Review

Current policies in Brazil for ensuring nutritional quality

Jane Mara Block*, Adriana Pavesi Arisseto-Bragotto** and Maria Manuela Camino Feltes*

*Department of Food Science and Technology, Federal University of Santa Catarina - UFSC, Florianópolis, and **Department of Food Science, State University of Campinas - UNICAMP, Rua Monteiro Lobato, Campinas, São Paulo, Brazil

Correspondence to: Jane Mara Block, Department of Food Science and Technology, Federal University of Santa Catarina - UFSC, Rodovia Admar Gonzaga, 1346, Florianópolis, Santa Catarina 88034-001, Brazil. E-mail: janeblock@gmail.com

Received 23 May 2017; Revised 4 July 2017; Editorial decision 25 July 2017.

Abstract

Objectives: In this work the current policies and regulatory actions of the government agencies in Brazil for ensuring nutritional quality are discussed.

Material and methods: Information on the efforts of industry, academia and nongovernmental organizations to achieve the proposed goals, the results achieved and the challenges that must still be faced by the different sectors of the Brazilian society are presented and discussed.

Results: The joint action of regulatory agencies, the food production sector, non-governmental entities and academia resulted in the reduction of saturated and trans fats, salt and sugar in foods produced in Brazil.

Limitations: Most of the information related to the food industries in Brazil is made available by ABIA (Brazilian Association of Food Industries) which represents around 60% of the food market in Brazil. Information regarding the rest of the market is limited.

Conclusions: The reduction of saturated and ‘trans’ fats, sodium, and sugar in industrialized foods seems an effective strategy for reducing the intake of these compounds by the Brazilian population. In addition the adequate nutrition labeling and consumer education will allow healthier food choices by the population.

Key words: Brazilian food industry; healthy foods; ‘trans’ fats; salt; sugar.

Introduction

In the last decades, a decrease has been reported in the consumption of traditional foods of the Brazilian diet and unprocessed foods such as cereals, legumes, fruits, and vegetables. On the other hand, for the same period, an increase in the consumption of processed foods with high amounts of fat, sugar, and sodium has been observed, as well as the consumption outside the home (IBGE, 2010).

Changes in eating habits and the sedentary lifestyle of the Brazilian population caused an increase in overweight individuals and obesity and a decrease in the incidence of malnutrition. Between 1974 and 2009, the overweight in the adult male and female population increased from 18.5% to 50.1% and from 28.7% to 48%, respectively. Among children and teenagers aged 10 to 19 years, an increase in overweight from 3.7% to 21.7% in males and from 7.6% to 19.4% in females was observed. In 2009, one in three children aged five to nine years was overweight, and 16.6% of boys and 11.8% of girls were obese. In addition to obesity, an increase in other non-transmissible chronic diseases (NCDs) such as cardiovascular diseases, diabetes, and cancer has been observed and such diseases became the leading cause of death in Brazil (IBGE, 2011).

The relationship between diet and population health has been established and it is well known. The World Health Organization (WHO) through the Global Strategy on Healthy Eating, Physical Activity and Health establishes guidelines and strategies of action for...
The relationship between diet and chronic non-communicable diseases

Cardiovascular disease, diabetes, cancer, and respiratory diseases are NCDs that account for more than 50% of all deaths annually, which corresponds to 63% of the total deaths worldwide (WHO/PAHO, 2005; Alwan et al., 2010; Malta et al., 2011). About 80% of these deaths occur in low- and middle-income countries (LMIC) and 29% in people under 60 years of age (WHO, 2014). It is estimated that by 2020, chronic diseases will account for 75% of deaths worldwide and 60% of them will occur in developing countries (O’Neil and Nicklas, 2007).

Diseases of the circulatory system (31.3%), cancer (16.3%), diabetes (5.2%), and chronic respiratory disease (5.8%) account for 72% of the causes of deaths each year in Brazil. Individuals of all socioeconomic strata are affected and most of them belong to vulnerable groups such as the elderly and people with low education and income (Malta et al., 2011).

The NCDs are also the cause of a large number of premature deaths in LMIC. Between, 10% and 15% of such deaths could be avoided successfully by implementing preventive measures, including changes in the diet (‘trans’ fats, salt, and sugar reduction); tobacco and alcohol control; and drug therapy for cardiovascular disease. Hyperlipidemia, hypertension, high levels of blood glucose, overweight, and obesity are the main factors affected by diet, which result in chronic diseases (WHO, 2003, 2014).

The international health policies and strategies within the United Nations are coordinated by WHO. The primary role of the agency is the proposal of plans and programs with well-defined goals and deadlines, as well the coordination of the efforts of multiple sectors of the government and partners such as the private sector, academia, and civil society organizations (WHO, 2017a).

The sedentary lifestyle (only 15% of the population practice physical activity associated with leisure) and diet (only 18.2% of the adult population usually have five servings of fruit and vegetables on five or more days per week) are risk factors for the increase of the NCDs in Brazil. On the other hand, 34% of the population consume foods with high fat content and 28% consume soft drinks five or more days a week. As a result of this lifestyle in the last 10 years, the prevalence of obesity increased from 11.8% (2006) to 18.9% (2016), reaching almost one in five Brazilians. The prevalence of overweight reaches more than 50% of the adult population (BRAZIL. Ministry of Health. Vigíl Val Brazil, 2016). The eating habits of the majority of the Brazilian population have placed the country fifth in the world for the obesity levels, behind USA, China, India, and Russia (Ng et al., 2014). The increase in the obesity rates is related with the improvement of the purchasing power of the population. The consumption of a large quantity of industrialized foods of high energy density and low nutritional value has been associated with low education (Cabral et al., 2013).

Brazilian government’s policies for nutritional quality of foods

The healthy diet, physical activity, and the prevention of tobacco and alcohol use are the priority actions of the National Policy on Health Promotion, which was approved in Brazil in 2006. Actions related to healthy eating for 2006–2007 included promotion of healthy eating for all sectors of Brazilian society and in the school environment. Educational materials were produced and distributed such as the Food Guide for the Brazilian Population; Ten Steps to Healthy Eating for Diabetics and Hypertensives; Basic Attention Notebooks on Obesity Prevention and Treatment; Guidelines for Healthy Eating for the Elderly; and Ten Steps to Healthy Eating at School. The benefits of breastfeeding as well as information on food labeling have also been disseminated through the media campaigns and distribution of educational material (BRAZIL. Ministry of Health, 2010).

The main recommendations of The Food Guide for the Brazilian Population are:

1) The diet should be based on a wide variety of fresh or minimally processed foods of vegetable origin;
2) oils, fats, salt, and sugar should be used in small quantities in culinary preparations;
3) processed foods (canned food preserved in salt and/or vinegar; fruits preserved in sugar; meat and fish preserved in salt or oil; cheeses and breads) should be consumed in small quantities as ingredients of culinary preparations or as part of fresh or minimally processed-based meals;
4) processed foods, such as filled cookies and snacks should be avoided because they are not nutritionally balanced.

In addition, food and nutritional surveillance actions for the prevention and control of diseases caused by poor diet include the monitoring of the food consumption and nutritional status of the Brazilian population every 5 years; prevention of micronutrient deficiencies through iron supplementation for pregnant women and children and administration of mega doses of vitamin A for puerperal and children in endemic areas; surveys of risk factors for NCDs in the general population every 5 years and for schoolchildren every 2 years, as provided in the Ministry of Health’s National Agenda for Surveillance of Diseases and Noncommunicable Diseases; monitoring the sodium content of processed products, in partnership with ANVISA and sanitary surveillance agencies in states and municipalities, and strengthening mechanisms for regulating, controlling and reducing the use of pesticides and other forms of food contamination (BRAZIL. Ministry of Health, 2010).

The reformulation of processed foods in Brazil has been included in ‘The Ministry of Health’s Multi-Year Plan of Action for 2012–2015’ (BRAZIL. Ministry of Health, 2013a), as well as in the ‘National Plan for Coping with NCDs (2011–2022)’ (BRAZIL. Ministry of Health, 2011c). The plan for the period 2011–2020 aims to develop and implement public policies for the prevention and control of major NCDs. The proposed goal is the reduction of premature mortality through the control of the risk factors (smoking, harmful alcohol consumption, physical inactivity, inadequate diet, and obesity). The main planned actions for this period are the creation of the National School Meal Program (Programa Nacional de Alimentação Escolar—PNAE); supply of healthy food through partnerships and agreements with civil society (family farmers, small associations, and others) in order to increase the production and supply of fresh food; support the intersectoral initiatives to increase the production, supply, and consumption of basic and minimally processed food; regulate the nutritional composition of processed foods, mainly salt and sugar; stimulate the consumption of fruits and vegetables through fiscal actions and incentives (i.e. reduction of taxes, fees, and subsidies) for the reduction of prices; control and prevent obesity in childhood and adolescence through an intersectoral plan; reduce the prevalence of obesity in adults, and the regulation of food advertising, especially those for children. The strategies for promoting a healthy diet in Brazil involve different sectors of society such as MS, ANVISA, ABIA (Brazilian Association of Food Industries - Associação Brasileira das Indústrias de Alimentação), non-governmental civil entities, and academia. An important agreement between the Ministry of Health and ABIA representative associations of the food industry was held in 2007 and renewed in 2010 to reduce the content of ‘trans’ fats, salt, and sugar in processed foods (BRAZIL. Ministry of Health, 2007). In 2007 and 2008, the saturated and ‘trans’ fats, sodium, and sugar in processed foods consumed in Brazil was monitored by the National Institute of Health Quality Control (Instituto Nacional de Controle de Qualidade em Saúde—INCQS) in partnership with the General Food Management from ANVISA (Gerência-Geral de Alimentos—GGALI/ANVISA) and the General Coordination of the Food and Nutrition Policy of the Ministry of Health (Coordenação Geral da Política de Alimentação e Nutrição do Ministério da Saúde—CGPAN/MS). The results helped the discussion between the governmental agencies, nongovernmental entities, ABIA, and academia, to establish an agenda for the reduction of these compounds in processed foods.

The regulation of food labeling has been mandatory in Brazil since 2003 (ANVISA, 2003a and 2003b) and harmonized in the scope of Mercosur. It follows The Global Strategy on Diet, Physical Activity and Health which emphasizes that the standardized, correct, and understandable nutritional information allow healthier choices for the consumers. The actions that have already been taken related to the nutritional quality and food labeling in Brazil, the established goals and also the challenges that must be faced for the regulatory agencies, food companies, and society will be discussed below.

Government policies in Brazil to reduce saturated and ‘trans’ fats
Between 1980 and 2014, the prevalence of obesity more than doubled over the world. Between the world’s adult population, 13% (11% of men and 15% of women) were obese and 39% (38% of men and 40% of women) were overweight. The obesity and overweight between children and adolescents have increased as well (WHO, 2016). It has been reported that in 2010 overweight and obesity accounted for 3.4 million deaths worldwide (Ng et al., 2014). The risks for heart diseases, stroke, and diabetes increase consistently with the weight gain, and a high body mass index also increases the risks for certain types of cancer (Shaper et al., 1997; WHO, 2016), and it has been reported that in 2010 overweight and obesity accounted for 3.4 million deaths worldwide (Ng et al., 2014).

de Souza et al. (2015), after a systematic review and meta-analysis reported associations of saturated fat and/or ‘trans’ unsaturated fat (total, industrially manufactured, or from ruminant animals) with CHD/CVD mortality, total CHD, ischemic stroke, or type 2 diabetes. They concluded that saturated fats are not associated with all causes of mortality, CVD, CHD, ischemic stroke, or type 2 diabetes. On the other hand, ‘trans’ fats are associated with all causes of mortality, total CHD, and CHD mortality. The scientific evidence associating the high consumption of ‘trans’ and saturated fat with increasing risk for cardiac diseases and diabetes has caused concern in government health agencies around the world. The WHO and FAO published a report on Diet, Nutrition, and Chronic Disease Prevention in 2003 recommending that the consumption of ‘trans’ fat should be less than 1% of the total daily energy calories (maximum 2 g/day for a 2000 kcal diet) (WHO, 2003a).

The World Health Assembly in 2004 endorsed the Global Strategy on Healthy Eating, Physical Activity and Health and proposed that the elimination of ‘trans’ fats should be considered a priority worldwide. The “‘Trans’ Fat Free Americas” was a program established in 2008 (WHO/PAHO, 2007, 2008). According to the goal, ‘trans’ fats could not be present in amounts greater than 2% of total fats in oils and margarines and 5% of total fats in processed foods.

The impact of eliminating or reducing dietary ‘trans’ fat from processed foods has been reported by different research groups and indicated considerable reductions in heart diseases. It is estimated that in the Americas, excluding the United States and Canada, a reduction in daily ‘trans’ fat consumption of 4.5 and 9 g would lead to the prevention of 30 000 to 130 000 and 62 000 to 225 000 cases of coronary heart disease, respectively (BRAZIL. Ministry of Health, 2007). Rubinstein et al. (2015) estimated that in Argentina, with the elimination of ‘trans’ fat from diet, 1517 deaths, 5373 acute coronary heart disease (CHD) events, and 26 394 disability-adjusted life years (DALYs) would be prevented per year and, in addition US $87 million would be saved.
The first regulatory action in Brazil regarding the ‘trans’ fats was implemented in 2003 when the declaration of their content in food became mandatory from July 2006 (BRAZIL, 2005). An extension of the deadline was requested by the food companies and this date was later extended to January 2007. Since then the ‘trans’ fatty acids should be listed as ‘“trans” fat’ on a separate line under the listing of saturated fat in the nutrition label. ‘Trans’ fat content must be expressed as grams per serving when its content is higher than 0.2 g. The claim ‘“trans” free’ or ‘0% of “trans” fat’ can be used if a serving contains less than 0.2 g and the content, when declared, must be expressed as ‘0 g’.

The discussion on public policies and implementation of changes in the production processes of oils and fats and also in food formulations started after this regulatory action. In 2007, the ABIA sponsored a workshop on ‘trans’ fats in the city of São Paulo. The event was supported by the International Life Sciences Institute (ILSI-Brazil) and the Brazilian Society of Oils and Fats (Sociedade Brasileira de Óleos e Gorduras—SBOG). The presence of ‘trans’ fats in food, regulatory policies adopted in other countries, and different points of view, from industry, government, and universities, have been widely discussed at this event.

In November of the same year, the ‘1st Healthy Eating Forum’ (Fórum da Alimentação Saudável) was held in Rio de Janeiro and important joint actions were developed between the partner agencies: the Ministry of Health, ABIA, and the National Health Surveillance Agency (ANVISA). A technical cooperation agreement to elaborate a national plan of healthy life, covering aspects of healthy eating, physical activity and nutritional education, and the gradual reduction of ‘trans’ and saturated fats in processed food as well as sugar and sodium, was defined as a priority action (BRAZIL. Ministry of Health, 2007).

The ‘2nd Healthy Eating Forum’ was held in 2008 in São Paulo and alternatives for replacing the ‘trans’ fats, the difficulties, the exceptions, and the necessary timeframes to reach the established goal were discussed. An agreement between the MS and ABIA established a 2-year deadline for the reduction of ‘trans’ fat in processed foods taking into account the limit recommended by the PAHO and WHO (no more than 5% of ‘trans’ fat in processed food and no more than 2% in oils and margarines).

The ‘3rd Healthy Eating Forum’ took place in Brasilia in 2010. At that time, the main difficulties encountered in reaching the PAHO target were discussed. The results obtained by 135 ABIA-associated industries for the reduction of the ‘trans’ fat content of 12 categories of processed foods also were presented. ABIA reported that 93.4% of the ABIA-associated industries reached the goal established by PAHO. These results represented a reduction of 230 thousand tons of ‘trans’ fats in processed products produced and marketed in Brazil in 2009 (ABIA, 2010). For the snack segment, the target was reached in 100% of the products (77% of the Brazilian market); for noodles in 100% of the products (90% of the Brazilian market); for oils in 96% of the products (65.9% of the Brazilian market); for ready dishes in 91.7% (90.7% of the Brazilian market); and for the biscuit segment in 87.7% of the products (60.9% of the Brazilian market).

The agreement between ANVISA and ABIA was extended with the objective of achieving 100% of ‘trans’ fat reduction in processed foods specially for those categories that showed less expressive results, such as margarines and vegetable creams, cakes, and biscuits. After the agreement, a decrease of 309 thousand tons of ‘trans’ fats in food marketed in Brazil in 2015 was reported (ABIA, 2016). Figure 1 shows the timeline for the regulatory action in Brazil regarding the ‘trans’ fats.

**Government policies in Brazil to reduce salt**

Sodium is an essential nutrient in our diet that is absorbed and excreted by the kidneys. The active and continuous transport of these ions through the cellular membranes is made by the sodium and potassium pump which increases the concentration of sodium ions (Na+) outside the cell and potassium ions (K+) inside the cell. This process, which occurs against the concentration gradient, is performed by a carrier protein present on the plasma membrane. Active and continuous transport of sodium and potassium maintain the electrical gradients across cell membranes, which is necessary for several physiological functions such as nerve impulse transmission and muscular contraction, and constant and regulated exchange of nutrients such as amino acids and sugars into the cell. An adequate

![Figure 1](https://example.com/figure1.png)

*Figure 1* Timeline for the regulatory action in Brazil regarding the ‘trans’ fats.
concentration of potassium in the intracellular environment is important for protein synthesis and respiration and the pumping of sodium out of the cell is related with the maintenance of the osmotic balance. The cell volume stability and the concentration of water in the intracellular medium are also maintained through this transport. Low and moderate sodium intakes cause the aldosterone hormone to act on the kidneys to conserve sodium, which are needed for body functions (Bazanelli and Cuppari, 2009; Erulkar and Lentz, 2017).

Sodium has the important function of maintaining the osmotic balance of cells and regulates the volume of bodily fluids like blood, in addition to acting in the normal functioning of muscles and nerves. (Bazanelli & Cuppari, 2009). On the other hand, it is well established that high amounts of sodium in the diet can lead to increased blood pressure, a common risk factor for circulatory diseases such as heart disease and stroke (Cappuccio, 2013, He et al., 2013; Brown et al., 2009). These diseases accounted for 15 million deaths in 2015 which represents 54% of the total deaths in the world (WHO, 2017b and 2017c).

It is estimated that 1 billion people are hypertensive in the world, which accounts for around 7.1 million deaths a year, equivalent to 12.8% of the total (Pickering et al., 2008). The prevalence of high blood pressure is generally lower in the high-income population (Abegunde et al., 2007).

Among the countries in Europe, Germany is the one with the highest rate of hypertension in the population over 18 years (55%), followed by Spain (40%) and Italy (38%) (Sharma et al., 2004; Márquez et al., 2007). In Brazil, systemic arterial hypertension affects between 22% and 44% of the adult population (32% on average). It can reach 50% in individuals between 60 and 69 years and 75% in those over 70 years old, and accounted for 3.7% of all these deaths (Nilson et al., 2012; BRAZIL. Ministry of Health, 2013b). The circulatory system diseases accounted to 29.4% of all registered deaths in Brazil in 2007.

An excessive amount of sodium intake has been also associated with obesity, renal stones, stomach cancer, and osteoporosis (Dickinson and Havas, 2007; He and Macgregor, 2009). On the other hand, a lower sodium intake has been associated with a reduced risk of stroke and fatal coronary heart disease in adults indicating that most people could benefit from reducing sodium intake (Cook et al. 2007). There is a consensus among different international health organizations that sodium intake must be less than 1500 mg of sodium per day and not more than 2300 mg (approximately 6000 mg of salt) (AHA, 2017; USDA, 2017).

Most of the sodium in the diet comes from salt whose main component is sodium chloride, composed of 40% sodium and 60% chloride. Salt in Brazil is still enriched with iodine in order to prevent thyroid-related diseases and promote proper neurodevelopmental in children during gestation. The estimated level of global sodium intake in 2010 was above the recommended maximum level by different international health organizations, ranging from 2300 to 4600 mg/day (Brown et al., 2009; WHO, 2013).

Several countries such as Japan (1960–1970), Finland (1975 onwards), and more recently United Kingdom have adopted policies and regulatory actions in order to reduce the salt intake by the population. In America, health agencies in Canada, USA, and Brazil are also prioritizing public and regulatory policies for reducing dietary sodium intake (Cappuccio et al., 2011). The established goal by PAHO for the region is the consumption of less than 2000 mg per person per day (equivalent to 5g of salt) by 2020 (PAHO, 2010).

The PAHO recommendation is also present in the Food Guide for the Brazilian Population (2014). The estimated consumption of salt in the different regions of Brazil is between 9.7 and 13.8 g per day (11.75 average or 4700 mg of sodium) (IBGE, 2010). It represents more than the double of the maximum recommendation made by the health agencies. The consumption of sodium is mainly from added amounts during the processing and preparation of food. Figure 2 shows the daily consumption of salt, the amount coming from processed foods, and the contribution of these foods for salt consumption by the Brazilian population. Between 2002 and 2003, the added salt and salt-based condiments were the main sources of dietary sodium (76.2%) followed by processed food with added salt (15.8%); processed or unprocessed food without added salt (6.6%); and ready-to-eat meals (1.4%). The consumption of different categories of food was different according to the economic power and location of the residences. The consumption of processed food was higher in households with higher purchasing power located in urban areas.

The ABIA (2015a) reported that 71.5% of the sodium intake by the Brazilian population between 2008 and 2009 has been added salt. Processed foods, French bread, ‘in natura’ foods, and semi-processed foods accounted for 33%, 23%, and 3% of the sodium consumption, respectively. The reported daily consumption of sodium was 4.46 g, corresponding to 11.38 g of salt and the processed and semi-processed food accounted for 23.8% of the total consumption (1.06 g of sodium and 2.71 g of salt). The highest sodium consumption was observed for the Northern region (13.80 g of salt) followed by Center-West (5.26 g); South (3.06 g); the Northeast (4.47 g); and Southeast (3.8 g). The salt consumption reported by ABIA is in agreement with IBGE (2010). Molina et al. (2003) reported for the population of Vitória, capital of Espírito

![Figure 2](https://academic.oup.com/fqs/article-abstract/1/4/275/4735148/fig2)

**Figure 2** Daily consumption of salt for different regions in Brazil (adapted from ABIA, 2015).
Santo state, an average consumption of 12.6 ± 5.8 g of salt/person with added salt accounting with 52.3% of total consumption. de Moura Souza et al. (2013) estimated a mean daily intake of sodium of 3190 mg/day in Brazil in 2008–2009. Sodium consumption was higher among male subjects and decreased with age among female.

The population education for the use of less salt in prepared foods as well as added salt to foods already prepared (table salt) are necessary to reduce the consumption of sodium. It also requires a large reduction in the consumption of processed foods with a high density of sodium such as chips, smoked, and canned products.

The reduction of the amount of sodium in industrialized foods in Brazil has been discussed by the Food Sector Chamber (Câmara Setorial de Alimentos—CSA) from ANVISA, the General Coordination of Food and Nutrition (Coordenação-Geral de Alimentação e Nutrição—CGAN/MS) from MS and the General Coordination of Diseases and Noncommunicable Diseases (CGDANT/MS), as well as representatives of the productive sector (ABIA), consumer protection organizations, and medical and nutrition associations (Brazilian Society of Cardiology, Brazilian Society of Hypertension, Brazilian Society of Nephrology, Brazilian Association of Nutrition). Recommendations related with education and communication, search, monitoring, reformation of processed foods, regulation, and its approval by regulatory agencies were discussed. The recommendations for reduction are similar to those proposed by the document PAHO’s National Policy Recommendation and an agreement to reduce sodium consumption in the Brazilian population from the current 4700 mg to less than 2000 mg/day by 2020 was made in 2010 among Ministry of Health, ANVISA, and ABIA (Brazil/Portal da Saúde, 2016).

Studies with food labels showed that processed foods sold in Brazil in 2011 showed high amount of sodium. In such studies, the absence of nutritional facts and incorrect or incomplete description of the ingredients with added sodium, were also observed. Martins (2012) reported the sodium content declared on 3449 foods labels of ready-to-eat meals and pre-cooked foods. The nutritional information showed high sodium content (>600 mg/100 g) in 59.6% of the samples and a wide sodium variation between similar foodstuff. Nishida (2013) reported the sodium content declared on 3449 foods labels of processed foods in their regular versions and with nutrient exemption or reduction claims (‘diet’, ‘light’, or with reduced content of sugar and/or fat). The median of sodium content in the group with nutrient exemption or reduction claims was 43% higher than regular version ($P = 0.007$). In two groups of foodstuffs analysed, the sodium content was higher in the samples with nutrient exemption or reduction claims. Milk and dairy products and fats, oils and oilseeds showed a content of sodium of 7% ($P = 0.03$) and 132% ($P = 0.001$) higher, respectively. The group which included meats sausages and hamburgers presented sodium content 29% lower ($P < 0.001$) when compared with the samples with nutrient exemption or reduction claims. Kraemer (2013) reported the information of salt/sodium declared on labels of 2945 foods usually consumed as snacks by children and adolescents. Meats, oils, fats, oilseeds, sauces, seasonings, broths, soups, and cooked meals showed high sodium content. Some samples of sausages, burgers, hot dogs, and ready meals showed more than 100% of the daily requirement of sodium for children. Medium or high sodium levels were observed in most of the foodstuff analysed indicating that the daily consumption of this micronutrient may be above the recommended for the age group. Ribeiro et al. (2013) reported the sodium content of 17 food samples (instant noodles, breaded items, hamburger patties, hot dogs, and bologna sausages). The results obtained by flame photometry and chloride titration were compared with nutritional information in the label. Results showed that most of the samples exceeded the sodium contents by more than 20% than those reported on label. All samples had more than 480 mg of sodium per serving and exceeded the tolerable upper intake level for sodium for children aged 4–8 years.

An agreement between Ministry of Health, ABIA, the Brazilian Association of the Pasta Industry (Associação Brasileira das Indústrias de Massas Alimentícias (ABIMA), the Brazilian Wheat Industry Association (Associação Brasileira das Indústrias de Trigo (ABITRIGO)), and Association of Bakery and Confectionery Industry (Associação brasileira das Indústrias de Panificação) ABIP) was signed in April 2011 establishing goals for the reduction of sodium in foods considered as priority (BRAZIL. Ministry of Health, 2011b). The foodstuffs (noodles, French bread and processed bread, cakes, snacks, mayonnaise, and biscuits) were selected based on their contribution to sodium consumption (consumption + average sodium content) and vulnerable public (adolescents and children). In 2012 and 2013, the goals for the reduction of sodium were established for cereals; margarines; instant broth and seasonings; and for bread, hamburgers; sausage; ham; mortadella; mozzarella cheese; requeijão and instant soups, respectively. Table 1 shows the agreement for sodium reduction in processed foods for the period 2012–7.

The established agreement made in 2011 resulted in the withdrawal of 18.047 tonnes of sodium from the food market between 2013 and 2014. It is expected to reduce 28.5 tonnes of sodium in processed food by the end of 2020 (ABIA, 2015a). Table 2 shows the sodium content in food reported by regulatory agencies for 2007–16, respectively.

A large variation for the sodium content among the products of the same category was observed indicating that most of the analyzed foods may be reformulated to reduce the amount of sodium. The highest variation in sodium content was observed for French fries, snacks, instant noodles, and its seasonings (14, 12.5, 7.5, and 7.2 times, respectively). The highest amount of sodium was reported for the instant noodles and its seasonings and the consumption of some of these products, the recommended daily sodium intake (2400 mg), could be exceeded with the consumption of only a single portion. Sodium content was higher for zero sugar or ‘low-calorie’ soft drinks when compared with sugar-containing soft drinks since sodium-containing additives such as sodium cyclamate and sodium saccharin, sodium benzoate, and sodium citrate are used in those products. Between the analysed foodstuffs, just a few of them met the criterion of low sodium content.

Substitution of salt is not an easy task since it has different effects on foods such as preservative, hydration, and binding of proteins with fats in emulsions. In addition, it may change the sensory characteristics of foods. Several options of salt substitutes are available in the market, including sodium chloride with different density, shape, particle size and sodium amount, mixtures of sodium and potassium chloride (KCl), salt potentiators, yeast extracts, seasonings, herbs, acids, natural flavourings, mixtures with other mineral salts, amino acids, nucleotides, monosodium glutamate, and also possible combinations among these substances. Some of these compounds may cause bitter, metallic, acidic, and other undesirable residuals flavours.

**Government policies in Brazil to reduce sugar consumption**

Reports from several international health agencies recommend a limited intake of added sugars since it has been related with the increased risk for dental caries; weight gain, overweight and obesity; type 2 diabetes mellitus; high blood pressure and hypertension;
higher serum triglycerides, high blood cholesterol, and cardiovascular diseases; stroke and cancer (Monteiro et al., 2015). The WHO recommends limiting the intake of added sugars by adults and children. The recommended maximum daily calorie consumption from free sugars should be 10% (200 kcal or 50 g or 12 teaspoons on a diet of 2000 kcal per day), and a consumption of 5% would bring additional benefits. These recommendations are made only for free sugars (monosaccharides and disaccharides added to foods or naturally present in honey, syrups, fruit juices, and concentrated fruit juices) and do not apply to intrinsic sugars found in fresh fruits and vegetables (WHO, 2015). These recommendations are based on scientific evidence showing that adults who consume less sugars have lower body weight and children who consume sweetened beverages are more likely to have overweight or be obese than children with a low intake of sweet drinks. In addition, when the intake of free sugars is greater than 10% of the total energy the dental caries rates in children are higher. Studies have also been linked to the high consumption of sugar in recent years with obesity (Song et al., 2012); metabolic syndrome, a physiological condition that includes insulin resistance, elevated waist circumference, dyslipidemia, and hypertension (Malik et al., 2010; Chan et al., 2014); hypertension, obesity and the metabolic syndrome, diabetes, kidney disease, and cardiovascular disease (Johnson et al., 2007; Dekker et al., 2010); cancer (Boyle et al., 2014), dental caries (Fioretti and Haikel, 2010), and acne (Danby, 2015).

Brazil is the country with the second highest consumption per capita of sugar (600 kcal/day). It is estimated that the USA has the highest worldwide consumption of sugar per capita (658 kcal per day). The added sugar in food is the source of 15.7% of the calories consumed by Brazilians. A decrease in the use of table sugar and an increase in the sugar content of industrialized products have been observed (IBGE, 2010). The sugar used to sweeten coffee or in cake recipes currently corresponds to 71.7% of the sugar ingested followed by candies and chocolates (11.6%) and soft drinks (10.9%).

An excessive consumption, more than 60% the maximum consumption limit recommended by the WHO, of sugars by the Brazilian population was reported by Levy et al. (2012). The results were similar for all regions of the country and social classes and juices, soft drinks and refreshments are the main consumed foods with high sugar content. Between 1987/88 and 2002/03 the ‘added sugars’ in the total of calories consumed by the population in the metropolitan regions of Brazil remained stable. On the other hand, for the same period, there was a substantial increase in the fraction of sugar ingested through processed foods.

The estimated average for sugar consumption in Brazil is 30.1 kg per year (Figure 3). The table sugar accounts for 56.3% (16.9 Kg) and sugar added in food and from beverages represents 19.2% (5.8 Kg) of the total consumption. The intrinsic sugar of food, whether it is consumed ‘in natura’ or used as raw material for the food companies, represents 24.6% (7.4 Kg) (ABIA, 2015b).

### Nutritional and food allergens labeling

In Brazil, the nutritional labeling of food is part of the PNAN strategies since it is considered an instrument that may facilitate the choice of healthy food by the population. The information such as caloric value; carbohydrates; proteins; total and saturated fat; cholesterol; fiber; calcium; iron and sodium, and the percent of the daily value of each nutrient per serving fat have been made mandatory in 2001 (BRAZIL, 2005). The labeling of ‘trans’ fats has also become...
mandatory in 2003 when the nutritional labeling of food was harmonized in the scope of Mercosur (ANVISA, 2003a).

Table 2. Sodium content measured in food products consumed in Brazil

| Food product            | Year, sodium content (mg/100 g) and number of analyzed samples | Established content |
|-------------------------|------------------------------------------------------------------|---------------------|
|                         | 2007/08* | 2009 | 2010/11 | 2012 | 2013 | 2012 | 2014 | 2016 |
| Shoestring potatoes     | 40–744 (14) | 250–719 (11) | 30–430 (31) | 133–396 (10) | 650 | 586 | 529 |
| French fries            | 40–186 (51)* | 196–716 (17) | 447–832 (4) | 175–1282 (6) | 133–308 (2) | 650 | 586 | 529 |
| Snacks                  | 96–434 (40)* | 384–1735 (18) | 395–1395 (7) | 310–1589 (14) | 508–1496 (6) | 1090 | 852 | 747 |

Dough
- 3.6–30 (40)*
- 360–2810 (11)
- 1435–2160**
- 1582–2385**
- 291–897 (10)
- 591–623 (10)
- 1921
- 419

Seasoning
- 75.2–562 (40)*
- 7520–56200 (11)
- 9740–31110 (11)
- 1178–1332 (3)
- 419
- 359

‘Polvilho’ biscuit
- 609–1100 (14)
- 427–1398 (17)
- 204–1829 (16)
- 1178–1332 (3)
- 419
- 359

Cornstarch biscuit
- 240–477 (17)
- 345–624 (5)
- 266–423 (2)
- 419
- 359

Sandwich cookie
- 130–650 (21)
- 72–160 (5)
- 389

Cream craker
- 104–420 (20)*
- 347–1400 (20)
- 437–1130 (14)
- 282–863 (3)
- 923

Small bread rolls
- 340–1045 (17)
- 394–564 (10)
- 645

Dough + seasoning
- 282–863 (3)

Infant cereal with milk
- 20–170 (4)
- 258–500 (6)
- 226–532 (9)
- 351

Frozen cheesy bread
- 367–782 (20)
- 478–648 (9)

‘Minas Frescal’ cheese
- 290–767 (10)

Mozzarella cheese
- 209–1068 (25)
- 250–1140 (15)

Cracker
- 91–271 (20)*
- 303–903 (16)
- 1150–2976 (8)
- 533–1130 (5)

‘Requeijão’ cheese
- 4.2–6.6 (40)*
- 280–800 (25)
- 34–65 (10)

Light ‘Requeijão’ cheese

Grated Parmesan cheese
- 420–660 (15)
- 1100–2976 (8)
- 533–1130 (5)

Fresh Ricotta cheese
- 41–432 (24)

Mayonnaise
- 683–1504 (4)

Infant formula
- 22–46 (12)

Cake mix
- 334–659 (15)
- 349

Soup mix
- 3204–4240 (6)

‘Guaraná’ soda
- 30–175 (27)*
- 3–14.6 (19)
- 11–22 (4)

Light ‘Guaraná’ soda
- 5.6–17.4 (8)
- 3–19 (14)

Cola soda
- 29–138 (23)*
- 2.9–13.8 (13)
- 7–17 (6)

Dairy beverages
- 75–115 (8)

Infant formula
- 22–46 (12)

Cake mix
- 334–659 (15)
- 349

Soup mix
- 3204–4240 (6)

‘Guaraná’ soda
- 30–175 (27)*
- 3–14.6 (19)
- 11–22 (4)

Light ‘Guaraná’ soda
- 5.6–17.4 (8)
- 3–19 (14)

Cola soda
- 29–138 (23)*
- 2.9–13.8 (13)
- 7–17 (6)

Adapted from Jacob (2013). Data obtained from INCQS and Technical Reports 43, 50 and 54 regarding to the years 2010/12 and 13, respectively.

*Result expressed for the serving size: *mg/25 g; Bmg/g; *mg/30 g; *mg/l.

**Dough + seasoning.

Figure 3 Estimated average for sugar consumption in Brazil (adapted from ABIA, 2015).

The labeling of cholesterol, calcium, and iron is not required but the voluntary declaration of these nutrients in the labels is recommended by ANVISA when the food product shows 5% or more of the recommended daily value, in order to increase the level of the consumer information. When a statement of nutritional properties is made, it is mandatory to declare the amount of nutrient and for fats it must be indicated the amount of saturated, ‘trans’, monounsaturated, and polyunsaturated fat.

Supplementary nutritional facts or nutritional claims, which suggest that a food possesses particular nutritional properties, especially but not only in relation to its energy content and/or its content of proteins, fats, carbohydrates and fiber, as well as its vitamin and mineral content, have been regulated and harmonized in MERCOSUR (ANVISA, 2012).

Nutrition labeling is not mandatory for foods such as mineral water; alcoholic beverages; food additives and co-adjuvants; spices; vinegar; salt; coffee, mate, tea, and other herbs without the addition of other ingredients; food prepared and packaged in restaurants and commercial establishments; ready-to-eat foods, such as packed sandwiches; fruit salads; foods fractionated at retail outlets; sliced foods

Table 3. Estimated sugar consumption in Brazil

| Region          | Added Sugar (g) | Intrinsic Sugar (g) | Extrinsic Sugar (g) |
|-----------------|-----------------|---------------------|---------------------|
| North           | 5.6             | 1.8                 | 2.9                 |
| North-West      | 6.3             | 2.1                 | 3.2                 |
| West            | 8.1             | 2.9                 | 3.6                 |
| Center-West     | 8.2             | 3.2                 | 3.7                 |
| Center-East     | 8.7             | 3.4                 | 3.2                 |
| Northeast       | 7.8             | 3.4                 | 3.5                 |
| South           | 6.5             | 2.7                 | 2.4                 |

with Ministry of Health; USDA Nutrient Database for Standard Reference; the Table of Food Composition published by ENDEF/IBGE, and the Nutri Software developed by University of São Paulo, also may be used for the calculations.
| Country          | Allergenic foods                          | Exception                                                                 | Instruments                                                                                     |
|------------------|-------------------------------------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| USA              | (1) Wheat                                 | Highly refined oils and its derivatives.                                  | Food Allergen Labeling and Consumer Protection Act of 2004 (FALCPA). 21 CFR, Part 101 - Gluten-Free Labeling of Food. |
|                  | (2) Crustaceans                           |                                                                            |                                                                                                  |
|                  | (3) Eggs                                  |                                                                            |                                                                                                  |
|                  | (4) Fish                                  |                                                                            |                                                                                                  |
|                  | (5) Peanut                                |                                                                            |                                                                                                  |
|                  | (6) Soy                                   |                                                                            |                                                                                                  |
|                  | (7) Milk                                  |                                                                            |                                                                                                  |
|                  | (8) Chestnuts                             |                                                                            |                                                                                                  |
|                  | (9) Sulphites in concentrations ≥ 10 ppm  |                                                                            | 21 CFR, Part 130 - Section 130.9. Sulphites in Standardized foods.                                |
|                  | Obs.: It also applies to ingredients that contain proteins obtained from these food products |                                                                            |                                                                                                  |
| European Union   | (1) Cereals containing gluten (wheat, rye, barley, oats or hybrids, and their derivatives) | (1) Glucose syrups made of wheat and barley and derivatives                | Regulation (UE) n. 1169/2011. Delegated Regulation (EU) n. 78/2014.                                  |
|                  | (2) Crustaceans and its derivatives        | (2) Maltodextrins made of wheat and derivatives                          |                                                                                                  |
|                  | (3) Eggs and egg products                  |                                                                            |                                                                                                  |
|                  | (4) Fish and fish products                 |                                                                            |                                                                                                  |
|                  | (5) Peanut and its derivatives             | (3) Cereals used in the manufacturing of distilled alcoholic beverages, including ethyl alcohol of agricultural origin |                                                                                                  |
|                  | (6) Soy and soy products                  |                                                                            |                                                                                                  |
|                  | (7) Milk and milk products, including lactose |                                                                                |                                                                                                  |
|                  | (8) Chestnuts and its derivatives          |                                                                            |                                                                                                  |
|                  | (9) SO2 and sulphites in concentrations > 10 ppm | (4) Fish gelatin used as carrying agent of vitamins/carotenoids               |                                                                                                  |
|                  | (10) Celery and its derivatives            |                                                                            |                                                                                                  |
|                  | (11) Mustard and its derivatives           |                                                                            |                                                                                                  |
|                  | (12) Sesame and its derivatives            |                                                                            |                                                                                                  |
|                  | (13) Lupins and its derivatives            |                                                                            |                                                                                                  |
|                  | (14) Molluscs and its derivatives          |                                                                            |                                                                                                  |
| Canada           | (1) Cereals containing gluten (wheat, rye, barley, oats or hybrids, and their derivatives) | None found. Observations. Regulation only applies to the fraction of the ingredient responsible for the adverse effect (ex. protein segment) | Amendments to Division 1 of the Food and Drug Regulations.                                               |
|                  | (2) Crustaceans                           |                                                                            |                                                                                                  |
|                  | (3) Eggs                                  |                                                                            |                                                                                                  |
|                  | (4) Fish                                  |                                                                            |                                                                                                  |
|                  | (5) Peanut                                |                                                                            |                                                                                                  |
|                  | (6) Soy                                   |                                                                            |                                                                                                  |
|                  | (7) Milk                                  |                                                                            |                                                                                                  |
|                  | (8) Chestnuts                             |                                                                            |                                                                                                  |
|                  | (9) Sulphites in concentrations ≥ 10 ppm  |                                                                            |                                                                                                  |
|                  | (10) Mustard                              |                                                                            |                                                                                                  |
|                  | (11) Sesame                               |                                                                            |                                                                                                  |
|                  | (12) Molluscs                             |                                                                            |                                                                                                  |
|                  | Obs.: It also applies to ingredients that contain proteins obtained from these food products |                                                                            |                                                                                                  |
| Australia and New Zealand | (1) Cereals containing gluten (wheat, rye, barley, oats or hybrids, and their derivatives) | (1) Cereals with gluten used for distilled alcoholic beverages and standard beers. | Australia New Zealand Food Standards Code, Standard 1.2.3.                                              |
|                  | (2) Crustaceans and its derivatives        |                                                                            |                                                                                                  |
like cheeses, hams, salami, and Bologna; fruits, vegetables and fresh meat, chilled or frozen; foods in pack sizes smaller than 100 cm² (BRAZIL, 2005).

Cassemiro et al. (2006), in a study with 200 consumers, reported that 68.5% of them read the nutrition information on the labels but only 23% used this information to improve the quality of their diet. Cavada et al. (2012) reported that between 241 consumers (average age of 42.4 years), 48.1% read the labelings of the food products. Monteiro et al. (2005), Machado et al. (2006), and Pinheiro et al. (2011) reported a higher prevalence of label reading among consumers (74.8, 80, and 85.4%, respectively). In all studies, the habit of reading the labels was associated with a higher education level.

Marins et al. (2008) carried out a qualitative evaluation with 400 consumers of the habit of reading and understanding the information contained in food product labels. The low consumer confidence in the information present in the labels; the technical language; the excess of advertising in different media, and poor information on potentially allergenic food components were the main problems reported by consumers. Câmara et al. (2008) reported that between 1997 and 2004 there were 49 academic studies published on food labeling in Brazil. The authors concluded that there were many inadequacies in food labels, mainly to nutritional information, indicating lack of enforcement over regulations.

### Food allergens

It has been reported in the literature that food allergy is a worldwide problem and its prevalence is increasing in both developed and developing countries, especially in children. Lifestyle changes such as diet, living conditions, and also the excessive use of antibiotics have been associated with the increase of reported cases (Devaraja et al., 2016). Food allergy is an immune-mediated reaction that can trigger to cutaneous, ocular, respiratory, gastrointestinal, and cardiovascular symptoms. The clinical manifestations of food allergy may range from mild to severe (anaphylaxis), depending on factors such as genetics, age, allergen, level of processing, environmental aspects, and individual physiological condition. Non-fatal anaphylaxis occurs in 0.5 to 16 people for every 100 000 inhabitants and the fatal cases of anaphylaxis in 1 for every 800 000 inhabitants (children) and 1 for 4 000 000 (adults). It was estimated that food consumption accounts for between 30% and 50% of anaphylaxis in North America (Cianferoni and Muraro, 2012) and 20% in Brazil (Bernd, 2008).

More than 170 foods have been described as allergenic but most of the reported cases are associated with a few foods such as eggs, milk, fish, crustaceans, nuts, peanuts, wheat, and soybeans. It is estimated that food allergy affects between 7% and 10% of children and between 3% and 4% percent of adults (Perry and Pesek, 2013; Prescott et al., 2013; Devaraja et al., 2016). The prevalence of food allergy worldwide is not well known, but it is estimated that between 30% and 50% of anaphylaxis in North America (Cianferoni and Muraro, 2012) and 20% in Brazil (Bernd, 2008).

The main prevention strategy for food allergies is to avoid the consumption of allergens and therefore consumer education and adequate information on food labeling are considered fundamental.

### Table 3. Continued

| Country | Allergenic foods | Exception | Instruments |
|---------|------------------|-----------|-------------|
| Brazil  | (1) Wheat, rye, barley, oats and their hybrids (2) Crustaceans (3) Eggs (4) Fish (5) Peanut (6) Soy (7) Milk from all mammals (8) Almonds (9) Hazelnuts (10) Cashew nuts (11) Brazil nuts (12) Macadamia (13) Nuts (14) Pecans (15) Pistachio (16) Pinoli (17) Chestnuts | None found. | Resolution ANVISA/DC Nº 26 of 02/07/2015 |
|         |                  |           |             |

Like other studies, this work highlights the importance of research on food allergy prevention and the role of public health strategies in reducing its impact on society. Further studies are needed to better understand the factors influencing food allergy prevalence and to develop effective prevention strategies.
to the risk management. Excessive information, inadequate terms, and illegibility may make it difficult to read the labels. Unreliable, inaccurate, or overuse claims also have been reported as some of the problems in the labeling of foods and a more standardized, simple, and easy information have been required (Pieretti et al., 2009; Sheth et al., 2010).

The regulation of the food allergens labeling in Brazil was initiated in 2008 through a Public Civil Action addressed to ANVISA. In 2009, a revision of the food labeling in Mercosur was requested, and in 2011, the agenda for discussion of this subject was established by the Food Commission (Comissão de Alimentos do Subgrupo técnico GGT-3). After 3 years without any consensus, this theme was unlabeled from Mercosur in 2014. A public consultation on food allergen labeling was approved and published (ANVISA, 2014), and in 2015, the public hearing was held. The proposal was approved in June 2015 and published in July 2015 (ANVISA, 2015a). The labeling of 18 allergenic foods and/or their derivatives was made mandatory in July 2016 (ANVISA, 2015b). Due to the absence of scientific evidence on the main allergens affecting the Brazilian population, the list of the Codex Alimentarius for allergens was used as a reference. Table 3 shows the food allergens and their derivatives that must be labeled in different countries as well as their regulatory acts. In 2016, the manual ‘Questions and Answers on Allergen Food’ was published to promote awareness in the population (ANVISA, 2016).

Challenges to be faced

The reduction of ‘trans’ and saturated fats, sodium, and sugars in foods seems to be an effective alternative for reducing the prevalence of NCDs in Brazil. Continuing the dialogue on issues relating to the nutritional quality between the regulatory bodies, the productive sector, non-governmental entities, and academia is necessary for the production of healthier foods.

The development of innovative technologies, new ingredients, and formulations to produce healthier foods that are sensorially and economically viable is still a great challenge for the food industry. On the other hand, public policies for education and communication should be implemented in order to allow consumers both better food choices and healthier lifestyle habits. Clear labeling combined with nutritional education will enable consumers to understand the information in the labels and make better purchase decisions. Finally, national health and nutrition policies should be implemented and also be more effective in monitoring food labeling and nutritional quality.

Conclusions

In Brazil, where the consumption of processed foods has greatly increased, the reduction of saturated and ‘trans’ fats, sodium, and sugar in these foods seems an effective strategy for reducing the intake of these compounds by the Brazilian population. The goals established by international health agencies should be effectively achieved through the partnerships between government agencies, industry, and non-governmental organizations and with the intersectoral actions. In addition, adequate nutrition labeling and consumer education will allow healthier food choices by the population. The appropriate response from the food industry, consumer education, and the effective regulatory and enforcement policies will allow the changes in dietary habits and improve the health of the population. Finally, the contribution of the governmental regulatory bodies in food regulation is undeniable; however, effective inspection is necessary to ensure the application of established standards and regulations.

Conflict of interest statement. None declared.

References

Abegunde, D. O., Mathers, C. D., Adam, T., Ortegon, M., Strong, K. (2007). The burden and costs of chronic diseases in low-income and middle-income countries. Lancet (London, England), 370: 1929–1938.

ABIA (Brazilian Association of Food Industries). (2016). Panorama da produção e uso de gordura parcialmente hidrogenada e suas alternativas tecnológicas em alimentos industrializados no Brasil. Audiência Pública – Gorduras Trans. Março, Brasília, DF.

ABIA (Brazilian Association of Food Industries). (2015a). Scenario of sodium consumption: study based on data from the Brazilian Institute of Geography and Statistics. http://www.abia.org.br/sodio/sodio2. Accessed 15 February 2017.

ABIA (Brazilian Association of Food Industries). (2015b). Cenário do consumo de açúcar no Brasil. Estudo baseado em dados do Instituto Brasileiro de Geografia e Estatística. http://www.abia.org.br/estat/lemb/201747/infografoabiaacucar.pdf. Accessed 27 March 2017.

ABIA (Brazilian Association of Food Industries). (2010). Redução dos teores de gorduras trans dos alimentos. 3º Fórum da Alimentação Saudável. Acordo de cooperação técnica ABIA e Ministério da Saúde, Brasília, DF.

AHA (American Heart Association). (2017). The American Heart Association’s Diet and Lifestyle Recommendations. Healthy Living. http://www.heart.org/HEARTORG/HealthyLiving/Diet-and-Lifestyle-Recommendations_UCM_305855_Article.jsp?V9LM7krKUK. Accessed 5 December 2016.

Alwan, A., et al. (2010). Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. Lancet (London, England), 376: 1861–1868.

ANVISA (National Health Surveillance Agency). (2003a). Resolution no 359 and 360 (December 23). Technical Regulation of Portions of Packed Foods for Nutritional Labeling Purposes. http://portal.anvisa.gov.br/documents/33880/2568070/res0359_23_12_2003.pdf/76678765-a107-40d9-bb34-505ae897fbf3. Accessed 11 November 2016.

ANVISA. (2003b). RDC No. 39 -Reference for Portions of Packaged Foods and Beverages for Nutrition Labeling and RDC No. 40 - Technical Regulation for Labeling Nutritional Compulsory Packaged Foods and Beverages. Resolution no (December 23). http://portal.anvisa.gov.br/documents/33880/2568070/res0360_23_12_2003.pdf/5d4cf713-9c66-4512-bc31-afe357e7d9bc. Accessed 11 November 2016.

ANVISA (National Health Surveillance Agency). (2012). Provides for the Technical Regulation on Complementary Nutrition Information. Technical Report nº 54, November,12. http://bvsms.saude.gov.br/bvs/saudelegis/anvisa2012/tdc/0054_12_11_2012.html. Accessed March 23 2017.

ANVISA (National Health Surveillance Agency). (2014). Public Consultation no 359 from June 29th 2014. Technical Regulation that establishes the requirements for mandatory declaration, in the Labeling of packaged foods, sources recognized as causing allergies or Food intolerances in sensitive people. https://alimentusconsultoria.com.br/consulta-publica-no29-de-5-de-junho-de-2014-anvisa/. Accessed 16 December 2016.

ANVISA (National Health Surveillance Agency). (2015a). Resolution no 26 from December 2nd 2015. Report on requirements for mandatory labeling of major foods that cause food allergies. https://www.legisweb.com.br/legislacao?id=286510. Accessed 16 December 2016.

ANVISA (National Health Surveillance Agency). (2015b). Technical Report no 67 from September 1st 2015. Guidelines on the procedures for requesting changes to the list of food allergens. http://portal.anvisa.gov.br/resultado-de-busca?p_p_id=101&c_p_lifecycle=1&c_p_state=maximized&c_p_mode=view&c_p_col_id=colum1&c_p_col_count=1&c_101_struts_actions%2Ffasset_publisher%2Fview_content&c_101_assetEntryId=3402504&c_101_type=content. Accessed 16 December 2016.
Feltes, M. M. C., Ariseto-Bragotto A. P., Block, J. M. (2017). Food quality, foodborne diseases, and safety in the Brazilian food industry. Food Quality and Safety, 1: 13–27.

Fioresi, F., Haikel, Y. (2010). Carie et sucre: caries and sugars. Médecine des Maladies Métaboliques, 4: 543–549.

He, F. J., MacGregor, G. A. (2009). A comprehensive review on salt and health and current experience of worldwide salt reduction programmes. Journal of Human Hypertension, 23: 363–384.

He, F. J., Li, J., Macgregor, G. A. (2013). Effect of longer term modest salt reduction on blood pressure: cochrane systematic review and meta-analysis of randomised trials. BMJ (Clinical Research Ed.), 346: f1325.

IBGE (Brazilian Institute of Geography and Statistics). (2010). Family Budget Search 2008–2009 - Acquisition of food per inhabitant. http://biblioteca.ibge.gov.br/visualizacao/livros/liv45419.pdf. Accessed 27 April 2017.

IBGE (Brazilian Institute of Geography and Statistics). (2011). Family budget research 2008–2009 - Anthropometry and nutritional status of children, adolescents and adults in Brazil. http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pod/2008_2009_enca/default.asp?UF=shmt. Accessed 27 April 2017.

Jacobi, S. C. (2013). Sódio em alimentos. INCQS/ FIOCRUZ/MS. V Seminário Nacional sobre a redução do Consumo de Sódio no Brasil, Brasília, 25 de dezembro de 2013. http://ecos-redenutr.bvs.br/tiki-read_article.php?articleId=1009. Accessed 20 February 2017.

Johnson, R. J., et al. (2007). Potential role of sugar (fructose) in the epidemic of hypertension, obesity and the metabolic syndrome, diabetes, kidney disease, and cardiovascular disease. The American Journal of Clinical Nutrition, 86: 899–906.

Katz, D. L., Meller, S. (2014). Can we say what diet is best for health? Annual Review of Public Health, 35: 83–103.

Kraemer, M. V. D. S. (2013). Informação nutricional de sal/sódio em rótulos de alimentos industrializados para lanches consumidos por crianças e adolescentes. Dissertação (Mestrado em Nutrição) – Programa de Pós-Graduação em Nutrição, Universidade Federal de Santa Catarina, Florianópolis.

Levy, R. B., Claro, R. M., Bandoni, D. H., Mondini, L., Monteiro, C. A. (2012). Availability of added sugars in Brazil: distribution, food sources and time trends. Revista Brasileira De Epidemiologia = Brazilian Journal of Epidemiology, 15: 3–12.

Machado, S. S., Santos, F. O., Albinatti, F. L., Santos, L. P. R. (2006). Comportamento dos consumidores com relação à leitura de rótulo de produtos alimentícios. Alimentos e Nutrição, 17: 97–103.

Malik, V. S., Popkin, B. M., Bray, G. A., Després, J. P., Willett, W. C., Hu, F. B. (2010). Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. Diabetes Care, 33: 2477–2483.

Malta, D. C., Morais Neto, O. L. D., Silva Junior, J. B. D. (2011). Apresentação do plano de ações estratégicas para o enfrentamento das doenças crônicas não transmissíveis no Brasil, 2011 a 2022. Epidemiologia e Serviços de Saúde, 20: 425–438.

Mans, B. R., Jacob, S. C., Peres, F. (2008). Qualitative evaluation of the reading habit and understanding: reception of the information contained in labels of food products. Food Science and Technology, 28: 579–585.

Márquez, C. E., de Rivas, O. B., Divisón, G. J., Sobreviela, B. E., Luque, O. M. (2008). Are hypertensive patients managed in primary care well evaluated? Journal of Hypertension, 26: 379–406.

Ng, M., et al. (2014). Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the global burden of disease study 2013. Lancet (London, England), 384: 766–781.

Nilson, E. A. F. Jaime, P. C., Resende, D. D. O. (2012). Iniciativas desenvolvidas no Brasil para a redução do teor de sódio em alimentos processados. Revista Panamericana de Salud Pública, 34: 287–92.

Nishiura, W. (2013). Teor de sódio declarado em rótulos de alimentos industrializados comercializados no Brasil em suas versões convencionais e com alegações de isenção ou redução de nutrientes. Dissertação (Mestrado em Nutrição) – Programa de Pós-Graduação em Nutrição, Universidade Federal de Santa Catarina, Florianópolis.

O'Neil, C. E., Nicklas, T. A. (2007). State of the art reviews: relationship between diet/physical activity and health. American Journal of Lifestyle Medicine, 1: 457–481.

PAHO (Pan American Health Organization). (2010). Recommendations for national policies: prevention of cardiovascular diseases in the Americas by reducing salt consumption for the whole population. OPAS. 2010. http://new.paho.org/hq/index.php?option=com_docman&task=doc_download&gid=6369&Itemid=. Accessed 12 September 2011.

Palet, D. A., Holdford, D. A., Edwards, E., Carroll, N. V. (2011). Estimating the economic burden of food-induced allergic reactions and anaphylaxis in the United States. The Journal of Allergy and Clinical Immunology, 128: 110–115.e5.

Perry, T. T., Pesek, R. D. (2013). Clinical manifestations of food allergy. Pediatr Annals, 42: e106–e111.

Pickering, T. G., Miller, N. H., Ogdenge, G., Krakoff, L. R., Artinian, N. T., Goff, D. (2008). AHA/ASH/PCNA Scientific Statement. Call to action on use and reimbursement for home blood pressure monitoring: a joint scientific statement from the American Heart Association, American Society of Hypertension, and Preventive Cardiovascular Nurses Association. Hypertension. http://hyper.ahajournals.org/content/hypertensiona/52/10.full.pdf. Accessed 19 February 2017.

Pieretti, M. M., Chung, D., Pacenzia, R., SLOTKIN, T., SICHERER, S. H. (2009). Audit of manufactured products: use of allergen advisory labels and identification of labeling ambiguities. The Journal of Allergy and Clinical Immunology, 124: 337–341.

Pinheiro, F. A., Cardoso, W. S., Chaves, K. F., Oliveira, A. S. B., Rios, S. A. (2011). Perfil de Consumidores em Relação à Qualidade de Alimentos e Hábitos de Compras. UNOPAR Cientificas:Ciências Biológicas e da Saúde, 13: 95–102.

Prescott, S. L., et al. (2013). A global survey of changing patterns of food allergy burden in children. The World Allergy Organization Journal, 6: 21. doi:10.1186/1939-4551-6-21.

Ribeiro, V. F., Ribeiro, M. D. A., Vasconcelos, M. A. D. S., Andrade, S. A. C., Marins, A. R., Rubinstein, A., et al. (2011). Profil des consommateurs au Canada. Canadian Journal of Allergy and Clinical Immunology: Official Publication of the American College of Allergy, Asthma, and Immunology, 104: 60–65.

Song, W. O., Wang, Y., Chung, C. E., Song, B., Lee, W., Chun, O. K. (2012). Is obesity development associated with dietary sugar intake in the U.S.? Nutrition (Burbank, Los Angeles County, Calif.), 28: 1137–1141.
