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PEDIATRIC ORIGINAL ARTICLE

Nutritional quality of packaged foods targeted at children in Brazil: which ones should be eligible to bear nutrient claims?

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OBJECTIVES: This study aimed to assess the nutritional quality of food products marketed at children, with and without nutrient claims, using two different approaches.

METHODS: Analyses were performed based on a data set with food composition and labelling data from every packaged food marketed at children sold in a major Brazilian supermarket ($n = 535$). Foods were classified as 'healthier' and 'less healthy' according to the UK/Ofcom nutrient profile model and to the NOVA classification based on the level of food processing. Pearson's χ^2 test was used to compare proportions between models. Agreement was assessed using Cohen's κ -statistic ($P < 0.05$).

RESULTS: The NOVA model was stricter than the UK/Ofcom model, classifying more products as 'less healthy' (91.4%) compared with the nutrient profile-based model (75.0%; $P < 0.001$). Agreement between models was 79.4% ($k = 0.30$), because 72.9% ($n = 390$) of products were categorised as 'less healthy' by both models, and 6.5% ($n = 35$) as 'healthier'. Half of the food products marketed at children from the database (270; 50.5%) bore nutrient claims. From these products with nutrient claims, 95.9% (92.8–98.0) were classified as 'less healthy' by the NOVA model, whereas this percentage was 74.1% (68.4–79.2) according to the UK/Ofcom model ($P < 0.05$).

CONCLUSIONS: The high number of foods with low nutritional quality being marketed at children via product packaging and nutrient claims should be of concern to policy makers wanting to improve children's diets and to tackle childhood obesity. The implementation of nutritional quality criteria to ensure that foods targeted at children should be eligible to bear nutrient claims on their labels could avoid a situation where claims mask the overall nutritional status of a food.

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INTRODUCTION

The global population is undergoing a pandemic of overweight and obesity.¹ In 2010, both conditions were estimated to cause 3.4 million deaths and 3.9% of years of life lost worldwide.² In Brazil, an emerging nation, the prevalence of overweight and obesity ranks among the highest in the world.³ From 1989 to 2006, the relative prevalence of overweight in Brazilian preschoolers increased by 160.0%.⁴ Also, from 1974 to 2009, the prevalence of overweight in children (6–11 years) significantly increased in both males (8.3–33.8%) and females (7.2–30.0%),⁵ whereas obesity rates among children (5–9 years) reached 15.0% by 2009.³

Evidence linking the occurrence of overweight and obesity in childhood and early development of diabetes mellitus, cardiovascular disease, dyslipidaemia and hypertension in adult life is strong.⁶ Therefore, childhood constitutes a crucial period for the prevention of non-communicable diseases. A poor diet is a cause of excess weight, and food marketing has been identified as an important driver of poor diets, with high occurrence worldwide.⁷ The marketing of foods targeting children is associated with increased preferences for the advertised products and short-term consumption behaviour.⁸

Nutrient profiling is a scientifically sound method for assessing the nutritional quality of food and beverage items, and it can be used by national authorities to promote public health dietary goals.⁹ Different nutrient profile (NP) models have been

developed for a number of countries and regions. Each model consider different nutrients and components and use either thresholds or scoring, and there is no unanimity as to which one of them is best suited to classify foods according to their nutritional composition for health-promoting reasons.¹⁰

An NP model developed by the UK Food Standards Agency for the UK regulator for broadcast media (Ofcom) is being used to control the marketing of foods and non-alcoholic beverages targeted at children in its original version in the United Kingdom¹¹ and Republic of Ireland,¹² and its adapted version for controlling health claims on food packages in Australia and New Zealand.¹³ The model scores food and drinks as 'healthier' and 'less healthy', using an algorithm based on saturated fats, sodium, total sugars, energy, protein, fibre, and fruit, vegetable and nut content per 100 g or 100 ml.¹¹

In spite of being among the first countries to include mandatory nutrition labelling and product information on food packages, Brazil does not have a system in place specifically to regulate the marketing of foods targeted at children. According to a report of a World Health Organisation/International Association for the Study of Obesity technical meeting on nutrient profiling, a consensus has not been achieved by the Brazilian National Health Surveillance Agency (ANVISA) together with the Southern Cone Common Market (MERCOSUR) as to whether it is necessary to develop a new NP model or adapt an existing one.⁹

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An alternative to an NP model could be the new Brazilian classification system, nominated NOVA,^{14,15} recently used for the 2014 edition of the Dietary Guidelines for the Brazilian population.¹⁶ This system is based on the extent and purpose of processing for a food, and divides foods into three groups: 'natural or minimally processed foods', 'processed foods' and 'ultraprocessed foods'. Processed and ultraprocessed foods, mainly the latter, typically have properties that are conducive to over-consumption: they are often hyperpalatable and sold in large portion sizes; are durable and easy to transport and therefore frequently consumed as snacks. They are often marketed intensively and persuasively.^{14,16} The growing evidence, related to the impact of their consumption on human health, indicates the necessity of halting their increasing consumption.^{14,15}

Regardless of the model used to evaluate the nutritional quality of foods, the need to regulate the marketing of 'less healthy' food to children is undeniable.⁸ As stated by Colby *et al.*¹⁷ any advertising of food or beverages using health or nutrition information beyond minimum requirements can be defined as nutrition marketing. The presence of nutrition claims on food products has the potential to mislead consumers and boost sales, through the inappropriate emphasis on attributes considered positive.¹⁸

This paper aims to investigate how two different models classify foods targeted at children available in a large Brazilian supermarket, and to test which foods would be allowed to bear nutrient claims if either model was applied. The research questions for this paper are:

RQ1: How does the UK Ofcom NP model compares to the NOVA model with respect to strictness, that is, the percentage of foods classified as 'less healthy' by the criteria?

RQ2: What is the level of agreement between the models, that is, to what extent do the nutritional criteria classify the same foods the same way?

RQ 3: Are foods bearing nutrient claims classified as 'healthier' or 'less healthy' by the UK/Ofcom model and/or the NOVA model?

RQ4: What proportion of packaged foods marketed at children would be allowed to bear nutrient claims if the UK/Ofcom model or the NOVA model were applied to regulate them?

MATERIALS AND METHODS

Study design

This cross-sectional study used a data set with food composition information derived from food labelling collected in-store from all foods aimed at children available in a major Brazilian supermarket ($n = 535$). The supermarket belongs to one of the 10 largest Brazilian chains, with 27 stores throughout the country. Therefore, most of the products available are from big food and beverages' brands, and are similar to those sold in other supermarket chains in Brazil.

Products considered to be targeted at children were those where at least one of the following marketing strategies was identified on the front-of-package label: words and phrases such as 'child' or 'ideal snack for your child'; cartoons, TV series or film characters; own-brand characters; child celebrities; images of creatures; games or hobbies; colours or shapes that appeal to children; or free gifts.^{19–22} Data collection procedures and data set preparation are described in detail elsewhere.²³

Nutrient claims

Information on the presence and type of nutrient claims on labels of all food products targeted at children was obtained from pictures of packages taken in-store and available on the database. Our analysis included all nutrient claims that could be observed on any surface of the packaging visible to the consumer (comprising all different formats, for example, single words, phrases, sentences, symbols, logos or images). The nutrient claims identified on the food products aimed at children were grouped and registered according to the terms established by the Brazilian regulation no. 54/2012.²⁴

Applying the models

The UK Ofcom NP model. The UK Ofcom NP model scores food and drinks separately, but using the same algorithm as a basis to define products that are 'healthier' and 'less healthy'. The score is based on nutrient and ingredient content per 100 g of a food or drink.¹¹

Food composition data on energy, protein, carbohydrates, total fat, saturated fat, fibre, sodium and total sugars were obtained from the database. Ingredient list photographs were used to calculate fruit, vegetable and nut content of foods, as well as to estimate total sugars content when information was not available on the nutrient declaration tables (displaying data for total sugars content is not mandatory by Brazilian food labelling regulation no. 360/2003).²⁵

Data on sugars content missing from food packages were estimated according to a systematic methodology involving 10 steps,²⁶ and this was needed for 58.1% of the data set. The proportion of fruits, vegetables and nuts content for each food was estimated as referred at the guide to apply the model.²⁷

Points A (0–10) were allocated for each energy (kJ), total sugar (g), saturated fat (g) and sodium (mg) content. Points C (0–5) were allocated for each of the fruit, vegetable and nut (%), fibre (g) and protein (g) contents. The overall score is calculated by 'total C points' minus 'total A points'. Individual scores ranged from -15 (most healthy) to +40 (least healthy). Cutoff points used were the same as those established by the Office of Communication to regulate marketing to children on TV: products were categorised as 'less healthy' (4 points or more for food, and 1 point or more for drinks) and 'healthier' (3 points or less for food, and 0 points or less for drinks).¹¹

The NOVA model. Food products targeted at children were also classified into one of the three groups established by the NOVA classification based on the extent and purpose of industrial processing: 'natural or minimally processed foods', 'processed foods' and 'ultraprocessed foods'.¹⁴

According to the NOVA model, the first group contains 'natural foods', that is, foods obtained directly from plants or animals, purchased ready for consumption without having undergone any alteration after leaving the natural source; and 'minimally processed foods', which are natural foods that, before their acquisition, underwent minor changes that do not involve adding substances to the food. This group includes foods such as vegetables, fresh, dried or juiced fruits with no added sugars or additives, nuts, fresh, chilled or frozen meats, pasteurised and UHT milk, plain yoghurt, eggs, tea, coffee and water.^{14,16}

The second group is essentially constituted of manufactured products to which salt, sugar, oil or vinegar is added to make them last longer and be more pleasing to the palate. The group includes canned vegetables, fruits in syrup, cheeses and breads made with flour, water, salt and yeast.^{14,16}

The third group is composed of manufactured products that are entirely or mostly made from substances extracted from food (oils, fats, sugar, proteins), those that are derived from food constituents (hydrogenated fats, modified starch) or from substances synthesised in a laboratory based on organic materials (where colourants, flavourings, flavour enhancers and other additives are used to give the products attractive sensory properties). 'Ultraprocessed foods' include sweet and savoury biscuits, chips, granola bars, confectionary in general, fast food dishes, instant noodles, various types of ready or semiready meals and soft drinks.^{14,16}

The 2014 edition of the Dietary Guidelines for the Brazilian population recommends that people limit their intake of 'processed products' to small servings, and to avoid the consumption of 'ultraprocessed products' because they are mostly nutritionally unbalanced.¹⁶ Therefore, after the classification according to the NOVA model, food products targeted at children from the 'processed' and 'ultraprocessed' groups were designated 'less healthy', whereas the 'natural or minimally processed' group was considered 'healthier'.

Statistical analysis

Analyses were conducted on the entire data set and also stratified by the presence of nutrient claims (food products with nutrient claims and food products without claims). The criteria to classify food products as 'healthier' and 'less healthy' according to both models were applied to the data set using Stata syntax files (available upon request from the first author).

For both models, the proportion of 'healthier' and 'less healthy' products was estimated. Standard errors and 95% confidence intervals were estimated assuming a binomial distribution of the proportion of foods in the population. Proportions and 95% confidence intervals were calculated for the whole data set, and then stratified by the presence of nutrient

Table 1. Percentage of foods categorised as 'less healthy' by the UK/Ofcom nutrient profile model and the NOVA model, overall and by the presence of NC (95% CI)

	NOVA	UK/Ofcom	Difference between models' categorisation
Overall (<i>n</i> = 535)	91.4% (88.7–93.6)	75.0% (72.0–79.5)	<i>P</i> < 0.001 ^a
With NC (<i>n</i> = 270)	95.9% (92.8–98.0)	74.1% (68.4–79.2)	<i>P</i> < 0.001 ^a
Without NC (<i>n</i> = 265)	86.8% (82.1–90.6)	75.8% (70.2–80.9)	<i>P</i> = 0.001 ^a
Difference in categorisation by the presence of nutrient claims	<i>P</i> < 0.001 ^a	<i>P</i> = 0.663	

Abbreviations: CI, confidence interval; NC, nutrient claims. ^aStatistically significant at *P* < 0.05 (Pearson's χ^2 test).

claims. Pearson's χ^2 test was used to compare proportions and determine positive associations between inter- and intra-models.

Agreement between models was assessed using Cohen's κ -statistic and classified by the rating system devised by Landis and Koch.²⁸ Cohen's κ -statistic scores and associated 95% confidence intervals were estimated for each pairwise combination of the models. This was also carried out for the whole data set and stratified by the presence of nutrient claims. The statistical package Stata version 11.0 (Stata Corp, College Station, TX, USA) was used for the analyses.

RESULTS

The NOVA model was stricter compared with the UK/Ofcom model, classifying more products as 'less healthy' (91.40%) compared with the NP-based model (74.95%), and this difference was statistically significant.

Half of the food products marketed at children from the database (270; 50.5%) bore nutrient claims. The NOVA model was also stricter compared with the UK/Ofcom model when applied to food products with nutrient claims (95.9%, 92.8–98.0; 74.1%, 68.4–79.2) and without nutrient claims on labels (86.8%, 82.1–90.6; 75.8%, 70.2–80.9; *P* < 0.05).

Foods marketed at children that bore nutrient claims were significantly 'less healthy' compared with foods that did not bore nutrient claims according to the NOVA model. According to the UK/Ofcom model, there was no difference in classification between foods bearing and not bearing nutrient claims (Table 1).

Foods such as sliced white and whole grain bread, sweetened dairy drinks, chicken nuggets and fish fingers, gelatine powder mix, soy milk-based fruit beverage, diet carbonated drinks, savoury whole grain biscuits, sugar-free banana granola, pudding and flan powder mixes, and lasagne were classified as 'less healthy' by the NOVA model, but as 'healthier' by the UK/Ofcom model. On the other hand, cocoa milk, butter and honey were classified as 'healthier' by the NOVA model and not by the UK/Ofcom model.

Agreement between the models was 79.4% (74.6–81.7; *k* = 0.30). From the 535 food products aimed at children evaluated, 72.9% (64.3–81.5) were classified as 'less healthy' according to both models. Only 6.5% (1.8–11.2) of food products were considered 'healthier' by both models (that is, rice, dried pasta, fruit juice, fresh fruits and vegetables, eggs, peanuts and desiccated coconut).

Agreement between models for foods bearing nutrient claims was 74.44% (68.8–79.5; *k* = 0.08), whereas the agreement for foods without nutrient claims was 84.23% (79.2–88.3; *k* = 0.50). Overall agreement between models was high, but the κ -score indicated only 'fair' agreement. There was a greater agreement between models when categorising foods targeted at children without nutrient claims, achieving 'moderate' agreement. As suggested by examining the 'strictness' of models when applied to the foods, the least agreement between the models came from foods with nutrient claims. Within the latter category, agreement fell to as low as 0.08 (slight agreement).

DISCUSSION

Most foods marketed at children from our database were considered 'less healthy' by both the UK/Ofcom and the NOVA model. Findings from this study suggest that if either of the models presented here was adopted to indicate which foods marketed at children should not be allowed to bear nutrient claims on labels, around three-quarters of the products evaluated would not be considered suitable to do so.

Additionally, it was found that the model based on the level of food processing (the NOVA model) was stricter than the model based on nutrients (the UK/Ofcom model), although both models classified most of food products marketed at children as 'less healthy'. Only 6.5% of the food products were considered 'healthier' by both models. When retailed foods were grouped and analysed by the presence of nutrient claims on labels, similar results were obtained with both models. The NOVA model categorised 95.9% of food products with nutrient claims as 'less healthy', whereas this percentage was 74.1% according to the UK/Ofcom model.

The key feature of an NP model (such as the UK/Ofcom model) is that it uses information about levels of nutrients and/or ingredients from a food in isolation. It does not take account of how often the food is consumed, and in what context or which other foods it is eaten with.²⁹ The application of criteria considering the whole food rather than just a single nutrient to allow the use of nutrient claims on packages could avoid a situation where the claim mask the overall nutritional status of a food product, which could mislead consumers when trying to make healthy choices. Common front-of-package nutrient claims are potentially misleading, especially when placed on products with high levels of nutrients to limit and low levels of nutrients to encourage.³⁰

The NOVA model is based on the level of food processing and not on the nutrient composition of foods. However, according to a systematic review, studies in different countries have shown that ready-to-consume, processed and ultraprocessed products are more energy dense, have higher sugar, sodium, total and saturated fat content with lower protein and fibre content compared with natural or minimally processed foods.¹⁴ Moreover, ultraprocessed products are often served in large portions, are hyperpalatable, have long shelf-lives, can be easily carried around and are aggressively promoted through persuasive marketing strategies, which encourage excessive energy intake and facilitate the habit of eating between meals and snacking.^{14,15}

Results presented here showed that the NOVA system is significantly stricter than the UK/Ofcom model when classifying foods targeted at children as 'less healthy'. This difference in strictness can be attributed to a number of differences between the models: for example, the UK/Ofcom model takes no account of non-caloric sweeteners and other artificial food additives which the NOVA model does albeit indirectly. Therefore, some of the foods targeted at children classified as 'less healthy' because of their level of processing, such as some types of sliced bread,

chicken nuggets and diet carbonated drinks, were classified as 'healthier' by the UK/Ofcom model but not by the NOVA model.

The UK/Ofcom NP model is a recognised method for evaluating the nutritional quality of food products targeted at children, and takes account of nutrients such as saturated fat and sodium which the World Health Organisation and other authoritative bodies recommend should be controlled. There is no gold standard for nutrient profiling, but ideally, the nutrients selected for use in an NP model should be directly linked to desirable health outcomes for the target population.³¹ Considering that the Brazilian population's diet exceeds the recommended intakes for energy density, free sugar, trans-fat and sodium, and is insufficient regarding fibre and potassium,¹⁵ the absence of components such as trans-fat acids to calculate the score could be something to contemplate if the model were to be adapted for use in Brazil.

However, although the current recommendation from World Health Organisation is no consumption of industrially produced trans-fat, the current Brazilian legislation on food labelling from 2003, which is based on portion sizes for different kind of food products, establishes that foods containing an amount of trans-fat per serving is ≤ 0.2 g can declare 'does not contain trans-fat' or 'not significant amount' on its labels.²⁵ Hence, the consumption greater than the referred portion size may lead to significant intake of this type of fat.³² A study which investigated how trans-fat is reported on the packaging of food products sold in a Brazilian supermarket found that more than half of products had components high in trans-fats in the ingredient list. Moreover, a small percentage of the nutrition facts tables had the trans-fat content, and roughly a quarter of the food products claimed to contain no trans-fat on the front of the packaging.³³ Therefore, it would be difficult to estimate the amount of trans-fat acids based on what have been reported on the nutrition facts of Brazilian products, and thus the trans-fat content would not be a good parameter to evaluate foods in the current Brazilian scenario of regulations.

At least three-quarters of the retailed products targeted at children bearing nutrient claims on labels would not be allowed to do so if either the UK/Ofcom or the NOVA models were adopted for a Brazilian regulation on claims.²⁴ This suggests that the majority of products marketed at children bearing nutrient claims are 'less healthy' than they should be. Similar results have been found in other countries. A study in Canada that investigated child-oriented marketing in all product categories found that 90% of the products were unhealthy and 63% had misleading health or nutrition claims.¹⁹ An Australian study found that 75.2% of foods marketed to children via product packaging were high in fat or sugar, and that half of them bore health and nutrition claims.³⁴ In New Zealand, most cereals for kids (72%) were categorised as 'less healthy', containing significantly higher energy, sugar and sodium content and lower protein and fibre content compared with 'healthier' cereals. 'Less healthy' cereals for kids bore significantly more nutrition claims compared with the 'healthy' ones.³⁵

Our results also indicated that most food products targeted at children considered 'less healthy' by the NOVA system bore nutrient claims on labels, that is, the claims were mainly found on processed and ultraprocessed foods. These findings are alarming considering that the consumption of ultraprocessed foods is associated with higher body mass index and greater prevalence of both excess weight and obesity in Brazilian aged > 10 years,^{15,36} and that there are also significant associations between ultraprocessed food consumption and dyslipidaemias in Brazilian children.³⁷ Studies from high-income countries that have assessed the influence on obesity of foods that could be classified as ultraprocessed also found positive associations between the consumption of such foods and long-term weight gain.³⁸⁻⁴⁰

Finally, the main characteristic of the 6.5% of foods targeted at children considered 'healthier' by both models is that they are fresh and natural. This group was mainly established by the NOVA

system, as it was the stricter model. However, many studies have shown that most foods that are recommended to be consumed, such as fruits and vegetables, are not typically marketed at children.^{19,23} Protective associations between intake of foods such as fruits, vegetables, nuts and yoghurt and long-term weight gain have been reported.³⁸

The difficulties in precisely calculating the fruit, vegetable and nut content of foods from the information in ingredients lists and also of estimating total sugars content for the purpose of applying the UK/Ofcom model are a limitation of this study, but calculations were carefully performed to minimise potential mistakes. Also, it is possible that the thresholds adopted to define 'less healthy' and 'healthier' products according to the UK/Ofcom model have affected the results. However, we decided to maintain the same limits used to regulate food marketing to children on TV.

The rising burden of obesity and diet-related non-communicable diseases has drawn attention to policy-responsive aspects of the food environment that might influence consumers' food choices and/or influence food manufacturers towards improving when developing or reformulating food products. Food labelling is a policy area where improvements have potential health benefits.⁴¹ The high percentage of foods with low nutritional quality being marketed at children via product packaging found in this study should be of concern to policy makers wanting to improve children's diet and to tackle childhood obesity. Furthermore, the introduction of nutritional quality criteria to indicate whether foods targeted at children should be eligible to bear nutrient claims on their labels could avoid a situation where claims mask the overall nutritional status of a food.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

VMR was responsible for planning the research, collecting, analysing and interpreting the data, and for drafting the first version of the manuscript. ACF and RCO contributed towards data collection, analysis and interpretation, and revision of the manuscript. RPCP and MR contributed to data analysis, interpretation of results and revision of the manuscript. GMRF had overall responsibility for the study, research coordination, supervision of data collection and analysis and revision of the final manuscript. All of the authors approved this version for publication and accepted the conditions established by International Journal of Obesity.

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