution of ultra-processed foods increases, while the opposite occurs for the protein, fiber, potassium, and sodium contents. The variables related to family income, urban or rural residence, region of the country, age, and gender did not modify these results.

Diets with high energy density compromise the ability of the human body to regulate energy balance, increasing the risk of excessive weight gain (ROLLS, 2009). The increased free sugar intakealso increases the risk of excessive weight gain and obesity (TE MORENGA et al., 2013), in addition to increasing the incidence of dental cavities (MOYNIHAN and KELLY, 2014). Excessive content of saturated and trans fats increases morbidity and mortality from cardiovascular diseases (MOZAFFARIAN et al., 2009; WHO, 2009). On the other hand, insufficient fiber intake increases the risk of obesity, diabetes, cardiovascular diseases, and various types of cancer, such as colon, rectum, and breast cancer (WHO, 2003; PEREIRA et al., 2004; MOYNIHAN and KELLY, 2014), while the insufficient potassium intake increases risks of hypertension (WHO, 2012). In this scenario, recent evidence suggests that the high consumption of sugar and fats and low consumption of fibers can induce intestinal dysbiosis, promoting a pro-inflammatory response and consequently a "permeable intestine", which increases the risk of autoimmune diseases such as diabetes and celiac disease (AGUAYO-PATRÓN and LA BARCA, 2017).

Analyzes from the 2009-2010 National Health and Nutrition Examination Survey (NHANES), which collects information on the individual food consumption of the US population, also showed a strong impact of ultra-processed foods on the excessive consumption of added sugar. Each increase of five percentage points in the relative consumption of ultra-processed foods (% of total energy) increased the relative consumption of added sugar (% of total energy) by one percentage point. The added sugar consumption linearly increased according to quintiles of consumption of ultra-processed foods, from 7.5% of total energy in the lowest quintile to 19.5% in the highest. A total of 82.1% Americans in the highest quintile of consumption of ultra-processed foods exceeded the recommended limit of 10% of added sugar calories compared with 26.4% in the lowest quintile (STEELE et al., 2016). In Chile, participants in the last quintile of relative consumption of ultra-processed foods (% of total energy) showed three times more chances (OR = 2.9; CI 95% = 2.4; 3.4) of exceeding the superior limit of 10% of calories from added sugar compared with those in the first quintile (CEDIEL et al., 2008). The diet of the individuals in the quintile with lower relative consumption of ultra-processed foods was adequate both for fiber and trans-fat content and close to the adequacy for energy density, free sugar, and potassium (Table 7), as well as for the consumption of total and saturated fats, nutrients consumed excessively by the quintile with the highest relative consumption of ultra-processed foods. The sodium content in the diet exceeded the consumption recommendation (< 1 g/1.000 kcal) in all strata of the population.

The stratification of the Brazilian population, according to the participation of ultra-processed foods in the diet, indicates that the diet of the 20% of the Brazilians who consume ultra-processed foods the least meets or approximates to the international recommendations related to all dietary nutritional indicators evaluated, with the exception of sodium. On the other hand, the diet of the 20% of the Brazilians who consume ultra-processed foods the most has excessive content of total, saturated, and trans fats, free sugar, and sodium and insufficient fiber and potassium content. This finding indicates that the reduction in consumption of ultra-processed foods in Brazil is a natural way to promote healthy eating. The high sodium content detected in the three dietary fractions (natural or minimally processed, processed, and ultra-processed foods) indicates that the solution for the excessive sodium consumption in Brazil requires both the reduction of the sodium content added by the industry to the ultra-processed foods and the reduction in the addition of salt in culinary preparations. This result is different from that observed in other developed countries, where the consumption of ultra-processed foods is much higher. In the United Kingdom, for example, the sodium consumption presents a linear and direct relation to the percentage of caloric participation of ultra-processed foods in the diet, and its excessive consumption (> 1 g/1.000 kcal) increases by 55% from the first to the last quintile of ultra-processed consumption.

TABLE 7 Mean nutritional indicators of the food consumption correspondent to the first quintile of consumption of ultra-processed foods, considering the Brazilian population aged 10 years or older, between 2008 and 2009.

Indicator	Q1	Recommended values for indicators
Energy density (kcal/g)	**1.5**	**1.25 to 1.45**
Percentage contribution to the total energy of:		
Proteins	19.3	10 to 15
Carbohydrates	56.7	55 to 75
Free sugar	10.9	< 10
Total fat	23.8	15 to 30
Saturated fat	7.9	< 10
Trans fat	0.8	< 1
Fiber density (g/1,000 kcal)	13.0	> 12.5
Sodium density (g/1,000 kcal)	1.9	< 1
Potassium density (mg/1,000 kcal)	1,414.2	≥ 1,755

Source: adapted from Louzada et al., 2015a.

The average protein content of the Brazilian diet (17.2% of calories) exceeds the recommendation range for this nutrient (10% to 15%) (WHO, 2003) due to the high protein content in natural or minimally processed foods (19.5%) and the significant inclusion of beans and meat in the Brazilian diet. In any case, the negative health effects of high protein intake, as in the case of renal impairment, are unclear and apparently occur only if the ingestion values exceed more than twice the upper limit of the recommendation (WHO, 2007). On the other hand, recent studies indicate that the increase in protein content between 10% and 20% increases the satiety power of the diet and prevents the excessive consumption of calories (SIMPSON and RAUBENHEIMER, 2005; GOSBY et al., 2014).

Ultra-processed foods also have low micronutrient content.

Table 8 shows the micronutrient content in dietary fractions related to natural or minimally processed, processed, and ultra-processed foods, respectively. For 16 of the 17 studied micronutrients, the content of the fraction correspondent to ultra-processed foods was lower than that of natural or minimally processed foods. The content of vitamin B12, vitamin C, vitamin D, vitamin E, niacin, pyridoxine, copper, magnesium, manganese, and zinc in ultra-processed foods was at least twice as high as those of natural or minimally processed foods. Particularly evident were the differences in vitamin B12, vitamin C, and magnesium, whose levels were, respectively, four, five, and 13 times lower than in ultra-processed foods. The content of vitamin A, iron, and phosphorus in ultra-processed foods represented 60 to 70% of that found in natural or minimally processed foods. The riboflavin, calcium, and selenium content in UP was less concerning. Thiamine was the only micronutrient whose content in the fraction of ultra-processed foods that was comparable tothat of natural or minimally processed foods, and yet only slightly.

TABLE 8 Means of micronutrient content in food consumption fractions of natural or minimally processed, processed, and ultra-processed foods by the Brazilian population aged 10 years or older, between 2008 and 2009.

	Food consumption fraction		
Micronutrients	**Natural or minimally processed foods**	**Processed foods**	**Ultra-processed foods**
Vitamins			
Vitamin A (mcg/1,000 kcal)	340.5	118.7	239.1*
Vitamin B12 (mcg/1,000 kcal)	3.5	1.2	1.0*
Vitamin C (mg/1,000 kcal)	121.2	1.9	23.8*
Vitamin D (mcg/1,000 kcal)	2.1	0.6	0.9*
Vitamin E (mg/1,000 kcal)	2.7	0.4	1.4*
Niacin (mg/1,000 kcal)	17.1	4.7	7.3*
Pyridoxine (mg/1,000 kcal)	0.8	1.6	0.4*
Riboflavin (mg/1,000 kcal)	0.8	1.9	0.7*
Thiamine (mg/1,000 kcal)	0.5	1.1	0.7*
Minerals			
Calcium (mg/1,000 kcal)	265.8	312.3	243.1*
Copper (mg/1,000 kcal)	0.9	0.4	0.4*
Iron (mg/1,000 kcal)	7.0	3.5	4.1*
Phosphorus (mg/1,000 kcal)	548.6	578.4	356.3*
Magnesium (mg/1,000 kcal)	150.2	91.9	66.4*
Manganese (mg/1,000 kcal)	9.6	1.3	0.7*
Selenium (mg/1,000 kcal)	28.6	18.9	24.6*
Zinc (mg/1,000 kcal)	7.0	4.3	3.0*

* Value significantly different ($P < 0.05$) from estimated for natural or minimally processed and processed foods.
Source: adapted from Louzada et al., 2015b.

The comparison between ultra-processed and processed foods shows less obvious contrasts in micronutrient content. In general vitamin B12, pyridoxine, riboflavin, thiamine, calcium, phosphorus, magnesium, manganese, and zinc are lower in UPP while vitamin A, vitamin C, vitamin D, vitamin E, and niacin are lower in processed foods. Processed and ultra-processed foods showed similar contents of copper, iron, and selenium.

Table 9 describes the gross analyzes of the association between quintiles of the relative consumption of ultra-processed foods and diet content in micronutrients. There was an important negative correlation between dietary intake of ultra-processed foods and micronutrient content in the diet for 11 of the 17 micronutrients studied: vitamin B12, vitamin, D, vitamin E, niacin, pyridoxine, copper, iron, phosphorus, magnesium, selenium, and zinc. Three micronutrients — vitamin A, vitamin C, and manganese — did not show a significant link between the participation of ultra-processed foods and nutrient content in the diet. Significant reduction in the micronutrient content of the diet as the increase in the share of ultra-processed foods was observed only for calcium, thiamine, and riboflavin, and yet reaching a very small magnitude in the last two cases.

TABLE 9 Means of nutritional indicators of food consumption correspondent to quintiles of ultra-processed foods consumption, considering the strata of the Brazilian population aged 10 years or older, between 2008 and 2009.

	Quintiles of consumption of ultra-processed foods					Gross regression coeficient*	p
Micronutrients	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**		
Vitamins							
Vitamin A (mcg/1,000 kcal)	254.6	290.5	339.3	300,0	249.3	– 0.12	0.974
Vitamin B12 (mcg/1,000 kcal)	3.2	3.0	3.1	2,7	2.2	– 0.23	< 0.001
Vitamin C (mg/1,000 kcal)	74.1	98.5	106.2	87,6	71.0	– 1.71	0.147
Vitamin D (mcg/1,000 kcal)	2.1	1.9	1.7	1,6	1.5	– 0.14	< 0.001
Vitamin E (mg/1,000 kcal)	2.4	2.3	2.3	2,1	1.9	– 0.10	< 0.001
Niacin (mg/1,000 kcal)	14.7	14.6	14.3	13,9	13.1	– 0.41	< 0.001
Pyridoxine (mg/1,000 kcal)	0.8	0.8	0.8	0,8	0.7	– 0.02	< 0.001
Riboflavin (mg/1,000 kcal)	0.8	0.9	0.9	0,9	0.9	0.01	< 0.001
Thiamine (mg/1,000 kcal)	0.6	0.6	0.6	0,6	0,7	0.03	< 0.001
Minerals							
Calcium (mg/1,000 kcal)	248.9	254.5	271.0	291,5	327.9	19.50	< 0.001
Copper (mg/1,000 kcal)	0.7	0.7	0.8	0,7	0.6	– 0.03	< 0.001
Iron (mg/1,000 kcal)	6.7	6.3	6.2	6,0	5.7	– 0.22	< 0.001
Phosphorus (mg/1,000 kcal)	543.9	528.7	522.2	512,5	504.7	– 9.47	< 0.001
Magnesium (mg/1,000 kcal)	147.2	136.8	130.8	121,5	109.7	– 9.02	< 0.001
Manganese (mg/1,000 kcal)	6.2	6.3	7.0	7,3	5.9	0.02	0.913
Selenium (mg/1,000 kcal)	52.4	49.0	46.3	43,9	41.7	– 2.66	< 0.001
Zinc (mg/1.000 kcal)	6.6	6.2	6.1	5,8	5.3	– 0.9	< 0.001

* Regression coefficient of the micronutrient content in the diet on the percentage of the total caloric value of the diet from ultra-processed foods.
Source: adapted from Louzada et al., 2015b.

Table 10 shows the association between relative consumption of ultra-processed foods and dietary content in micronutrients adjusted for per capita family income. This adjustment does not substantially change the results of the association. Statistically significant decreases are seen in both the positive link between relative consumption of ultra-processed foods and the calcium content in the diet and the negative link between the relative consumption of ultra-processed foods and the vitamin C content in the diet.

The positive correlation between relative consumption of ultra-processed foods and the calcium content in the diet was not expected since the content of this mineral in these foods is lower than in natural or minimally processed foods. Detailed analyzes (not shown) of the variation of ultra-processed consumption items in the diets according to the quintiles of their relative consumption show a significant increase in the consumption of ultra-processed products particularly rich in calcium, such as ready and semi-prepared meals and fast-foods (both often containing cheese among its ingredients) and dairy drinks with sugar.

Few studies have evaluated the association between the consumption of ultra-processed foods and the micronutrient content in the diet, but evidence that this consumption could dilute micronutrient concentration was documented by studies that focused on the intake of soft drinks (YAMADA et al., 2008; FIORITO et al., 2010; LYONS et al., 2015) or fast-food type meals (PAERATAKUL et al., 2003). In the United States, the average content of vitamins A, C, D, and E and of zinc, potassium, phosphorus, magnesium, and calcium in the diet decreased significantly with the increase in the contribution of ultra-processed foods to the total energy consumed (STEELE et al., 2017).

TABLE 10 Means of nutritional indicators of food consumption correspondent to the quintiles of ultra-processed foods consumption adjusted for per capita family income, considering the strata of the Brazilian population aged 10 years or older, between 2008 and 2009.

	Quintiles of consumption of ultra-processed foods					Adjusted regression coefficient*	p
Micronutrient	Q1	Q2	Q3	Q4	Q5		
Vitamins							
Vitamin A (mcg/1,000 kcal)	290.0	286.8	283.4	280.1	276.7	– 4.00	0.437
Vitamin B12 (mcg/1,000 kcal)	3.3	3.1	2.8	2.6	2.4	– 0.22	< 0.001
Vitamin C (mg/1,000 kcal)	92.4	89.2	85.9	82.6	79.3	– 3.27	0.066
Vitamin D (mcg/1,000 kcal)	2.0	1.9	1.8	1.6	1.5	– 0.13	< 0.001
Vitamin E (mg/1,000 kcal)	2.4	2.3	2.2	2.1	2.0	– 0.11	< 0.001
Niacin (mg/1,000 kcal)	15.1	14.5	13.9	13.4	12.8	– 0.56	< 0.001
Pyridoxine (mg/1,000 kcal)	0.8	0.8	0.8	0.7	0.7	– 0.01	< 0.001
Riboflavin (mg/1,000 kcal)	0.9	0.9	0.9	0.9	0.9	0.01	< 0.001
Thiamine (mg/1,000 kcal)	0.6	0.6	0.6	0.7	0.7	0.02	< 0.001
Minerals							
Calcium (mg/1,000 kcal)	245.0	259.2	273.2	287.2	301.2	14.00	< 0.001
Copper (mg/1,000 kcal)	0.7	0.7	0.7	0.7	0.7	– 0.02	< 0.001
Iron (mg/1,000 kcal)	6.6	6.4	6.2	5.9	5.7	– 0.23	< 0.001
Phosphorus (mg/1,000 kcal)	545.7	531.8	517.9	504.0	490.1	– 13.9	< 0.001
Magnesium (mg/1,000 kcal)	147.4	138.2	129.1	119.9	110.8	– 9.15	< 0.001
Manganese (mg/1,000 kcal)	6.6	6.5	6.4	6.3	6.3	– 0.08	0.746
Selenium (mg/1,000 kcal)	52.0	49.3	46.2	43.9	41.2	– 2.71	< 0.001
Zinc (mg/1.000 kcal)	6.6	6.3	6.0	5.6	5.3	– 0.33	< 0.001

* Regression coefficient of the micronutrient content in the diet on the percentage of the total caloric value of the diet from ultra-processed foods after adjusting for monthly per capita family income.
Source: adapted from Louzada et al., 2015b.

The negative impact of ultra-processed foods on dietary micronutrient content is of great importance when vitamins and minerals are considered to play critical roles in cell signaling, hormone production, immune response, and the development and maintenance of vital functions (WHO, 2004). Although micronutrient deficiency does not always manifest clinically, subclinical deficiencies can cause health damage (WHO, 2004).

Deficiencies of iron, zinc, vitamin A, and nutrients present in smaller quantities in ultra-processed foods when compared to natural or minimally processed foods are among the most important nutritional problems in the world, affecting mainly children, pregnant women, and populations of developing countries (LOPEZ et al., 2006). Its consequences, of extreme relevance in public health, include defects in infant growth and development, and increased fetal and maternal mortality (LOPEZ et al., 2006).

Iron, zinc, and vitamin A, as well as vitamin B12, vitamin C, riboflavin, and selenium have immunomodulation functions and influence the susceptibility to infectious diseases and their severity (GUERRANT et al., 2000; WHO, 2004). The adequate ingestion of vitamin D, calcium, magnesium, and phosphorus, in turn, is important to the development and maintenance of bone mass (PALACIOS, 2006), while B vitamins (thiamine, riboflavin, niacin, and pyridoxine) are involved in the maintenance of cognitive functions (HUSKISSON et al., 2007). Finally, micronutrients with antioxidant functions, such as vitamins C and E and minerals selenium and zinc, play a key role in the etiology and prognosis of chronic diseases (CHERUBINI et al., 2005; KALIORA et al., 2006).

In addition to the inadequate nutritional profile, there are other characteristics of ultra-processed foods that may explain its connection with health outcomes. Ultra-processed foods are convenient, practical and portable, and are usually developed so that they can be consumed anywhere — in front of the television, in the work environment or in the means of transportation — without the use of plates and cutlery. Mostly, they are sold as snacks, beverages or ready-made or semi-prepared foods and can easily replace freshly prepared meals based on natural or minimally processed foods.

It is also noteworthy that processing techniques (which often lead to partial or total remove of food water), high amounts of sugar, salt and fats, and the use of additives, such as flavor enhancers and texturizing agents, make the ultra-processed hyperpalatable. This means that they can interfere with the signaling of satiety and appetite, causing excessive and unconscious calorie consumption (mindless eating) (LUDWIG,2011;OG- DEN et al., 2013). Indeed, preliminary results from a sample of 98 foods consumed in France showed lower satiety index and higher glycemic response of ultra-processed foods compared to minimally processed foods (FARDET, 2016).

Food additives with a cosmetic function, such as emulsifiers, thickeners, and dyes, are widely used in the production of ultra-processed foods. Although its use is permitted, there is increasing evidence that these additives are not harmless. A recent review suggests that the increased consumption of substances such as emulsifiers, surfactants, organic solvents, microbial transglutaminase and nanoparticles may be linked to the increased prevalence of autoimmune diseases in recent decades. The hypothesis is based on the fact that these substances damage mechanisms of intestinal protection against external antigens and thus increase the risk of immunological diseases (LERNER e MATTHIAS, 2015). An experimental study demonstrated that mice that received low concentrations of emulsifiers commonly used by the industry — carboxymethylcellulose and polysorbate 80 — presented alterations in the intestinal microbiota that led to inflammation, weight gain and metabolic syndrome (CHASSAING et al., 2015). Non-caloric artificial sweeteners, initially aimed at reducing calorie and glucose intake, are also related to damage to the intestinal microbiota and increased glucose intolerance in mice and humans (SUEZ et al., 2014).

Ultra-processed beverages, such as soft drinks and artificial juices, have peculiar characteristics. Their consumption is associated with weight gain due to an incomplete compensatory reduction in energy consumption of meals after the ingestion of liquids (DIMEGLIO and MATTES, 2000). Studies that used individual consumption data from the Family Budget Survey (POF), in 2008-2009, showed that there is a deficiency in the caloric compensation of meals eaten after the consumption of sugary drinks, reinforcing their role in increasing calorie intake (GOMBI-VACA et al., 2016). Some compounds present in its formulation, such as the advanced glycation end products generated in the caramelization of cola drinks, may also affect pathophysiological pathways related to type 2 diabetes and metabolic syndrome (URIBARRI et al., 2007).

Another feature that can correlate with the consumption of ultra-processed foods and obesity is the portion size. Often these products are sold in "supersized portions" and many studies have shown a direct link between portion size, total energy consumption, and weight gain (DILIBERTI et al., 2004; STEENHUIS and VERMEER, 2009; ALBAR et al., 2014). The portion size of many ultra-processed foods has increased significantly in recent decades (NIELSEN and POPKIN, 2003; PIERNAS and POPKIN, 2011). In the United States, increasing portion sizes accounted for much of the increase in energy consumption by the population over the past 30 years (DUFFEY and POPKIN, 2011).

Concerning the connection with the development of cancer, the hypothetical explanations include the production of neocontaminants (such as acrylamide or nitrosamine) from food processing, and particularly from thermal treatments and the routine use of plastic packaging made of bisphenol A, substances already linked to neoplasia.

Finally, the set of unfavorable characteristics of ultra-processed foods is amplified by aggressive and sophisticated marketing that modifies social norms, especially among vulnerable consumers, such as children (MALLARINO et al., 2013). Many marketing strategies of these products rely on unfounded health claims. In low and middle-income countries, direct and targeted marketing at lower-income communities is quite frequent, which has helped the ultra-processed food industries — mostly transnational corporations — to quickly penetrate emerging markets.

FROM FOODS TO MEALS

In its recommendations on meals, the *Dietary Guidelines for the Brazilian Population* is based on the Brazilians evaluated in the 2008-2009 POF belonging to the lowest quintile of consumption of ultra-processed foods, that is, individuals whose consumption of natural or minimally processed foods and their culinary preparations correspond to at least 85% of the total food calories and present examples of meals reported in the 2008-2009 POF. These Brazilians come from both genders, from various age groups (from 10 years onwards), from the five major regions of the country, from the urban and rural areas, and from all income classes.

Among the Brazilians who base their diet in natural or minimally processed foods, the three main meals of the day (breakfast, lunch, and dinner) provide about 90% of the total calories consumed throughout the day.

In the selection of the examples, to meet their desirable regular consumption of vegetables — which represents only 1.4% of total calories —, lunches and dinners containing at least one of those foods were selected. On the other hand, red meats, consumed in excess (10% of calories), appear in only one-third of selected lunches and dinners (LOUZADA et al., 2015a).

Regarding a more diverse diet in terms of nutrients, taste, and presentation, the *Guideline* higlights the various combinations of techniques and dietary, culinary, and food history knowledge in order to guide the substitution between food types with similar nutritional composition and culinary use. In 2014, the Ministry of Health reissued the publication *Brazilian regional foods*, which is a great reference for stimulating the increase of variety, disseminating the various types of fruits, vegetables, legumes, tubers, cereals, and herbs in Brazil. It presents typical varieties in each of the five macroregions of the country and recipes of culinary preparations that use these foods, highlighting the richness of Brazilian food diversity (MINISTRY OF HEALTH, 2014d).

It should be noted that the meals proposed in the *Guideline* do not focus on the absolute amount of each food or the total amount of calories in meals. This omission is on purpose, since people's nutritional needs, particularly calories, vary greatly depending on age, gender, size (weight and height), and level of physical activity, and the fact that the *Guideline* has been directed to the general population, and not for health professionals.

5 | Modes of eating: the evidence on why they also matter

The *Dietary Guidelines for the Brazilian Population* innovates by considering in its recommendations the commensality and the modes of eating, understanding that characteristics such as time, attention, and company at the table are determinants for a healthy diet and for health (Chart 1). Moreover, the modes of eating structure social organization, influencing sociability and, ultimately, the pleasure of eating (MOREIRA, 2010).

CHART 1. The three recommendations on modes of eating and commensality according to the Dietary Guidelines for the Brazilian Population.

Eat with regularity and attention
Try eating your daily meals at similar times. Avoid snacking in the intervals between meals. Always eat slowly and enjoy what you are eating, without engaging in any other activity.
Eat in appropriate environments
Always try to eat in clean, comfortable, and quiet places, where there is no incentive to consume unlimited amounts of food.
Eat with company
Whenever possible, prefer to eat with the company of family, friends, coworkers or classmates. Also, try to share domestic activities that take place before and after the consumption of meals.

Regular meals favor the circadian rhythm, the functioning of the digestive and metabolic processes, and the maintenance of the energy balance (POT et al., 2016). Cross-sectional and longitudinal studies suggest that irregular meal patterns are related to a higher risk of metabolic syndrome and cardiovascular risk factors, such as overweight and high blood pressure (POT et al., 2016). In addition, randomized clinical trials have described that regular meal consumption for two weeks compared to an irregular meal pattern was associated with lower glycemic and insulin response, lower total and LDL cholesterol, and higher food thermic effects (FARSHCHI et al., 2004 e 2005). In night workers, it was observed that the irregular eating habits caused changes such as loss of appetite or obesity, and diseases of the digestive system (LENNERNAS et al., 1995; LASFARGUES et al., 1996).

Environmental distractions also affect the consumption of food and decrease the perception of satiety. Children and adolescents who watched television or used the computer or mobile during meals presented a less healthy diet, with higher consumption of ultra-processed foods (FELDMAN et al., 2007; DUBOIS et al., 2008; MAIS et al., 2018), lower consumption of fruits, vegetables and legumes (BOUTELLE et al., 2003), and higher risk of obesity (LIANG et al., 2009). Among Danish workers, the environment — determined by physical conditions, time available, social context, and mindful eating — was strongly and directly linked to meal satisfaction and the perception of satiety (HAUGAARD et al., 2016).

Several studies have described that dietary behavior may differ according to the place of the meal. Scagliusi et al. (2016) analyzed the opinions of Brazilian working mothers about the act of eating and identified the importance and different meanings attributed to the places where family meals were held. The table was identified as a very common arrangement, a maximum symbol of commensality, meaningful for the family union and linked to the sharing of personal values, the practice of manners, and the notion of hierarchy. Then, the use of the sofa was related to a casual, relaxed, and less rigid environment. Less frequently, the use of the bed was indicated as a symbol of illness.

In many high-income countries, the out-of-home consumption, when compared to home-made food, was associated with ingestion of food with low nutritional quality, high energy density, large portions, and high level of processing (GUTHRIE et al., 2002; TODD et al., 2010; COHEN and BHATIA, 2012). In Brazil, the scenario is a bit different. A study comparing the quality of meals at home, at work, and in commercial restaurants found that meals at the workplace had a lower energy density, higher fiber density, and greater inclusion of fruits, vegetables, and legumes compared to those at home. However, meals in commercial restaurants resulted in higher consumption of sugar and sweets, and oils and fats compared to home-made meals (BRANDONI et al., 2013).

The availability of foods also influences dietary choices. Children who lived in houses with greater availability of sugary drinks, for example, showed greater consumption of these foods and lower global quality of the diet. (SANTIAGO-TORRES et al., 2014). Similarly, the presence of fruits, vegetables, and legumes in the households incentivizes greater consumption of these foods by children and adolescents (RASMUSSEN et al., 2006). The consumption of water, in turn, was strongly influenced by its distance from the table where meals were eaten (ENGELL et al., 1996).

The presence of other people during the act of eating can also have a profound impact on food consumption. Eating with company has social and health benefits. Commensality satisfies a need for contact, strengthens social bonds and cultural identities, and improves nutritional conditions (SOBAL and NELSON, 2003). Although some studies suggest that commensality is losing ground in western families, this practice is still common in Brazil (MALTA et al., 2011b; SATO et al., 2016).

For children and adolescents, the frequency of family meals was associated with higher diet quality (NEUMARK-SZTAINER et al., 2004 and 2010; HAMMONS e FIESE, 2011; DALLACKER et al., 2018), lower occurrence of eating disorders and depressive symptoms (MUSICK and MEIER, 2012), as well as being a potential protective factor for obesity (VALDÉS et al., 2013; DALLACKER et al., 2018). Studies based on data from the National Survey of School Health, which evaluated a representative sample of Brazilian schoolchildren, showed that adolescents who used to have meals with their parents had a lower chance of tobacco, alcohol, and drug use (MALTA et al., 2011b) and better quality of food (AZEREDO et al., 2015).

Among adults, the frequency of family meals was directly related to a higher consumption of fruits, vegetables, and legumes, lower ingestion of sugary drinks and lower body mass index (BMI) (CHAN and SOBAL, 2011; SOBAL and HANSON, 2011; BERGE et al., 2012; LARSON et al., 2013). In the work environment, the sharing of meals was also associated with greater employee satisfaction (HAUGAARD et al., 2016) and organizational benefits (KNIFFIN et al., 2015).

In aging, eating alone is a widely recognized determinant of the increase in nutritional risk. Among the elderly, the sharing of meals was linked to better food quality, possibly due to an increase in food variety, in the time spent eating, and the interaction during meals (LOCHER et al., 2005; HAYS and ROBERTS, 2006; KIMURA et al., 2012).

The sharing of meals must go beyond the act of eating itself, involving the division of tasks related to food. Many women report that they do not always enjoy eating meals with their family (SATO et al., 2016). This lack of pleasure during eating may be related to the pressure and stress caused by the responsibility of preparing meals and the activities associated with it, such as the hygiene of utensils. The equitable participation of the whole family in the activities of planning meals, purchasing, preparing and serving food, and cleaning the utensils used provides well-being for all. The discussion of each gender's or family member's roles in domestic activities is a milestone in the *Guideline*'s position in the defense of women's rights.

6 | Recognizing obstacles to the adoption of the Guideline's recommendations

The feasibility of adopting the recommendations is critical for the success of dietary guidelines. In this sense, the Brazilian *Guideline* recognizes the existence of important obstacles to people's adherence to its recommendations (Chart 2).

In this chapter, we intend to discuss evidence that supports the six obstacles pointed out in the *Guideline* since the ways of overcoming themselves are dealt with in the *Guideline* itself.

CHART 2 The comprehension and the overcoming of obstacles, according to the Dietary Guidelines for the Brazilian Population (adapted text).

Information
There is a lot of information about food and health, but few are from reliable sources.
To have the *Guideline* as a reliable source of information and recommendations on proper and healthy eating.
It is very useful to discuss the Guideline's information and recommendations with family, friends, and colleagues.

(continues)

Offering
Ultra-processed foods are present everywhere, always followed by a lot of propaganda, discounts, and promotions, while natural or minimally processed foods are not always sold in places near people's homes.
Avoid purchasing food in places where only ultra-processed foods are sold and avoid eating in fast-food chains.
Whenever possible, make at least a part of your food purchases at markets, street markets, producer's markets and other locations, such as vegetable stands or food wholesalers, where natural or minimally processed foods are sold, including organic and agroecological based products.
If there are vehicles that go around the streets selling fruits, vegetables, and legumes purchased from central suppliers, buy from them.
Cost
In Brazil, although vegetables, legumes, and fruits may be priced higher than some ultra-processed foods, the total cost of a diet based on natural or minimally processed foods is still lower than the cost of a diet based on ultra-processed foods.
To reduce costs and save on the purchase of vegetables, legumes, and fruits, prefer varieties that are in the harvest because these will always have a lower price. Buy these foods in places where there are fewer intermediaries between the producer and the end consumer, such as vegetable stands of food wholesalers.
To reduce costs of out-of-home meals without giving up on natural or minimally processed foods, take food from home to work or eat in restaurants that offer self-service and pay-by-weight.
In addition, by acting collectively you can claim from the municipal authorities the installation of public equipment that sells natural or minimally processed foods at affordable prices and the creation of popular restaurants and communal kitchens.
Culinary skills
The weakening of the transmission of culinary skills between generations favors the consumption of ultra-processed foods.
If you have culinary skills, try to develop them and share them with the people with whom you live, especially children and young people, regardless of gender.
Value the act of cooking and stimulate people around you to do the same, particularly the younger.
Try to include the cuisine in the themes of your meetings or conversations with the population.
You can integrate civil society associations that seek to protect the cultural heritage represented by local culinary traditions.

(continues)

Time
For some people, the recommendations of the Guideline may imply dedicating more time to the food.
To reduce time spent in the acquisition and preparation of meals, plan the purchases, organize the pantry, set the menu of the week in advance, increase your domain of culinary skills, and make every family member share the responsibility for the domestic chores related to food.
To make time for regular meals, to eat without rush, to enjoy and share the pleasure of eating, re-evaluate the way you have been using your time and consider which other activities could make room for food.
Advertising
The advertising of ultra-processed foods dominates commercial food advertisements, often carries incorrect or incomplete information about food, and affects especially children and young people.
Parents and educators must make it clear to children that the role of advertising is essentially to increase products sales, not to inform or, even less, to educate people.
Know the Brazilian legislation that protects the consumers from advertising excesses practiced by companies. According to the Consumer Defense Code, it is illegal to mislead, whether transmitting false information or omitting information about the characteristics and properties of products and services. It is considered abusive any advertising that takes advantage of the child's judgment and experience. Public authorities, such as Procon, Public Prosecutor's Office, the Public Defender's Office, the Ministry of Justice and the Ministry of Education, may be called upon to take legal action whenever cases of non-compliance with the legislation are identified.

INFORMATION AND ADVERTISING

By typing the expression "healthy eating", Google finds more than 10 million results that direct the reader to the most varied pages and documents, including official publications of organizations such as the Ministry of Health and Pan American Health Organization (PAHO), scientific articles, articles in newspapers and magazines, posts on blogs, and even advertisements from health insurances and food brands. These results reflect the great volume of information about food, nutrition, and health of easy and fast access for anyone interested in the subject. Faced with this huge universe of available information, the key question is their quality, since information can be an obstacle to adequate and healthy food.

Even regarding the scientific production and dissemination, which is less accessible and palatable for most of the population, the published information should not be simply assimilated, without critical analysis. Thinking about obstacles to the population's adherence to the *Guideline*, it is pertinent to discuss the quality of the scientific production, since it can directly affect, by generating information, what is disseminated by the media. In this context, it is important to highlight the role of the ultra-processed food industry and the ingredients used in their production, such as sugar, in the financing of studies, researchers, research centers, and scientific events (BES-RASTROLLO et al., 2013; CANELLA et al., 2015b; KEARNS et al., 2016; NESTLE, 2016; BARLOW et al., 2018; LITMAN et al., 2018; SERÔDIO et al., 2018).

This type of financing, because it involves a conflict of interest, can influence the credibility and the results of studies or direct the focus of investigations (NESTLE, 2016). To illustrate this, two emblematic examples will be presented. In the first case, systematic reviews of the literature investigating the relationship between the consumption of sugary drinks and weight gain or obesity were evaluated, comparing the reviews with and without industry financing. It was found that studies with conflict of interests tended to show evidence of a lack of positive association between the consumption of sugary drinks and the studied outcomes, different from those that did not have industry financing (BES-RASTROLLO et al., 2013). In these cases, ultimately, the practice of financing the scientific production and dissemination can be used as a marketing strategy by the industry, which uses certain evidence to promote their products (NESTLE, 2016). The second case involves a study that discussed the role of the sugar industry in the studies of coronary diseases. The authors highlighted a literature review, published in the New England Journal of Medicine in the 1960s, about the relationship between coronary diseases and dietary factors, pointing to fat and cholesterol as dietary causes of the disease, underestimating the role of sugar. From the analysis of internal documents, reports, and statements from the Sugar Research Foundation (SRF), this foundation was identified as having defined the purpose of the review, contributing with articles to be included and receiving drafts of the final text; however, the financing and the role of SRF were not disseminated in the article. This review also influenced the course of subsequent studies and a series of nutritional recommendations (KEARNS et al., 2016). Recently, a study showed the conflict of interests in materials critical to the NOVA classification. The authors of the study evaluated 38 articles that criticized the classification and found that 32 of them bear signatures of authors and/or co-authors with a conflict of interest — explicit or camouflaged — with the production of ultra-processed foods (MIALON et al., 2018).

If in the context of scientific production not everything that is published, even in renowned magazines, is reliable, in a scenario of dissemination of information to the general population, of easy access and wide dissemination, reliability can be even smaller.

Concerning mass publication, some researches have been dedicated to investigating the dissemination of information about food. Studies that have evaluated mass-circulation magazines, directed to female adults of different income brackets, have found that food, nutrition, health, obesity, and weight loss content are very frequent and, although they try to rely on scientific legitimacy and seek support in health professionals, diverge from important evidence and recommendations of the area. In these magazines, the approach regarding food is often reduced to indicating nutrients and diets for weight loss or disseminating products that are designed to promote a spectacular, easy, and fast weight loss (TEO, 2010; PRADO et al., 2016). One of the studies observed, in one of the analyzed journals, carbohydrate-free sweet recipes that could compose an energy-restricted diet. However, when analyzing the recipes, they had in their composition wheat bran, oat bran or corn starch, which are sources of carbohydrate (PRADO et al., 2016). In addition to the fact that carbohydrates are important nutrients and are part of a healthy diet, such information misleads and confuses the reader.

In addition, the information scenario can, at times, be confused with advertising, since it is not uncommon for content published in mass media that are said to be informative to constitute, in fact, a veiled form of ultra-processed foods advertising.

Among the media that advertise food, television can still be considered the most significant, but the internet has been gaining significant ground among advertisers. Nevertheless, regardless of the media, a large portion of food advertising is targeted to children and young people (SOUZA, 2000; HAWKES, 2004; MARINS et al., 2011; HENRIQUES et al., 2012; BOYLAND and WHALEN, 2015).

The television advertisement for foods in Brazil was analyzed through more than 130 hours of programming from the four most popular television channels, based on the *Guideline*'s recommendations. It was found that food and beverage advertising represented 10% of total advertising, the third most advertised category. In this category, the ads were distributed as follows: 60.7% about ultra-processed foods, 31.9% about alcoholic beverages, and only 7.4% regarding natural or minimally processed foods and culinary ingredients. This scenario is opposed to what is recommended regarding food consumption in the *Guideline* and reinforces the relevance of food advertising regulation in the country (MAIA et al., 2017). A Brazilian study showed that the parents' television time was directly associated with the consumption of sugary drinks by children under two years of age, noting that the effect of advertising can cross generations in the same household (JAIME et al., 2017).

The analysis of advertising pieces in magazines and newspapers of national circulation shows that they stimulate a mindless consumption of the food advertised, with the target audience focused primarily on the female gender. It was also observed that they induced non-healthy practices, such as the replacement of meals with the advertised product, and they promised results related to aesthetics and health (MARINS et al., 2011). On the internet, ultra-processed foods advertising is extensively present in social media, such as Facebook, and in this context, the food industry employs several marketing strategies to stimulate the consumption of their products (HORTA et al., 2018).

The food advertising is an obstacle to the population's adherence to the *Guideline*'s recommendations since most of the food advertised is ultra-processed (BOYLAND and WHALEN, 2015; MAIA et al., 2017), influencing it's consumption. Several studies have consistently shown that exposure to food advertising results in more preference and increased consumption of ultra-processed foods, especially among children (HARRIS et al., 2009; BOYLAND and HALFORD, 2013; BOYLAND and WHALEN, 2015).

OFFERING AND COST

The access to healthy food may also be an obstacle in the adherence to the *Guideline*'s recommendations. In this context, two important dimensions of the food environment must be considered: the physical access and financial access. The first dimension refers to the adequacy of the offering (or availability of) healthy foods, which involves the presence and quantity of certain types of establishments, such as markets and restaurants, near houses and work and study places, for example; and the availability, variety, and quality of healthy food in these establishments. The second dimension relates to the cost of food to the population, both the price of healthy food itself and the comparison between the prices of healthy and unhealthy foods (CASPI et al., 2012).

Regarding the offering, there is an accumulation of evidence for the relationship between the food availability and consumption, especially fruits and vegetables (FRANCO et al., 2009; JAIME et al., 2011; CASPI et al., 2012; PESSOA et al., 2015; DURAN et al., 2016;

MAZIERO et al., 2017). Even if it is understood that fruits and vegetables are not the only healthy foods but should be integrated into a diet composed of natural or minimally processed foods and culinary ingredients, these foods can be identified as markers of a food environment that offers healthy food to the population.

In Belo Horizonte, MG, a higher consumption of fruits and vegetables was observed among subjects who lived in places with a higher density of street markets and vegetable stands. On the other hand, subjects who lived in areas with more bars and diners showed lower consumption of these foods (PESSOA et al., 2015).

A set of analyzes of the São Paulo Survey on the Obesogenic Environment (ESAO-SP) brings relevant results related to the availability and consumption of foods that reinforce the importance of the offering as an obstacle to the *Guideline*'s recommendations. It was verified that subjects who lived in areas with a low density (number of establishments/10,000 inhabitants) of supermarkets, street markets, and vegetable stands showed lower consumption of fruits and vegetables when compared to those who lived in areas with a higher density of these establishments. As a result, living near supermarkets, street markets and vegetable stands resulted in higher regular consumption of fruits and vegetables (DURAN et al., 2016). The practice of regularly attending full-service restaurants resulted in higher consumption of vegetables but not fruit, while regular attendance at fast-food restaurants was not associated with the consumption of these foods (MAZIERO et al., 2017). In terms of the availability of places to offer cooked meals, it was found that areas with greater circulation of people, evaluated by the density of the public transportation network, presented a higher density of restaurants, bars, and diners, as well as a greater density of fast-food like chains (CANELLA et al., 2015a), which basically offer ultra-processed foods.

Lastly, it was noted that subjects perceived their neighborhoods as favorable regarding the availability of ultra-processed foods and that convenience and price were facilitating aspects for their consumption (ALMEIDA et al., 2018).

As indicated in some way by the studies previously presented, the place where one purchases food may influence the type of food consumed. A study that used food purchase data, with national representativeness, showed that Brazilians buy most of the food in supermarkets (59.1% of total calories), followed by small markets (15.1% of total calories), street markets and vegetable stands (7.8%), and bakeries (7.7%). The largest share of ultra-processed food was purchased in supermarkets (60.4%) and small markets (15.4%), while the lowest consumption of ultra-processed foods was shown by households that had a purchase pattern characterized by the use of traditional retail outlets(street markets, small markets, small farmers, butcheries) (MACHADO et al., 2018).

In addition to the offering of ultra-processed foods, the supermarkets use several strategies to boost the sale of these foods, such as their location inside stores and shelves, the use of advertising, promotions and discounts, and even distribution of gifts (STANTON, 2015). This set of findings justifies the recommendation that people should try to purchase their food in places other than supermarkets.

Regarding cost, as highlighted by the *Guideline* and unlike what common sense points out, in Brazil a diet based on natural or minimally processed foods and culinary ingredients is no more expensive than that based on ultra-processed foods.

A study comparing data from Brazil and the United Kingdom on the cost (analyzed in the form of price/1,000 kcal) of food shows interesting results and differences between the two countries. The results suggested that most foods costed more in the UK than in Brazil, however, when the relative cost of ultra-processed foods was evaluated (in relation to other food groups: natural or minimally processed foods, culinary ingredients, and processed foods), the scenario changed. In the UK, the set of ultra-processed foods was 13% cheaper than the rest of purchased food, while in Brazil ultra-processed foods were 52% more expensive than other items (MOUBARAC et al., 2013a).

In a more in-depth analysis of the difference between the price of food groups in Brazil, the diet that combines natural or minimally processed foods and culinary ingredients (R$ 1.56/1,000 kcal) showed a lower average price than processed (R$ 3,88/1,000 kcal) and ultra-processed (R$ 2.26/1,000 kcal) foods. In the comparison between items in each food group, some natural or minimally processed foods (such as vegetables, fish, meats, and fruits) and processed foods tended to cost more than ultra-processed foods, however, foods such as rice and beans presented a low price. With the increase in family income, a higher price for food was observed, however, in general, in all income brackets, the price of a processed or ultra-processed food calorie was equal to the price of 1.5 calories of the whole of natural or minimally processed foods and culinary ingredients (CLARO et al., 2016).

Regarding the evolution of food prices, it is observed that in high-income countries, since the 1990s, the cost of healthy food seems to have increased more than the cost of non-healthy items. On one hand, the price of fruits and vegetables increased substantially and on the other, the price of ultra-processed foods such as cakes, cookies and bread, chocolate and snacks, ready meals, and ice cream presented a significant decrease in the period (WIGGINS et al., 215).

In Brazil, the price scenario is not as well defined in relation to the increase of natural or minimally processed foods and the decrease of ultra-processed foods costs. From 1980 to 2009 data referring to the cost of food for the population of São Paulo, SP, there was a substantial increase in the prices of baguette (271%), banana (235%), lettuce (203%), tomato (126%), biscuits (110%) and orange (108) and, at the same time, a decrease in the price of beans (-5%) and some increases for sausages (between 1 to 35% increase) (MONDINI et al., 2012).

As previously mentioned, supermarkets are responsible for the largest share of food purchased by Brazilians and also for the largest share of ultra-processed foods purchased (MACHADO et al., 2018). It is possible that this stems from the fact that average prices of foods and beverages purchased in supermarkets are 37% lower when compared to prices in other types of establishments that market food. By comparing the price of food groups according to the place of commercialization, the natural or minimally processed foods, culinary ingredients, and ultra-processed foods presented lower prices in supermarkets but processed foods were more expensive (MACHADO et al., 2017).

Regardless of the price differences between four food groups, it is possible to discuss, within the group of natural or minimally processed foods, the form of production: conventional, organic or agroecological. A study that collected data in five cities (São Paulo/SP, Alta Floresta/MT, Salvador/BA, Piracicaba/SP and Rio de Janeiro/RJ) and compared prices practiced in supermarkets, street markets (conventional and organic), and responsible consumption groups showed that the price difference is not only due to the production system but also to the establishment of commercialization of food. Among the foods studied (fruits, vegetables, and eggs), a higher average price was found for organic food purchased in supermarkets when compared to organic street markets and consumer groups, where 71% of the organic foods studied cost at least 50% more in supermarkets (RETIÈRE and IZIDORO, 2016).

Brazilian data show that a 1% decrease in the price of fruits and vegetables would result in a 0.8% increase in their share of total calories consumed and that the 1% increase in family income would increase of 0.3% in the share of these foods in total caloric intake (CLARO and MONTEIRO, 2010).

The data presented here reinforces that the price of food and financial access play a fundamental role in diet and can be barriers to the adherence to the *Guideline*.

CULINARY SKILLS AND TIME

The *Guideline* points out that the lack of culinary skills can be an obstacle to an adequate and healthy diet.

It is discussed in the literature the fact that we are going through a culinary transition, in which whole cultures experience fundamental changes in the types of skills necessary to purchase, prepare, and consume foods (LANG and CARAHER, 2001). It is possible that there is a weakening of both the transmission of culinary skills over generations and the value given to domestic cooking. This transition process is closely linked to the food practices of the populations. In countries such as Canada, United Kingdom, and United States, which have a high share of ultra-processed foods in their diets (47.7%, 56.8%, and 58.5, respectively), show a low share of culinary ingredients (6.1%, 4.2%, and 4.1%, respectively), which are crucial for preparing foods and meals, and about one third of the calories from natural or minimally processed foods consumed in these countries refers to foods that require little or no preparation (such as milk, yogurt, fruits, fruit juice, and nuts) (MOUBARAC et al., 2017; BARALDI et al., 2018; RAUBER et al.,2018).

In Brazil, although there has been a progressive increase in the consumption of ultra-processed foods since the 1980s, in the current scenario, 30% of total calories consumed still come from culinary ingredients and only about 15% of calories of natural or minimally processed foods come from foods that do not require preparation (MARTINS et al., 2013). From these data, it can be inferred that, unlike Canada, the United Kingdom, and the United States, which because of culinary skills have some difficulty in changing the type of food consumed, in Brazil, there still is the practice of cooking. This corroborates the *Guideline*'s orientation of transmitting culinary skills among generations so that they can be developed among children and young people and intensified among adults in order to promote adequate nutrition.

Indeed, the consumption of ultra-processed foods seems to be linked to culinary skills. In a review carried out with the inclusion of 11 cross-sectional studies dealing with home cooking, McGowan et al. (2017) found in seven of them an association between culinary skills and healthier food choices, such as increased consumption of fruits and vegetables and decreased consumption of convenience and takeaway foods, also affecting the improvement of the diet's nutritional quality. A study conducted in the United Kingdom evaluated the relationship between skills and behaviors related to home food preparation and consumption of ultra-processed foods. Confidence in using eight cooking techniques, trust in cooking 10 foods, the ability to prepare four types of meals and frequency of main meal preparation were assessed. The results showed that being confident with the preparation of the foods analyzed, being capable of baking cakes or cookies without help, and cooking the main meal at least five days a week resulted in a lower caloric share of ultra-processed foods in the diet. On the other hand, confidence in all preparation techniques studied was not related to the consumption of ultra-processed foods (LAM and ADAMS, 2017).

In the Brazilian context, a study correlated the culinary skills of parents and the consumption of ultra-processed foods by their children and, based on the use of an instrument that included culinary skills that facilitated adherence to the *Guideline*'s recommendations, there was an inverse association between the skills of the parents and the participation of ultra-processed foods in the children's diet (MARTINS, 2017).

Intervention studies have explored the relationship between the development or enhancement of culinary skills and food consumption. In Australia, the impact of a 10-week intervention program on cooking, conducted with subjects aged 18 years or older, was evaluated. The program focused on building positive attitudes and expanding knowledge, skills, and self-efficacy related to healthy eating, food, and cooking and aimed to ensure that people cooked fresh and healthy food quickly and easily. Among the results, it was detected that subjects submitted to the intervention showed a decrease in the weekly purchase of ready-to-eat and fast-food foods (HERBERT et al., 2014), i.e., ultra-processed.

Although culinary skills can be crucial for home cooking, it is recognized that this practice occurs not only due to being skilled or not. Determinants of cooking at home include issues of gender, time, personal relationships, and cultural and ethnic aspects (MILLS et al., 2017). The motivators for this practice go through the will or need to save money, familiarity with cooking techniques, and enough time to buy, cook and sanitize the utensils and the kitchen after meals (JONES et al., 2014).

Reasons for purchasing ultra-processed foods over meal preparation include lack of time (57%), family preferences, low self-efficacy, and lack of planning ability regarding food (HORNING et al., 2017). This proves that the culinary skills are important not only for the preparation of tasty and attractive meals but they are also useful to decrease the time of food preparation (HERBERT et al., 2014).

Time is a fundamental aspect for the population's adherence to the *Guideline*'s recommendations since it takes time for the selection, purchase, and storing of food, the pre-preparation, the preparation (seasoning and cooking), the presentation/assembly on the plate, the regular meal eating and eating in appropriate places, and the cleaning of utensils and the kitchen.

Indeed, the reports of lack of time and its reflex on people's diet are frequent, with emphasis on two central elements: the travel time, which "steals" the time that people could dedicate to other activities, and the division of chores in the household, that tends to be unequal, overloading one or a few people from the home, usually the woman.

An assessment of the evolution of travel time between home and work in the major Brazilian metropolitan areas (São Paulo, Rio de Janeiro, Belo Horizonte, Porto Alegre, Recife, Fortaleza, Salvador, Curitiba, Federal District and Belém) reveals a trend of deterioration in urban transport conditions since 1922, with an increase in travel time and an increase in the proportion of journeys over an hour. In 2009, the average time in metropolitan regions varied from 27.7 to 42.8 minutes of displacement per stretch (PEREIRA and SCHWANEN, 2013). Long journeys can negatively impact the planning of food purchases and the time that people dedicate to cooking and eating meals.

Regarding the division of chores, they predominantly refer to differences related to gender. According to data from 2016, the female gender dedicates 73% more time to domestic care and/or housework than the male gender, with 18.1 hours per week versus 10.5 hours per week, respectively. Considering the average number of hours combined between paid work and domestic care and/or housework, female subjects work 54.4 hours per week while male subjects work 51.5 hours per week. Still, for black or brown women living outside the urban centers of the South and Southeast regions, the scenario is even worse (IBGE, 2018): the data reveal that women reported as black or brown are heavily burdened in carrying out household activities, including cooking and other food-related activities. for people to dedicate enough time to food, it is necessary that the set of activities related to the preparation of meals is shared among the people living in the same house. Addressing time as an obstacle to healthy eating is of great importance, since the frequency and time dedicated to meal preparation have been associated with numerous positive results, such as better food quality, better nutritional status, and more pleasure in eating (LARSON et al., 2009; DUCROT et al., 2018; JONES, 2018).

7 | The *Dietary Guidelines for the Brazilian Population* and the potential repercussions for public policies

The challenges have just begun. Brazil is a country with about 200 million inhabitants and with huge differences and regional, social, and ethnical disparities. It is certainly a great challenge to make sure that the *Guideline* reaches people and that it contributes to the promotion of health with equity.

The *Guideline* recognizes that, although people have great responsibilities for their food choices, the adoption of the recommendations is far for being a simple individual decision and, in many cases, require public policies and regulatory actions by the State that make the environment more favorable to overcome the obstacles previously stated. In this sense, the Interministerial Chamber for Food and Nutrition Security (CAISAN) points out that the *Guideline*, besides being an instrument of food and nutritional education, can inform public policies involving other areas, not just health (CAISAN, 2015).

Primary health care, or primary care, organized through the Family Health Strategy (ESF), provides a privileged space for food and nutrition education practices and for the dissemination of the *Guidelines*. The ESF multidisciplinary team, the focus on actions to prevent diseases and promote health, the approach of life cycles, its work spread in the local territory and the possibility of carrying out activities in community groups and in homes favor the development of actions that are problematizing, dialogued, and integrated to the environment and which understand the determinants and respect the food choices. For this, the approach of food and nutrition in training and continuing education for the professionals, the matrix support, and the integration of different attention networks are fundamental. Jaime et al. (2018) developed and evaluated an education workshop protocol for the implementation of the *Dietary Guidelines for the Brazilian Population* for health professionals, considering its content valid and adequate to its purpose and with great potential for application in primary health care. In addition, the Nutrition Network from the Unified Health System (RedeNutri) providesan online course, free of charge. Still aiming to disseminate the *Guidelines*' content in primary care, the General Coordination of Food and Nutrition (CGAN) of the Ministry of Health has recently launched a set of support materials, available on its website (dab.saude.gov.br), which includes: educational videos, the *Pocket Dietary Guideline*[5] (its content in a reduced

5 Available in: <http://dab.saude.gov.br/portaldab/biblioteca.php?conteudo=publicacoes/guia_alimentar_bolso>. Accessed: Feb 13th 2019.

version), and the educational material "How's your food?"[6], which consist of a test to assess the adequacy of people's diet in relation to the recommendations.

The Guideline dialogues with all dimensions of the food system, including access to land, forms of food processing and distribution, individual choices, and waste disposal, with the implementation of its recommendations dependent on intersectoral actions. Its recommendations are strongly linked to the promotion of socially and environmentally sustainable food production and distribution systems, that is, preserving natural resources and biodiversity, valuing small farmers and traditional people and communities, and aiming at a fair distribution of land (OLIVEIRA and JAIME, 2016). Increasing funding, granting tax subsidies, and encouraging food purchases through public equipment can strengthen the production of natural or minimally processed foods and, consequently, facilitate their access by consumers. In Brazil, strategies such as the National Program of Strengthening of the Family Agriculture, the Food Acquisition Program and the Promotion of Rural Productive Activities Programme stimulate the generation of work and income in the countryside, strengthen local and regional distribution and marketing networks, and place value biodiversity and organic and agroecological production of food (HESPANHOL, 2013; SOUSA et al., 2015).

6 Available in: <http://dab.saude.gov.br/portaldab/teste _ alimentacao.php>. Accessed: Feb 13th 2019.

Easy access to places that market a variety of natural or minimally processed foods is also an important determinant of healthy eating. The street market stands out, a mode of the retail market, organized weekly, that takes place in open spaces and sells natural or minimally processed foods of agricultural origin. Programs to strengthen and qualify street markets by municipal governments can provide market opportunities with quick return and easy access to family farmers, as well as increasing the population's access to food produced in the region (SATO, 2007).

Regarding ultra-processed foods, the World Health Organization (WHO) recognizes the importance of tax policies that focus on certain foods in order to prevent the occurrence of chronic diseases (WHO, 2016). Studies indicate that taxing unhealthy food, such as soft drinks and high-energy snacks, is an effective and sustainable strategy to promote improved food quality and reduce the risk of obesity and cardiovascular diseases (EYLES et al., 2012; THOW et al., 2014; MOZAF- FARIAN et al., 2014). The Mexican government, in 2014 , began taxing soft drinks and other sugary drinks, and "non-essential foods with high energy density", called *comida chatarra* (junk food). The first results are quite encouraging, with a reduction in purchases of soft drinks and other sugary drinks and an increase in the purchase of water (COLCHERO et al., 2017; TAILLIE et al., 2017).

In Brazil, a study showed that the 1% increase in the price of sugary drinks would provoke a 0.85% decrease in consumption of calories from these drinks (CLARO et al., 2012). Nevertheless, the creation of taxation policies aimed at increasing the cost of ultra-processed foods in Brazil and throughout Latin America runs into policies that favor the uncontrolled opening of the market to food transnationals, the incentive of agrobusiness, and the food industry lobby.

As previously highlighted, another factor that may hinder the adoption of a healthy diet is exposure to unhealthy food advertising. Television and radio commercials, ads in newspapers and magazines, posts online, free samples of products, offering of gifts, discounts and promotions, setting the products in strategic places in the supermarkets, and in attractive packages are a few of the most frequent examples of the mechanisms adopted by food industries in the dissemination of their products. International organizations such as WHO (WHO, 2010) and the Pan American Health Organization (PAHO, 2011) strongly recommend that initiatives to reduce the consumption of ultra-processed food necessarily pass through the regulation of food advertising, since the inadequacy of self-regulation for this purpose is recognized (MAIA et al., 2017; HENRIQUES and VIVARTA, 2017).

The Child and Adolescent Statute and the Consumer Defense Statute, both from 1990, provide for the abusive character of advertising to the Brazilian children's public. In 2006, the Brazilian Health Regulatory Agency (Anvisa) published a proposal regulating the advertising of foods rich in sugar, sodium, and saturated and trans fats. The final document was prepared with broad participation of the company and the text was published on June 15, 2012. The resolution, however, was contested judicially by different sectors and associations (most related to the food industry) and was suspended by the Federal Public Prosecutor (JAIME et al., 2013).

In March 2014, the National Council for the Rights of Children and Adolescents approved the Resolution nº 163, which considers abusive the advertising and marketing communication aimed at children up to 12 years of age. The rule states that it is abusive to practice directing advertising and marketing communication to the child with the intention of persuading them to consume any product or service. The practical implications of existing legislation, however, require greater government effort to enforce them (CONANDA, 2014).

The nutritional labeling of foods is a central instrument for guaranteeing the right to information, strengthening consumer analysis and decision-making capacity (MINISTERIO DE SALUD, 2012). However, recent studies indicate that nutritional labeling is inadequate and fails to provide useful information (LIMA, 2014). In Brazil, current food labeling regulations favor the view of foods only from their nutrient content and ignore other dimensions of health. In addition, they allow the excessive use of technical language and that the communication effects on the packaging are modulated by industries through competitive graphics capable of reducing the benefits of mandatory information. The expanded approach of healthy eating, simplification of messages, focus on product's ingredients (rather than nutrients), and the communication resources to indicate nutrient content are potential strategies to increase label effectiveness as an instrument for health promotion (LIMA, 2014).

Recently, Chile has approved an innovative regulation for the food labeling law. Among its strategies, there is a requirement for visible labels alerting the public to foods considered unhealthy by the Chilean Ministry of Health. Messages such as "high in sugar" or "high in salt" appear on the front of the labels (CORVALÁN et al., 2013). The measure has been well accepted and has influenced the purchase profile of the Chilean population (MINISTERIO DE SALUD, 2017). In Brazil, Anvisa has been discussing changes in food labeling, with a proposal to adopt a front-of-pack labeling model (ANVISA, 2017). A study comparing warning labels with labels designating the colors of the traffic light found that for the adults involved in the study, the warning labels increased the ability to understand the excess of nutrients harmful to health and correctly identify healthier products (KHANDPUR et al., 2018). Organizational environments are privileged spaces for the implementation of the *Guidelines*. Concrete evidence shows the effectiveness of school interventions for the promotion of healthy eating and physical activities (LOBELO et al., 2013). Actions that guarantee children's access to meals based on natural or minimally processed foods restricting the supply of ultra-processed foods and promoting commensality and healthy modes of eating have a potentially protective effect against chronic noncommunicable diseases (CNCDs). Among these actions are the establishment of guidelines for national school feeding programs, the regulation of food sold in schools and other public places, the ban of food marketing in the school environment, and the implementation of food and nutritional education actions.

The Brazilian National School Feeding Program has made great strides in this direction and, today, its guidelines encourage the implementation of food and nutritional education actions, 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 agriculture, integrating various sectors of the government (JAIME et al., 2013; HAWKES et al., 2016). A study shows that the consumption of school food positively affects the overall diet quality of schoolchildren, with increased consumption of healthy foods and reduced consumption of ultra-processed foods (LOCATELLI et al., 2018).

Another important action aimed at children is the School Health Program (PSE), a joint initiative of the Ministries of Health and Education with the aim of providing comprehensive health care (preventing, promotion, and care) to public school students (JAIME et al., 2013). The PSE provides joint activities between professionals from Family Health Teams and education professionals and is an excellent opportunity for the implementation of the *Guidelines*. In 2018, the Ministry of Health has launched a series of educational books for primary and secondary school teachers and PSE health professionals, whose objective is to subsidize the discussion about adequate and healthy food in the school environment, establishing relationships with different aspects of the curricular parameters and valuing the transversality of the subject diet (MINISTRY OF HEALTH, 2018a and 2018b).

In the scope of the federal government, two ordinances that focus on the promotion of an adequate and healthy diet in the work environment deserve to be highlighted. The first, from the Ministry of Health, uses the *Guideline*'s recommendations to define the type of food that may exist during events performed by the agency. It has as one of its strategies the prohibition of direct sales, promotion, publicity or advertising of ultra-processed foods with excessive amounts of sugar, fat, and sodium. In relation to commensality, it encourages the creation of dining rooms equipped with tables and chairs, and places and equipment for temporary storage and preparation of food brought by the servers (MINISTRY OF HEALTH, 2016). The ordinance of the Ministry of Planning, Development and Management focuses on the other workplaces of the federal public service and was also based on the *Guideline*. The provision of adequate spaces for healthy meals and the implementation of food and nutritional education actions are among the planned strategies. It also provides that restaurants or diners present in institutional premises avoid the offering of ultra-processed foods (MINISTRY OF PLANNING, DEVELOPMENT AND MANAGEMENT, 2016).

Similar actions may be considered for other organizational environments, whether public or private, such as detention centers, shelters, long-term care facilities for the elderly, universities, hospitals and similar equipment, as well as general workplaces.

Considering that the negative impacts of the ultra-processed foods are global and interconnected, isolated initiatives are smaller in scope, and more susceptible to lobbying, litigation, and commercial embargoes. Therefore, some scholars propose, as an example of the great advances obtained with tobacco control, an international pact in the public health sector to promote healthy eating (SILVER, 2015).

Strategies used to prevent different risk factors for chronic noncommunicable diseases (CNCDs) caused by the excessive consumption of alcohol and tobacco may also be effective in relation to ultra-processed foods, since there are common characteristics, such as composition, packaging, labeling or size, prices, places in which they are marketed or consumed, how they are promoted, and their economic impact (SILVER, 2015).

In 2014, the nongovernmental organization Consumers International launched a campaign to press WHO to approve the creation of a *Global Convention to protect and promote healthy diets* and published a draft with the possible guidelines. The discussion of the proposal, which is still in progress, could lead to progress in global health (CONSUMERS INTERNATIONAL, 2014).

The Brazilian *Guidelines* had great national and international repercussions, receiving praise from renowned experts in the field of nutrition. In her blog *Food Politics*, Marion Nestle, a professor at New York University, said that "The guidelines are remarkable in that they are based on foods that Brazilians of all social classes eat every day, and consider the social, cultural, economic and environmental implications of food choices". Michael Pollan, professor at University of California, in Berkeley, and author of books such as *The Omnivore's Dilemma* (2007), *In Defense of Food: An Eater's Manifesto* (2008) and *Cooked: A Natural History of Transformation* (2014), said that the "Nation's revolutionary dietary guidelines are based on foods, food patterns, and meals, not nutrients". Digital magazine *Vox* even said that "Brazil has the best nutritional guidelines in the world". In November 2016, the *Dietary Guidelines for the Uruguayan Population* (*Guía alimentaria para la población uruguaya*) was published, whose principles and recommendations, which seek to promote a healthy, shared, and enjoyable diet, have been inspired by the Brazilian guidelines (MINISTERIO DE LA SALUD, 2016).

The year 2019 began by bringing a great defeat to the policies of promoting healthy eating in Brazil with the publication of provisional measure nº 870, which extinguished the National Council on Food and Nutrition Security (CONSEA). CONSEA has defended the sociocultural dimension of food and appreciation of a fair, healthy, and sustainable food system and has broadly and openly supported the publication, dissemination, and development of the *Dietary Guidelines for the Brazilian Population*. Its abolishment compromises the continuity and improvement of the National Policy on Food and Nutrition and, therefore, weakens the intersectoral articulation of the *Guideline* and its transcendence of the health sector.

Nevertheless, the principles, development method, evidence, and orientation of the *Dietary Guidelines for the Brazilian Population* can serve as an example and inspire the development of other dietary guidelines and public policies while promoting to the global healthy eating agenda.

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