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Nutritional adequacy of commercial food products targeted at 0–36-month-old children: a study in Brazil and Portugal

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Abstract

In the context of the global childhood obesity, it is essential to monitor the nutrition value of commercial foods. A cross-sectional study (November 2018 to April 2019) aimed to evaluate the nutritional adequacy of processed/ultra-processed food products targeted at 0–36-month-old children in Portugal and in Brazil. The nutrient profiling model developed by the Pan American Health Organization was used. A total of food 171 products were assessed (123 in Portugal and forty eight in Brazil). From the fifteen available meat- or fish-based meals in Brazil, 60 % exceeded the amount of Na and 100 % exceeded the target for total fat. Given the lack of specification of sugars within carbohydrates in the label of the foods in Brazil, it was not possible to calculate free sugars. In Portugal, from the seventeen fruit and vegetable purees and the six juice/smoothie/tea/drinks available, 82 % and 67 %, respectively, surpassed the level of free sugar, while total and saturated fat was excessive in all yogurt and yogurt-related products (*n* 21), 40 % of biscuit/wafer/crisps (two out of five) and 13 % meat- or fish-based meals (two out of sixteen). These findings demonstrate the relevance of improving the nutritional profile of some food products targeted to young children.

Key words: **Baby food: Pan American Health Organization: Product labelling: Nutritional adequacy**

During the first windows of opportunity for the prevention of noncommunicable diseases, such as the period of complementary feeding and the early childhood, food products targeted at children may be particularly consumed[1]. The importance of monitoring the nutritional composition of commercial food is particularly important in the light of the current childhood obesity pandemic[2].

Nutrient profiling systems are used around the world to assess the nutritional quality of foods. In addition, nutrient profiling systems may guide consumers towards healthier food choice which could therefore serve as one of the key strategies to prevent mortality from non-communicable diseases[3].

Assessing the nutrient profile of foods commercially available is key to inform policy makers and consumers helping them in purchasing nutritious food and making nutritionally balanced meals[4]. However, Lopes *et al.*[5] reported in children under 24 months of age that 74·3 % consumed some kind of ultra-processed food and that children start consuming ultra-processed foods at a very early stage; most infants older than 6 months already made use of breakfast cereals.

Another study conducted by Brigde *et al.*[6] aimed to assess the labelling and listed macronutrient and Na content of commercially available pureed foods marketed for infants and young children (0–36 months) in thirteen countries. The authors found that important part of the products was targeted at 4–6-month-

Abbreviations: NP, nutrient profiling; PAHO, Pan American Health Organization.

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old infants, going against what is recommended by WHO, European Union and European Commission. Even more relevant is the finding that those products contained added sugars.

WHO[7] and European Commission (EC 2006)[8] guidelines that state that infants should be exclusively breastfed up to 6 months, and this practice also favours the avoidance of early exposure to many of the previously reported food products that contained added sugars. Early and excessive intake of added sugars is a matter of concern because sugars can increase the risk of dental decay and non communicable disease (NCD) development both in childhood and in later life[9].

To aid parents and caregivers, guidance on complementary feeding practices needs to be updated to reflect the modern context where commercial foods are abundant and often marketed for infants under 6[9] months of age. Regulations should also be updated to reduce the availability of nutritionally inadequate foods and prevent the addition of sugars to infant foods. Regular research is required to monitor the nutritional profile of commercially available food products and to improve the understanding on the marketing characteristics of commercial infant and baby foods and how this impacts later food choices, consumption and child health.

According to the document by the Portugal Ministry of Health/General Directorate of Health entitled 'Healthy Eating from 0 to 6 Years – Guidelines for Professionals and Educators', from 6 months of age, the progressive introduction of other foods is necessary. Food diversification can occur between 4 months and 1 week and 6 months and 1 week (ideally as close as possible to 6 months), and ideally, breast-feeding should be maintained. At this stage, the infant should only be offered foods that are part of the food chain and the 'Food wheel', no processed foods sweet or savory should be offered, no salt or sugar should be added to cooking, and no juices (either natural or artificial) or tea should be offered, nor should foods (e.g. cookies and crackers) or products containing added sugar (e.g. juices, desserts, cakes and sweets) or salt (e.g. sausages), during the 1st year of life[10].

In Brazil, the Food Guide for Brazilian Children under 2 years recommends the introduction of foods other than breast milk, starting at 6 months of age, emphasising the importance of introducing minimally processed foods, using grated or mashed fruits and vegetables, avoiding juices and purees, as well as highlighting avoiding the use of sugar or salt[11].

Finally, according to the European Commission's Technical report by the Joint Research Center[12], in general, the introduction of weaning foods is recommended not earlier than the beginning of the 5th month and no later than the beginning of the 7th month. In the context of a balanced diet, most food-based dietary guidelines emphasise the importance of limited (added or free) sugars intake by opting for low sugar starchy foods and dairy products, limiting fruit juice consumption and preferring unsweetened or sugar-free beverages. In the case of Na, most EU Member States recommend, for infants and young children, limiting salt intake in general and not adding salt when preparing foods.

Guidelines[10,11] also recommend that introducing foods should follow the culinary tradition of their country and family. According to Sullivan and Birch[13], repeated exposure to new foods, including those that the child may like less, in a positive and favourable environment, can promote acceptance and, eventually, preference for some foods. As children get older, the influence of a number of factors, such as food availability, continues to shape food preferences and eating behaviours. Thus, it is desirable that the child eats foods with low levels of sugar and salt, so that this habit is maintained through adolescence and adulthood.

There are experimental studies that have verified that early weaning promotes several impacts in adult life, from preference to palatable foods and memory deficit to altered levels of serotonergic receptors[14]. Food labelling is the main communication link between a food product and its consumer, providing information about the product's ingredients, nutritional composition, presence of allergenic substances, net content and others that allow comparison of products during purchase[15].

However, if food labels fail to meet the rules stabilised by regulations or guiding principles, they may induce poor food choices[16]. According to Patzlaff and Melo[17], food choices are heavily influenced by the food label.

In some countries, the food industry participates in the design of these systems[18]. The WHO defines nutrient profiling (NP) as 'the science of classifying or ranking food according to their nutrient composition for reasons related to preventing disease and promoting health'[19]. Its objective is to serve as an instrument to classify food and beverages that contain excessive amounts of free sugars, salt, total fat, saturated fat and *trans* fatty acids. NP became the basis for the regulation of food labels, health claims and marketing and publicity for children[19].

In particular, the NP model of the Pan American Health Organization (PAHO) consists of a model planned to be used by governments for restricting the commercialisation of food products targeted at children. The inclusion criteria for nutrients listed in the PAHO NP model were based on the WHO Population Nutrient Intake Goals preventing obesity and other diet-related chronic diseases[20].

Facing the challenging scenario of contributing for the promotion of healthy eating practices of 0–36-month-old children, this study aimed to provide information that allows the monitoring of the commercialisation of food products targeted at children. The ultimate goal would be to concentrate efforts in the promotion of the correctly timed, appropriate and healthy complementary food introduction for strengthening the prevention and control of children's obesity and obesity-related conditions through the reduction of the consumption of products high in Na, sugar and saturated fat. Thus, this study aimed to evaluate the nutritional adequacy of processed/ultra-processed food products targeted at 0–36-month-old children commercialised in Porto, Portugal and in Natal, Brazil, using the PAHO NP model.

Materials and methods

Study design

The nutritional content in food label of products targeted at 0–36-month-old children were analysed in this cross-sectional study. Data collection occurred in two large cities in different countries, Porto, in Portugal, and Natal, RN, in Brazil. The

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neighbourhoods selected in both cities were those presenting the greatest per capita income contrast (highest *v.* lowest income). In Porto, the research was conducted in the neighbourhoods *Campanhã* (with the lowest per capita income) and Foz *do Douro (*with the highest per capita income). This classification according to income was in line the National Statistics Institute (INE) and Porto City Council. Likewise, the establishments surveyed in Natal were those in neighbourhoods with the greatest *per capita* income contrast. In this case, those with the highest (*Capim Macio, Petropólis, Cidade da Esperança* and *Potengi*) and lowest (*Nova Descoberta, Mãe Luiza, Guarapes* and *Lagoa Azul*) incomes per administrative region[21]. Besides those, four additional supermarkets were included in the research since they were located in central neighbourhoods (*Lagoa Nova* and *Tirol*), being popular amongst civilians independently of their households' location. The income information of the neighbourhoods selected in Natal was recovered from the city's Environment and Urbanism Secretary[22,23].

Inclusion/exclusion criteria

The label information of the food products targeted at 0–36-month-old children was registered tall commercial establishments (supermarkets, markets, convenience shops and drug stores) surveyed in this study, being found at the nonperishable food section, at the baby food island, and at the cooled or frozen food sections, as appropriate.

The eligible food products targeted at 0–36-month-old children were defined as the following: labels containing the words '*bebê*' (baby) or '*criança pequena*' (small child); products labelled as adequate or recommended as complementary food for children under 36 months old; products that had the image of a child whose appearance was that of one under 36 months old or feeding from a baby bottle; presented in any other way as suitable for children under 36 months old using a strategy other than labelling (e.g. posters, temporary sales zones or fairs, in-store, specially created for this age group).

We obtained the products' nutritional composition information from the values declared on labels, per 100 g and/or per serving, for energy (kilocalories and/or kilojoules), protein, fat (total and saturated fat), carbohydrates (total and sugars) and salt.

The following information was also collected: product name, brand, target age group and the photographic record of all parts of the product. The visual information was recorded for products which contained cartoons, pictures of infants or young children, pictures of mothers, pictures of ingredients, claims of endorsement by professional body and others.

Health claims were allocated to the following: (a) helps with growth and development, (b) strengthens the immune system, (c) it improves cognitive skills, d) helps to reduce/prevents allergies, nutritionally complete and (f) other.

The products that did not fit this study's scope, such as those that were not commercialised specifically for children under the age of 36 months and vitamin and mineral supplements (taken as pills, drops, or powder added to food), were excluded. The PAHO NP model is exclusively intended for processed and ultra-processed food products, therefore, in this study the unprocessed/minimally processed products were not included.

For that analysis, baby formulas and breast milk substitutes were excluded since they are specifically formulated to meet children's daily nutritional needs. In addition, food and beverages produced for specific purposes, like breast milk substitutes, follow-on formula/growing up-milk, and supplements should have their own specific regulation, and therefore, are not targeted by the PAHO NP model.

Two researchers analysed independently the food labels according to the PAHO NP model parameters, and after posteriorly comparison, observed no conflicts.

Data collection

Data were collected from November 2018 to February 2019 in Porto and from November 2018 to April 2019 in Natal. The food products were grouped according to the protocol for data collection of these foods within the WHO European Region. The suggested adaptations were made available the questionnaire called 'BabyFood Brazil Project'.

The products included in our study followed inclusion criteria listed by the Baby food Euro for products targeted at 0–36-month-old children.

In Portugal, the selected establishments and data collection followed the standardised methodology of the Baby food Euro study, in which data were collected in the neighbourhoods with the highest and lowest per capita income, selecting a central point and defining a radius from its centre (1 km), creating then a 'buffer zone', within which all eligible sales locations were mapped. However, in our study, the collection covered all establishments present in the selected neighbourhoods.

In Brazil, due to a geographic organisation with different social classes, its territorial scope and distinction of the administrative areas of the city, it was decided to expand the collection, leading to an adaptation on the way of selecting sales locations, thus being different from the one suggested by Baby food Euro study. We opted for the selection of neighbourhood by district and the selection of locations as used in the Brazilian census. In addition to these neighbourhoods, four supermarkets located in central neighbourhoods of the city were also included in the research, for they are widely visited by the population of Natal, regardless of the geographic location of their home.

In Brazil, 1645 foods were found. When excluding the repeated ones, ninety-five different types of foods remained. When the PAHO Nutritional Profile Model criteria were applied, minimally processed foods were also excluded, leaving forty-eight different types of foods. In Portugal, there were 431 foods initially, and 123 different types for analysis, after exclusions of repetitions and those that were outside the criteria.

The food products were grouped according to the protocol for data collection of these foods within the WHO European Region:

- Breast-milk substitutes/infant formulas (any formula labelled for infants under 6 months of age; the age might be listed 0–6 months or 0–12 months).
- Follow-on formulas (any milk product labelled for infants under 12 months of age but not under 6 months of age)

and growing-up milk (any milk product for which the target age range includes children under 36 months of age, or any milk products labelled for children under 36 months of age and over 12 months of age).
– Cereal/porridges (rice, maize, millet, wheat and oat porridge).
– Meat- or fish-based meal (products that may look like versions of adult dishes, such as pureed versions of roast chicken, pureed meat with vegetables and pasta or a prepared meal that could be country specific and recognisable as a 'meal'.
– Yogurt or yogurt-related product (products that are primarily labelled as yogurts, but may include additional ingredients or flavours such as fruit).
– Fruit/vegetable purée (may include 100 % fruit purees, or purees based on a combination of fruits and vegetables.
– Soup (any preparation of vegetables in soup form, which may include meat or cereals).
– Biscuits/wafers/crisps (may include crackers, biscuits, rusks, rice cakes, corn or grain puffs, vegetable crisps and cereal bars).
– Juice/smoothie/tea/other drinks (may include 100 % juice drinks, or drinks with fruit and vegetable combinations and other drinks suitable for children under 36 months of age, and teas labelled as suitable for babies).
– Other.

For the present analysis, duplicated food products were excluded. The electronic questionnaires BabyFood Euro Project and BabyFood Brazil (available through the android application KoBoCollect) were used in this study. The electronic questionnaire was developed to collect food label information, including nutrient composition of products targeted at infants and early childhood children sold in shops in cities of WHO Europe Region (Vienna, Austria; Sofia, Bulgaria; Budapest, Hungary; and Haifa, Israel)[9]. All eligible food products targeting at 0–36-month-old children available were evaluated in the commercial establishments surveyed in Porto and Natal.

Application of the nutrient profile model of the pan American Health Organization

Besides the critical nutrients (Na, free sugars and total, saturated and *trans*-fat), the presence of sweeteners is also a criterion included in the model.

The PAHO NP model[20] include an assessment of the following topics:

– Na;
– Total fat;
– Saturated fat;
– *Trans*-fat;
– Total sugars;
– Free sugars (monosaccharides and disaccharides added to foods and beverages by the manufacturer, cook and/or consumer plus sugars that are naturally present in honey, syrups and juices).
– Added sugars (free sugars added to foods and beverages during manufacturing or home preparation) and
– Other sweeteners (food additives that impart a sweet taste to a food, including artificial non-energetic sweeteners, natural non-energetic sweeteners and energetic sweeteners such as polyols; this category does not include fruit juices, honey or other food ingredients that can be used as a sweetener).

Table 1. The PAHO NP model criteria for the identification of processed and ultraprocessed products with excessive levels of sodium, free sugars, other sweeteners and saturated, total and *trans*-fats

Component	Quantity	Classification
Na	≥ 1 mg per 1 kcal	Excessive in Na
Free sugars	≥ 10 % of the EV*	Excessive in free sugars
Other sweeteners	Any amount	Contain other sweeteners
Total fat	≥ 30 % of the EV	Excessive in total fat
Saturated fat	≥ 10 % of the EV	Excessive in saturated fat
Trans-fat	≥ 1 % of the EV	Excessive in total fat

* EV, energy value.

The free sugar quantification followed the method described by the PAHO NP model, so the amount considered was the one declared in the nutrition facts label or calculated by the percentual stabilised by the model, according to the food category in which the product was placed[20].

The critical nutrients were analysed by the PAHO Nutritional Profile Model (Table 1).

In Brazil, the food products analysed did not specify free sugars within carbohydrates. For that reason, it was not possible the collection of that information.

Data analysis

The percentual contribution for the energy value of all macronutrients included in the PAHO was calculated. In our study, EV stands for energy value of each product, which is the value listed for energy in the products' nutrient table. According to PAHO Nutritional Profile Model, 'Energy' is the total chemical energy available in food (in kilocalories or kcal) and its macronutrient constituents (carbohydrates, fats and proteins). For Na calculation, the authors considered the label's Na (mg)/energy value (Kcal), following the PAHO model.

Mean values and standard deviation of the nutrients were calculated by food category (cereal/porridge, fruit/vegetable puree, soup, biscuit/wafers/chips, yogurt or yogurt-related product and meat-or fish-based meal) using the software SPSS Statistics 27.

The frequency and percentual values of the products which did not meet the reference values established by the PAHO model were also estimated by food category.

Results

The number of food products surveyed in the two countries was 171, and out of those, 72 % (*n* 123) were from Porto and 28 % (*n* 48) were from Natal.

The eligible products found in Portugal (*n* 123), included cereals and porridges (*n* 57), meat-or fish-based (*n* 16), yogurt or yogurt-related product (*n* 21), fruit and vegetable purees (*n* 17), soup (*n* 1), biscuit/wafers/chips (*n* 5) and juice/smoothie/tea/other drinks (6). In Brazil, the forty-eight products included cereals and porridges (*n* 25), fruit and vegetable purees (*n* 8) and meat- or fish-based

Table 2. Nutritional content (sodium, free sugars, total fat, saturated fat and *trans* fat) of commercial food products available for sale targeting children aged 0 to 36 years, according to the PAHO nutritional profiling model in Brazil (November 2018 to April 2019) and in Portugal (November 2018 to February 2019)

		Na (mg/kcal)		Free sugar (%EV)		Total fat (%EV)		Saturated fat (%EV)		*Trans*-fat (%EV)	
Food category	Country (*n*)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Cereal/Porridge	Brazil (25)	0·08	0·24	–		0·0	0·0	5·4	3·92	0·0	0·0
	Portugal (57)	0·25	0·20	5·7	1·76	18·5	9·05	5·4	3·92	–	
Fruit/Vegetable puree	Brazil (8)	0·0	0·0	–		0·0	0·0	0·0	0·0	0·0	0·0
	Portugal (17)	0·06	0·08	13·3	3·86	2·7	2·71	0·0	0·0	–	
Soup	Brazil (NF)	NF		NF		NF		NF		NF	
	Portugal (1)	0·39		3·61		39·8		13·3		–	
Biscuit/Wafers/Chips	Brazil (NF)	NF		NF		NF		NF		NF	
	Portugal (5)	0·12	0·06	4·0	2·0	23·0	2·96	8·3	8·26	NF	
Juice/Smoothie/Tea/Drinks	Brazil (NF)	NF		NF		NF		NF		NF	
	Portugal (6)	0·0	0·0	24·3	12·4	1·3	6·5	0·0	0·0	–	
Yogurt or yogurt-related product	Brazil (NF)	NF		NF		NF		NF		NF	
	Portugal (21)	0·42	0·37	5·2	3·50	28·9	6·55	18·0	4·59	–	
Meat- or fish-based meal	Brazil (15)	1·28	0·72	–		36·6	3·7	5·4	2·3	0·0	0·0
	Portugal (16)	0·41	0·71	1·9	1·03	29·3	4·37	7·6	2·03	–	

PAHO, Model of the Pan American Health Organization; NF, not found; EV, energy value; - not available in the label.

Table 3. Percentage of commercial food products available for sale targeting children aged 0 to 36 months that contain critical nutrients (sodium, free sugars, other sweeteners, total fat, saturated fat and *trans*-fat) above the criteria of the PAHO nutritional profile in Brazil (November 2018 to April 2019) and in Portugal (November 2018 to February 2019)

Food category	Country (*n*)	Excess Na (%)	Excess free sugar (%)	Excess total fat (%)	Excess saturated fat (%)	Excess *trans*-fat (%)
Cereal/Porridge	Brazil (25)	0	–	0	–	0
	Portugal (57)	0	0	0	0	–
Fruit/Vegetable puree	Brazil (8)	0	–	0	0	0
	Portugal (17)	0	82	0	0	–
Soup	Brazil (NF)	NF	NF	NF	NF	NF
	Portugal (1)	0	0	100	100	–
Biscuit/Wafers/Chips	Brazil (NF)	NF	NF	NF	NF	NF
	Portugal (5)	0	–	–	40	–
Juice/Smoothie/Tea/Drinks	Brazil (NF)	NF	NF	NF	NF	NF
	Portugal (6)	0	67	0	0	–
Yogurt or yogurt-related product	Brazil (NF)	NF	NF	NF	NF	NF
	Portugal (21)	0	0	38	100	–
Meat-or fish-based meal	Brazil (15)	60	–	100	7	–
	Portugal (16)	0	0	50	13	–

PAHO, Model of the Pan American Health Organization; NF, not found. Criteria components: Na ≥ 1 mg per 1 kcal; free sugars ≥ 10 % of the energy value (EV), total fat ≥ 30 % of the EV, saturated fat ≥ 10 % of the EV, *trans*-fat ≥ 1 % of the EV; other sweeteners: percentage of food that contained any amount; - not available in the label.

meals (*n* 15). The products analysed in Brazil belonged to eight different brands and the ones in Portugal to seventeen.

In order to express the results for critical nutrients, the PAHO Nutritional Profile Model (Table 1) categories and cut-offs were used, and Table 2 and 3 present the mean for each critical nutrient as well as the proportion of food products that exceeded each nutritional parameter. In Brazil, the mean Na content found in meat- or fish-based meals was 1·28 (±0·72) mg/kcal, with 60 % of those products above PAHO NP model critical point.

Given the lack of specification of sugars within carbohydrates in the label of the foods available in Brazil, it was not possible to calculate free sugars. In Portugal, the mean values of free sugars in the group fruit and vegetable purees (*n* 17) were 13·3 % of the EV and 24·3 % of the EV for juice/smoothie/tea/drinks (*n* 6). A total of 82 % of the fruit and vegetable purees and 67 % of juice/smoothie/tea/drinks were above the critical point (≥10 % of the EV). In both countries, no food product contained other sweeteners.

The mean percentual value of total fat for EV was above the critical point (≥ 30 % of the EV) in all meat- or fish-based meals available (Brazil, *n* 15, 36·6 % of the EV; Portugal, *n* 1, 39·8 % of the EV). Although the mean value of total fat content in meat- or fish-based meals available in Portugal (*n* 16) was under the critical point (29·3 % of the EV), 50 % of those products exceeded the cut-off of this nutrient.

The saturated fat content (critical point ≥ 10 % of the EV) in meat- or fish-based meals Brazil had a mean value of 5·4 % of the EV; however, 7 % of the products in that group were above the critical point. In Portugal, the only soup surveyed had a saturated fat mean value of 13·3 % of the EV, above the critical point while in yogurt or yogurt-related products (*n* 21), the saturated fat mean was 18·0 % of the EV. In biscuit/wafer/crisp (*n* 5), although the saturated fat mean value (8·3 % of the EV) was under the critical point, 40 % of the products in that group presented excess of that nutrient. Meat- or fish-based meal

group (*n* 16) presented a saturated fat mean of 7·6 % of the EV, with 13 % of its products above the critical point.

Discussion

In Brazil, most meat-or fish-based meal exceeded the amount of Na and total fat, according to the PAHO NP model and free sugars content was not presented in label of the assessed food products. In Portugal, all 'fruit and vegetable purees', surpassed the level of free sugar, while total and saturated fat was excessive in all yogurt and yogurt-related products.

The absence of the free sugar content in labels of products sold in Brazil was also important finding of this study. In fact, in Brazil, such information was not mandatory to be listed in the labels until the data collection of this study; however, the Brazilian Health Regulatory Agency (ANVISA) released a new resolution on 8 October 2020 (RDC N. 429) which defined and distinguished the types of carbohydrates/sugars and determined that information must be presented in the labels[24].

The products analysed in Brazil presented nutritional information and the quantity of *trans* fatty acids. In Portugal, however, *trans*-fat content was not available on the products label. In December 2019, the Brazilian legislation that regulates the use of industrial *trans*-fat in food was updated, and since then the total amount of *trans*-fat is not allowed to surpass 2 g/100 g in food products destined for consumption by the final consumer and in food directed to retail supply[25]. In a study conducted by the WHO Europe, an expressive part of the products investigated did not present the *trans*-fat content on their labels, possibly due to the fact that this information is not mandatory in the European Union[7,26]. However, the European Commission adopted in April 2019, a regulation that limits to 2 g of *trans* fatty acids per 100 g of fat in food. The adoption of this regulation is compulsory to all European Union countries from April 2021[26].

A recently published study evaluated 2634 food products targeted at young children using information from their labels in ten European countries. Their objective was to determine if food products targeted at young children (up to 36 months of age) in Europe had inadequate formulation and high sugar content. The study found that, in average, approximately one-third of the products' energy value derived from their total sugar content, and for most food categories, the energy from sugar was higher than 10 %, corroborating with this finding of the present study[27].

In a study conducted in Brazil, the composition of ultra-processed food in products present in the diet of 536 6–59-month-old children. The study revealed that those products had a high energy value and high levels of total fat, saturated fat, *trans*-fat and Na[28]. In the USA, research found excessive Na and sugar contents in the labels of products targeted at 0–36-month-old children[29] that are similar to those found in this research.

The ultra-processed food group is characterised by products with a high concentration of carbohydrates, saturated fat and Na and a low fibre and protein content when compared with unprocessed or minimally processed food[30,31]. In the present study, there was a predominance of ultra-processed food products[32,33] which possibly contributes to the nutrient profile found. According to Neri *et al.*[34], there is a cumulative recognition that the increases of the participation of ultra-processed food in the diet result in the deteriorating of the nutritional quality of the general diet and in negative effects to health. The WHO recommends not promoting complementary food which do not meet the composition standards (such as those rich in sugar, fat and Na), safety, quality and nutrient content or those which are not in accordance with the national dietary guidelines.[9]

Regarding lipids, they are vehicle for fat-soluble vitamins and an effective form of energy storage. In this age group, after 12 months of age, the reference intake range for total fats should constitute 35–40 % of the energy intake, which higher that the cut-off that we used in the present study (30 % EV). With regard to the saturated fat intake, EFSA states that it should be as low as possible[35].

The European Society for Pediatric Gastroenterology, Hepatology, and Nutrition emphasises the disapproval of the use of whole cow's milk as the main drink before 12 months of age[36].

Finally, the European Commission's Technical report by the Joint Research Center (2019) Food Based Dietary Guidelines, milk and dairy products recommendations vary between 3 and 5 servings per day, giving preference to low fat options for children > 2 years old, and this preference may be important to regulate the amount of saturated fat in the diet, few recommend low sugar options; and few Food Based Dietary Guidelines support fortification or enrichment with Ca or vitamin D[12].

The WHO highlights that the nutrient profiling models may be used for stabilising limits for the quantification of fat, sugar or Na allowed for a product to be promoted[9]. The WHO 2013–2020 Global Action Plan for the Prevention and Control of noncommunicable diseases had as goal a relative reduction on the average consumption of salt/Na by the population[37]. Therefore, the necessity of reducing the consumption of Na since young age is known and crosses the choices of what food is offered to young children.

Furthermore, considering that if the consumption of these foods is high, the child may be exposed to excess weight or metabolic diseases, among others, since the entire dietary pattern must be considered for the health effects assessment, keeping in mind the desired nutritional balance[9]. According to Maalouf *et al.*[29], feeding infants and toddlers foods that are low in excess Na, added sugar and saturated fat can lead to a preference for these foods and improve the health of children as they grow. Key recommendations for a healthy diet include limiting intake of excess Na, added sugars and products labelled specifically for infants and toddlers can help relatives and health professionals determine the place of these foods and beverages in a healthy diet.

The consumption of commercial food products targeted at children is highly prevalent in developed countries, exceeding the consumption of homemade food in some situations. Though such products may have practical advantages, there are concerns about their nutrient composition. There are few studies comparing food for children which are homemade with those commercially produced, and a lack of longitudinal studies to lead to solid conclusions about whether food products targeted at children are beneficial or harmful to children's health[34]. In the present study, some of those

products presented a nutrient profile, which may contribute to the occurring of noncommunicable diseases such as diabetes, obesity and hypertension[38–41].

In recent decades, the prevalence of obesity in children has increased dramatically. This worldwide epidemic has important consequences, including psychiatric, psychological and psychosocial disorders in childhood and increased risk of developing non communicable diseases. These trends have led member states of the WHO to endorse a target of no increase in obesity in childhood by 2025[42]. Portugal has consistently shown an inverted trend in the prevalence of overweight and obesity in children, between 2008 and 2019. It was found a reduction in the prevalence of overweight (37·9 % to 29·6 %) and childhood obesity from 15·3 % in 2008 to 12·0 % in 2019[43]. In Brazil, a systematic review[44] reported that the prevalence of obesity among children has been increasing in the last three decades, being higher in boys, higher according to the age and decade and more prevalent in more developed regions of Brazil.

A relevant characteristic of this study was the use of PAHO NP model[20] for the evaluation of the nutrient profile of the food products targeted at 0–36-month-old children since this model developed a simple way to calculate products' free sugar content based on the information supplied in the food label about the total sugar content, thus serving as an important component for the evaluation of their nutritional quality. The PAHO NP model was used to evaluate the food products in Portugal due to the absence of a model in the European continent which includes the age period studied. The NP model used in Europe is usually the one from WHO; however, such model is recommended for the analysis of food products targeted at individuals who are older than the age of 36 months. This model was compared with other three models used in Europe, WHO-EURO, WHO-EMRO (Mediterranean Eastern) and model published by Food Standards Agency UK (FSA/Ofcom), showing agreement between them[20].

Facing that epidemiologic scenario, PAHO NP model presents critical parameters for some nutrients in industrialised food products, especially in those that processed and ultraprocessed, based on scientific data and relevant works in nutrition aiming to supply information based on evidence to develop to discourage the consumption of unhealthy food. The PAHO NP model used in this study is based on robust scientific evidence and has as a goal to create environments that are favourable to healthy eating[20].

New strategies for primordial prevention of early childhood obesity require focusing attention on growth parameters during the first 2 years of life, with support for increasing the breast-feeding duration, and improvements in dietary quality and availability, particularly the reduced consumption of added sugars[45].

This study, being observational and cross-sectional, has as its main limitation the analysis of only a certain period of time.

Supporting changes and monitoring nutrient composition of food products targeted at children is important to improve their nutrient profile. Such products should meet all the regional, national and global standards of nutritional composition, safety and quality. It is equally important to develop strategies for the promotion of breast-feeding, good nutrition and healthy eating habits since the first 3 years of life are fundamental for a healthy development. Thus, it is needed to restrict the publicity of food products with high sugar, fat and Na content and to promote chances and monitoring their nutrient composition.

Conclusions

A considerable number of processed and ultra-processed food products targeted at 0–36-month-old children in Brazil and in Portugal did not meet the PAHO NP model parameters. Most meat- or fish-based meals in Brazil had a high amount of Na and total fat, and no food presented free sugar content in label. In Portugal, an important percentage of fruit and vegetable purees and juice/smoothie/tea/drinks, surpassed the level of free sugar, while saturated fat was excessive in all yogurt and yogurt-related products. The findings of the present study demonstrate the relevance of monitoring and improving the nutritional profile of some food products targeted to young children.

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