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Ultra-processed Foods Containing Children's Marketing: Packaging Analysis and Nutrition Labeling

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Abstract Increased incidence of overweight and obesity globally may contribute to practical foods use, which are represented by unbalanced nutritional value and empty calories. This study amid to analyze and compare ultra-processed foods (UPF) aimed at children with those not aimed at this population. This quantitative analytical study was based on information contained in UPF packaging, from supermarkets in medium-sized countryside in Brazil. Children's products had own brand characters in 71.7% of analysis, claiming to be "vitamins source" and "minerals source" (23.0% and 10.4%, respectively). Nutritional value to 100/g of products aimed at children has more carbohydrates, while those not intended have more protein and total fat. Comparing daily caloric value percentage to package for age group and sex of children, pre-teens and adolescents, showed average values of energy, carbohydrate, protein, and sodium with significantly increased percentages for all groups, with exception of dietary fiber ($p<0.05$). It was found that daily caloric value calculated percentage by diet reference to 2,000kcal in all products, can over or underestimate individual children and adolescents needs. This study shows that nutritional products content with children's characteristics, compared to related products without proper characteristics, present significantly different values. UFP with children's characteristics, carbohydrate content per serving of package were higher. With regard to UPF intended for adult consumption, protein and total fat contents were higher.

Keywords: *ultra-processed foods, adults, kids, food packaging, food labeling*

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1. Introduction

The world food panorama is characterized by lifestyle changes that involve the fresh food replacement for those that save preparation and consumption time [1]. Consequently, the population was exposed to processed foods consumption and ultra-processed foods, which began to replace foods made at home, precisely because their practicality.

Ultra-processed foods (UPF) refer at products submitted to industrial processing levels that modify their texture, color, aroma, and flavor [2,3]. According to Monteiro et al. (2016) [4], the purpose of this processing is given through methods that make these foods palatable and that bring them practicality at the consumption time, in addition to keeping them for certain period. Represented by their unbalanced nutritional value, these products present nutritional losses resulting from their use consumption, and, despite this, they are often introduced early in diet and last through all life stages, contributing to increased overweight and obesity prevalence [5,6,7]. Pursuant to Brazilian population statistics in 2009, the number of children aged five to nine with excess weight reached 33.5%, followed by obesity with 14.3% [8]. For adults, this rate in country increased 67% in the last decade [9].

The UPF have own their identification by the packaging, which are responsible for arousing consumer interest in the product. Labels are understood as means of information to the consumer at the time of purchase, as they contain statements of energy and nutrient value, in addition to nutritional properties [10]. Thus, the information on these products serves as a way to influence the consumer to make their food choices, since through labeling legislation, these products must clearly inform properties and nutrients from which these foods are formulated [10,11].

Liberti et al., 2018 investigated consumer's understanding of nutritional information on UFP. Although more than

half of consumers (63.79%) reported reading food labels, not everyone understood the information read. This points to need to rethink due knowledge importance in ultra-processed products composition, even more so if these are strongly present in children's eating routine.

When it comes to offering UPF aimed at children, food industry often uses product packaging as a way of attracting consumers' attention [13]. This strategy includes colored packaging, different letters and images associating the product with a drawing character, which are information that do not necessarily add food quality, but rather to purchase and sale strategies [14].

In marketing view of these products for children, combined with lack information lack on the labels and understanding by consumers, in studies that aim to analyze the nutritional composition quality of UPF targeted at children, exposed for consumption in supermarket shelves. Therefore, this study aimed to analyze information on the nutrition label of UPF aimed at children and compare them with related products not aimed at this audience.

2. Materials and Methods

The present study is observational analytical quantitative, conducted in a supermarket in a medium-sized countryside city of Paraná, Brazil. Data collection was performed from the information set contained in the UPF labels available for sale from the research place. All products were categorized into two classes: targeted and not targeted at children. UPF directed to children were considered those in which the advertising represented on the package front was somehow aimed at children.

According to Machado et al., 2019, these products have characters, phrases such as “kids”, cartoons, gifts, and fun games on their packaging, among other claims. For UPF not targeted at children, those whose packaging did not have any explicit content for children's consumption were considered.

To compose research data, two categories were used and, as a reference, products had to present similarities (the same brand or with similar characteristics), so that it was possible to conduct a comparison these two classes. Products classification was carried out in accordance with the Resolution of the Collegiate Board of Directors (RDC) No. 359/2003 of National Health Surveillance Agency (ANVISA) [15] and divided into five food groups. Sample consisted by following groups and subgroups: Food Group 1 (FG1) - Bakery products, cereals, leguminous, roots and tubers (savory biscuits and grissini, breakfast cereal, powders for preparing flans and desserts, gelatin); Food Group 2 (FG2) - Fruits, juices, nectars and fruit refreshments (concentrated fruit juice and juice, nectar and fruit drink); Food Group 3 (FG3) - Milk and dairy products (dairy drink, fermented milk, yogurt of all types and dairy dessert); Food Group 4 (FG4) - Sugars and products that provide energy from carbohydrates and fats (filled and unfilled cookies, snack-type snacks, dumplings with and without filling) and Food Group 5 (FG5) – Meat and eggs (Meat preparations with flour or breadcrumbs).

Other groups named as “Vegetables and canned vegetables”; “Oils, fats, and oilseeds” and “Sauces, ready-made seasonings, broths, soups and prepared dishes” were excluded from information collection, as there were no childish characteristics in the product packaging.

Data collection took place between July to November 2020. Products were photographed from all angles to analyze the information on trade name, flavor, manufacturer, country of origin what marketing type is present in the products packaging that o contained, product price, total package weight, portion, household measure and nutritional information (in table or in plain text), such as: amount of total energy and kilocalories (Kcal), percentage of daily caloric value (%DCV), protein, total fat, saturated fat and trans-fat, dietary fiber and sodium of all products.

UFP composition analysis, the first three ingredients that appeared in the ingredients list of the products were collected, as well as the artificial colors presence, stabilizers, and preservatives. In addition, the described nutritional claims were evaluated on the packages, such as, for example, source of vitamins and minerals and the addition of vitamins and minerals in the same product.

The amount nutrients indicated in nutritional table refers to a certain product portion that is established by RDC No. 359 [16] - ANVISA, where it varies according to product size it refers to, not being standardized across all food groups. Thus, declared portion amount of all products in infant and non-infant class was converted to 100 g or 100 ml.

In addition, according to data from the products themselves, the %DCV are presented in relation to a diet of 2,000 kcal per day for any UPF, regardless of whether it is intended for children or not. Thus, the %DCV was calculated with the daily amounts of energy, carbohydrate, protein, sodium and dietary fiber from the recommendations by age group for children (4-8 years) and pre-adolescents and adolescents (9-13 years) according to gender (female and male), based on Dietary Reference Intakes (DRIs), (Institute of Medicine, 2005; 2019), as shown in Table 1. Reference amounts of %DCV of total fat, trans fat and saturated fat for children were not calculated as they are not defined by the DRIs.

Table 1. Reference values for nutritional components of children, based on variables related to sex and age group, according to RDIs*

Age group	Sex	4-8 **years old**	9-13 **years old**
Energy (Kcal)	Male	1742 kcal/day	2279 kcal/day
	Female	1642 kcal/day	2071 kcal/day
Protein	Male	19 g/day	34 g/day
	Female		
Carbohydrate	Male	130 g/day	130 g/day
	Female		
Sodium	Male	1000 mg/day	1200 mg/day
	Female		
Dietary Fiber	Male	25 g/day	31 g/day
	Female		26g/day

Note. *Reference Daily Intakes. Sources: Dietary Reference Intakes for Sodium and Potassium (2019); Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (2005). These reports can be accessed at www.nap.edu.

For statistical analysis, the SPSS Statistics® software version 22.0 was, adopting significance level of 5% ($p<0.05$). The comparison of categorical variables performed using the chi-square test and the comparison of numerical

variables was performed using the Student t test. Regarding the mean value of %DV for packaging of both classes, the variables comparison was performed using Wilcoxon test and variables between food groups was applied the Post-Hoc test of Tukey, Scheffe, Dunnet and Bonferroni. Results were presented based on descriptive statistics, using relative and absolute frequencies for categorical variables, mean, median, as well as standard deviation (SD) and minimum and maximum values for continuous variables.

3. Results

Considering the inclusion criteria, 596 UFP packages were analyzed. These, 230 (38.5%) were considered products aimed at children because they had some type of marketing on packaging, and 366 (61.4%) products did not have children's characteristics, therefore, intended for other audiences.

Of the total packaging, 105 distinct brands were found. Most manufactured products were from the Southeast and South regions of Brazil, in the states of São Paulo (n=223; 37.4%), Paraná (n=182; 30.5%) and Santa Catarina (n= =69; 11.5%), respectively.

Considering marketing strategies on UPF packaging aimed at children, it was possible to observe that not only was there greater products stamped amount with characters of brand itself (71.7%), but almost a quarter (25%) had characters that cover cartoons and animated films (23%). Other ways to draw the children's audience attention were present in samples in smaller amounts (5.2%), as shown in Figure 1.

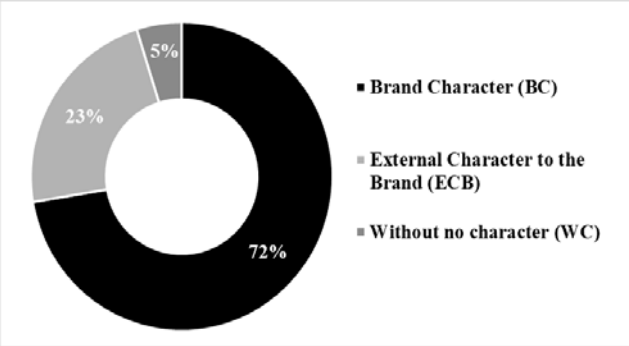

Figure 1. Industrial marketing strategies assigned to children's advertisements, printed on UPF marketed in a market in Guarapuava/PR, 2020

When food subgroups at Table 2 targeted and not targeted at children were analyzed separately, it was found that the sugars and products with energy from carbohydrates and fats group (FG4) represented a higher prevalence of the samples analyzed for both classes, when compared to groups FG1, FG2, FG3 and FG5 ($p<0.01$). For the class of UPF aimed at children, filled sweet biscuits had a higher quantity (n=53; 24.31%), while for the UPF class not aimed at this audience, there was a higher frequency of savory snacks snack type (n=85; 23.22%).

Table 2. Ultra-processed Foods (UPF) characteristics targeted and not targeted at children, according to food group and subgroup of Collegiate Board Resolution (RDC) No. 359/2003 of National Health Surveillance Agency, sold in a market of Guarapuava/PR, 2020

Food Group	Food Subgroup	n	%
UPF intended for children			
FG1 - Bakery products, cereals, legumes, roots and tubers	Morning cereal	10	4.34
	Salted biscuit	3	1.30
	Gelatin powder	8	3.47
	Instant noodles	10	4.34
FG2 - Fruits, juices, nectars, and fruit drinks	Fruit drink	19	5.21
	Juice powder	12	8.26
FG3 - Milk and dairy products	Milk drink	13	5.65
	Yogurt	10	4.34
	Fermented milk	7	3.04
	Milk dessert	2	0.86
	Chocolate powder	4	1.73
	Filled cookies	56	24.31
	Filled dumpling	15	6.51
	Snacks	55	23.91
FG5 - Meat and eggs	Nuggets or breaded	6	2.60
Total		230	100.00
UPF intended for adults			
FG1 - Bakery products, cereals, legumes, roots, and tubers	Morning cereal	8	2.18
	Salted biscuit	5	1.36
	Gelatin powder	11	3.00
	Instant noodles	50	13.66
FG2 - Fruits, juices, nectars, and fruit drinks	Fruit drink	8	2.18
	Juice powder	34	9.28
FG3 - Milk and dairy products	Milk drink	31	8.46
	Yogurt	43	11.74
	Fermented milk	7	1.91
	Milk dessert	8	2,.8
FG4 - Sugars and products that provide energy from carbohydrates and fats	Chocolate powder	5	1.36
	Filled cookies	46	12.56
	Filled dumpling	5	1.35
	Snacks	85	23.22
FG5 - Meat and eggs	Nuggets or breaded	20	5.46
Total		366	100.0

Note. Source: research data, 2021.

Table 3. Related characteristics to nutritional composition per serving (100g or 100ml) and nutritional claim of UPF packages sold in a supermarket in Guarapuava/PR, 2020

Characteristics	UPF intended for children		UPF intended for adults		
	Mean	SD	Mean	SD	P-value
Nutritional Composition					
Packing serving size (g or ml)	53.77	55.62	69.33	64.21	0.002[a]
Total energy value - portion (kcal)	370.82	179.03	349.19	193.73	0.166[a]
Proteins(g)	5.87	4.52	7.06	9.57	0.043[a]
Carbohydrates (g)	59.35	27.91	47.02	26.11	<0.001[a]
Total fat (g)	11.85	10.87	14.06	13.70	0.030[a]
Saturated fat (g)	4.28	4.21	4.95	4.76	0.074[a]
Trans fat (g)	0.16	0.83	0.14	0.74	0.805[a]
Dietary fiber (g)	1.54	2.36	1.95	3.24	0.099[a]
Sodium (g)	491.25	548.45	569.87	588.96	0.104[a]
Nutritional Claim	n	%	n	%	
Source of vitamins	53	23	30	8.2	
Source of vitamins and minerals	24	10.4	14	3.8	
Source of minerals	16	7	2	0.5	<0.001[b]
Absent	122	53	269	73.5	
Others*	15	6.5	51	13.9	

Note. *Others = claims of 0% trans-fat, less salt, more fiber, more cereal and reduced sugar were considered. [a]Student's T-test; [b]Chi-Square Test.

Nutritional contents analysis according to the mandatory labeling items of the UPF is presented in Table 3.

As the nutritional values per 100 grams, it was observed that the UPF aimed at children had an average of 59.4 (SD=27.9) grams of carbohydrates. On the other hand, products not aimed at children had an average of 14.7 (SD=13.7) grams to total fat and 7.06 (SD=9.6) grams to protein. There was no statistically significant difference for amounts of calories, trans and saturated fat, sodium, and dietary fiber for the products of both classes analyzed.

It was also found that, on the packages front, it was common to contain some type of nutritional claim, stating that a certain product had a nutritional value added to its composition. Thus, it was noticed that the nutritional claim "source of vitamins" and "source of vitamins and minerals" were more prevalent on the packaging of products intended for children (23% and 10.4%, respectively). In other hand, products intended for general public showed a greater absence of nutritional components claim on packaging (p<0.001).

Table 4. Average percentages of calories, carbohydrates, proteins, dietary fiber and sodium in relation to daily reference value (%DCV) based on 2000 kcal diet – products for children

			Mean(SD)				
	Age Group	% DVC	Energy value	Carbohydrates	Proteins	Dietary Fibers	Sodium
General FG (n=230)		Packaging	6,32(3,82)	6,39(3,10)	3,75(3,90)	2,56(3,10)	8,18(14,93)
	AG1	Female	7,70(4,67)*	14,77(7,27)*	14,83(15,40)*	2,29(3,09)*	9,55(35,84)*
		Male	7,26(4,40)*				
	AG2	Female	6,11(3,70)*	14,77(7,27)*	8,29(8,60)*	1,83(2,49)	16,29(29,87)*
		Male	5,55(3,37)*			2,19(2,97)*	
FG1 (n=31)		Packaging	8,45(6,99)	8,94(5,96)	4,45(3,86)	5,49(3,33)	25,58(33,15)
	AG1	Female	10,35(8,61)*	20,75(13,85)*	17,95(15,16)*	4,21(3,78)	61,40(79,69)*
		Male	9,76(8,11)*				
	AG2	Female	8,21(6,83)*	20,75(13,85)*	10,03 (8,47)*	4,04 (3,64)	51,17(66,41)*
		Male	7,46(6,21)*			3,39 (3,05)*	
FG2 (n=31)		Packaging	2,13 (1,57)	3,48(2,31)	NC	NC	0,65(0,49)
	AG1	Female	2,49(1,86)*	7,74(5,81)*	NC	NC	1,35(0,63)*
		Male	2,34(1,76)*				
	AG2	Female	1,97(1,47)*	7,74(5,81)*	NC	NC	1,12(0,53)*
		Male	1,79(1,34)*				
FG3 (n=32)		Packaging	5,16(2,10)	5,72(2,17)	3,88(1,56)	0,47(1,43)	3,31(2,31)
	AG1	Female	6,30(2,52)*	13,53 (4,93)*	15,61(6,20)*	0,47(1,45)	8,07(5,53)*
		Male	5,93(2,38)*				
	AG2	Female	4,99(1,99)*	13,53(4,93)*	8,72(3,47)*	0,45(1,39)	6,72(4,61)*
		Male	4,54(1,82)*			0,37(1,17)	
FG4 (n=130)		Packaging	6,71(1,90)	6,58(1,62)	2,68(0,97)	2,43(2,81)	5,90(4,49)
	AG1	Female	8,20(2,33)*	15,21(3,74)*	10,42(3,10)*	2,49(2,90)*	14,05(10,65)*
		Male	7,73(2,19)*				
	AG2	Female	6,50(1,84)*	15,21(3,74)*	5,82(1,73)*	2,37(2,78)	11,71(8,87)*
		Male	5,91(1,68)*			1,99(2,33)*	
FG5 (n=6)		Packaging	14,67(0,82)	7,50(0,84)	22,83 (1,47)	4,67(5,13)	22,0(2,28)
	AG1	Female	17,85(0,88)*	17,56(1,41)*	50,49(2,89)*	4,67(5,11)	52,40(5,34)*
		Male	16,83(0,83)*				
	AG2	Female	14,16(0,69)*	17,56(1,41)*	4,67(5,13)*	4,49(4,92)	43,67(4,45)*
		Male	12,86(0,63)*			3,76(4,12)	

Note. n = sample number; % = percentage; FG = Food Group, AG1- Age group 1 = 4 to 8 years old, AG2 = Age group 1 - 9 to 13 years old Age GDCV = daily caloric value; F = female; M = male; NC = not included *Averages that present a statistically significant difference in relation to mean value of %DV described on product packaging (Wilcoxon test, p<0.05).

Table 5. Mean percentages of calories, carbohydrates, proteins, dietary fiber and sodium in relation to reference Percentage of Daily Caloric Value (%DV) based on 2000 kcal diet in UPF not intended for children

		Mean (SD)				
	% VD	Calories value	Carbo hydrates	Proteins	Dietary Fibers	Sodium
General Food Group (n=366)	Packaging	*7,29 (4,46)*	*6,59 (3,88)*	*5,50 (5,24)*	*3,93 (5,43)*	*11,35 (15,14)*
Food Group 1 (n=63)	Packaging	11,89 (5,95)[a]	11,13 (5,06)[a]	6,56 (4,23)[a]	6,97 (8,06)[a]	34,28 (20,27)[a]
Food Group 2 (n=53)	Packaging	1,45 (1,05)[b]	2,08 (2,22)[b]	5,09 (5,09)	NC	0,88 (0,74)[b]
Food Group 3 (n=89)	Packaging	6,60 (2,09)[c]	7,16 (2,55)[c]	5,84 (2,48)	1,59 (4,60)[a]	3,46 (1,76)[b,c]
Food Group 4 (n=141)	Packaging	6,92 (1,80)[c]	5,66 (1,80)[d]	2,56 (1,03)	3,50 (3,73)[c]	6,80 (4,65)[c]
Food Group 5 (n=20)	Packaging	13,95 (2,01)[a]	7,40 (2,50)[c,d]	21,50 (4,58)	5,60 (2,84)[c]	28,25 (4,42)[a]
	P value*	<0,001	<0,001	<0,001	<0,001	<0,001

Notes: n = sample number; % = percentage; DV = daily value; F = female; M = male; NC = not included. *Mean Comparison percentage of daily reference value between food groups studied and for each food component analyzed (Analysis of Variance, p<0.05) - different letters indicate a statistically significant difference between groups (Tukey's Post-Hoc Test, p<0.05).

Table 4 and Table 5 show average percentages of calories, carbohydrates, proteins, dietary fiber, and sodium, in relation to %DV shown on packaging of products intended for children and adults. There was statistically significant difference between the calculated values for calories, carbohydrates, proteins, and sodium by food group, when compared to %DV of package. For dietary fiber, no statistical difference was found for age group from 9 to 13 years in the general average of products and in groups such as FG1, FG3, FG4 and FG5.

The average ingredients amount in foods intended for children was 16.3 (±6.52), with median of 16, with minimum amount of 4 and maximum of 37 ingredients. In products intended for adults, the average ingredients quantity was 15.60 (±7.08), median of 16, with minimum quantity of 1 and maximum quantity of 32 ingredients.

FG5 had higher ingredients number in both classes when compared to FG1, FG2, FG3 and FG4 (p<0.01). When comparing groups separately from two classes, it was noticed that FG1 had higher ingredients average for the class of products for adults, FG4 and FG5 for class of products for children, with the three groups mentioned above showed a significant difference (p<0.01). Figure 2a and Figure 2b shows the average comparison of ingredients amounts between different food groups, and in two products classes: for children and adults.

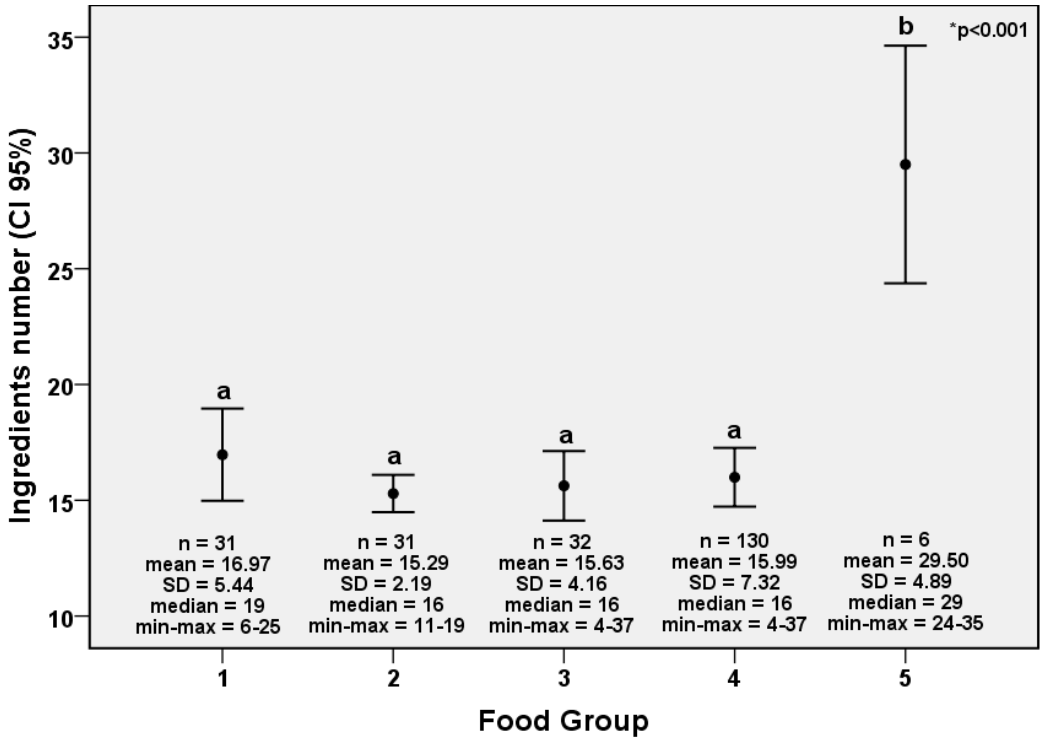

Figure 2a. Average amount comparison of ingredients between different food groups to UPF targeted at children (*Note*. CI = confidence interval; n = sample number; SD = standard deviation; min=minimum value; max = maximum value; *Analysis of variance at 5% level with post-hoc Tukey, Scheffe, Dunnet and Bonferroni tests, where equal letters indicate means without statistically significant difference between them (p>0.05), and different letters indicate means with statically difference significant with each other = (p<0.001))

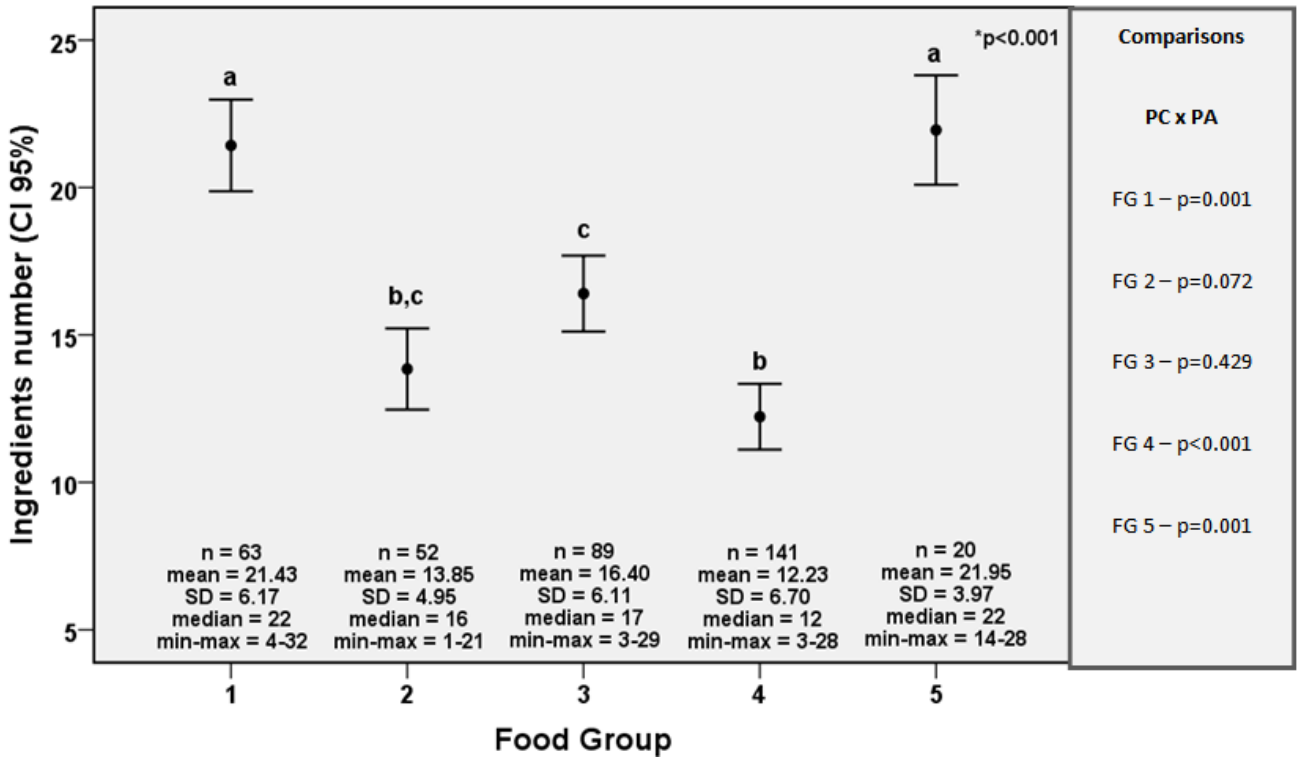

Figure 2b. Average amount comparison of ingredients between different food groups in UFPs not aimed at children (*Note.* CI = confidence interval; n = sample number; SD = standard deviation; min=minimum value; max = maximum value; FG = food group; PA = products for adults; PC = products for children. *Analysis of variance at 5% level with post-hoc Tukey, Scheffe, Dunnet and Bonferroni tests, where equal letters indicate means without statistically significant difference between them (p>0.05), and different letters indicate means with statically difference significant with each other = (p<0.001))

4. Discussion

Based in information obtained through the packaging and nutritional information UPF tables, it could be seen that when considering products targeted and not aimed at children, UPF analyzed showed differences in their nutritional quantity and quality.

Despite most of the products in sample are presented on packaging for children, it is known that the way they are presented to consumer can be one factors that contribute to inclusion of these products in food consumption [13,17,18].

In this study, it was possible to remark that the marketing means stamped on children's UPF packaging preceded the use of famous characters in cartoons or animated films, giving way to the brands characters themselves, which also draw children's attention for presenting colorful packaging and flashy.

Once the industries marketing in UPF was investigated, it was realized that the animals and mascots used or the dissemination of brand websites and social media were the most used playful ways to attract the consumer's attention and that, furthermore, the nutritional claim can be included among the ways to draw the consumer's attention to the purchase and consequent consumption of these products [13,19].

In addition, other ways to draw the consumer's attention are through the nutritional claims described on packaging. A cross-sectional study compared child consumption UPF combined with nutritional claims with adult products, in a large Brazilian market. More than half of nutritional claims were related to the “increase or presence” of vitamins (65.5%) and the remainder (20.4%) of minerals [20].

Data like this are similar to results of the present study. However, nutritional claim of the UPF studied comes from the word “source”, both of vitamins and minerals on packaging of the children's UFP. Divergence between terms is related to conditions of borderline quantity, governed by resolution on Complementary Nutritional Information (CNI) in UPF [11].

Brazilian legislation governing the CNI on UFP labels aims to control the declaration of nutritional properties present in these products. It is known that parents are more concerned about their children's health and, even though it is UFP, the strategy of informing that certain product has nutritional properties can influence them to think that this food is "healthier" than others because it is a vitamins source, for example. However, despite the product found on supermarket shelves containing a nutritional claim, it can be classified as a food of low nutritional value due to its ultra-processing [21].

With regard to the nutritional quality of the two classes of analysis in this study in 100 grams, significantly higher amounts of carbohydrates were observed in children's UPF. This result reinforces that the products tend to have a palatability focused on a sweet taste for children, since most child class UPF were filled and unfilled cookies. According to the nutrition labeling legislation, information on the total sugar content is not yet mandatory and may also be indicated as a percentage of total carbohydrates [10].

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Nutritional profile characterization in products consumed by children was found in other studies, such as the one by Machado et al., 2019 which showed greater carbohydrates amount in foods belonging to the FG4 of this study. In the same line of research, Beltrá et al., 2020 showed that in Spain, UPF intended for children and adolescents, in addition to presenting high levels of energy and carbohydrates, also had high saturated fat and sodium values. In both studies, lower fiber percentages in infant foods were found. In the current study, for analysis of dietary fiber amount per 100 grams, there was no significant result, which may be linked to sample number, as it almost reached the adopted level of significance.

UFPs aimed at children, have been related to characteristics mainly of high energy value and high levels of fat and sodium [14,21,22,23]. This nutritional profile is characterized by concept of “empty calories”, where products have increased energy density, but not in nutritionally balanced way, with little or no nutrients essential to health [24].

As a result, inclusion of these products in food routine, especially for children, contributes to nutritional problems such as childhood obesity and overweight [25,26]. Scientific evidence indicates that overweight and chronic non-communicable diseases (NCDs) onset in children are constant and that the reasons for these conditions are linked to dietary patterns [25,27,28].

A study conducted with schoolchildren in Brazil Southeast region showed that the UPF consumption is associated with excess weight. Children weighing above the recommended weight for age group between eight and twelve years are twice as likely to have ultra-processed foods in their diet [6], showing that unfavorable nutritional quality of these products can develop changes at long term to nutritional status.

In adult population, when analyzing Brazilian food consumption, Louzada et al., 2015 have showed that almost a quarter of the population has their diet from UPF. When investigated about nutritional contribution of these products in individuals’ diet, another study concluded that processed and ultra-processed foods, together, had values of calories and carbohydrates similar to fresh foods consumption [29].

This data reveals the population's knowledge importance about composition of these products, as a fresh food with amounts of calories similar to UPF does not have same nutritional quality. Furthermore, Silva et al., 2021 associated the highest degree of food processing with overweight and excess adiposity in this population, while consumption of unprocessed and minimally processed foods was related to a better quality of life.

Within the mandatory nutritional information on UPF labeling, there is still a parameter regarding calories and nutrients amount according to individual %DCV of each nutrient. As established by ANVISA's RDC No. 360/2003, nutritional information must be expressed in %DCV for mandatory nutrients and indicate the amount in percentage, in relation to an average diet of 2,000 calories per day.

Theoretically, %DCV described in packaged products is intended to assist in deciding the most appropriate choice, considering dietary quality factors, as the amount of each nutrient corresponds to daily needs and the highest percentage represents the highest nutrient content. Thus, consumer can compare two products and choose the one with the lowest calorie’s percentage, for example.

When it comes to products whose main consumption audience includes children, it is known that nutritional recommendations established for children, differ from adult audience. However, nutrition labeling does not consider this distinction and determines that the nutrition information on label is based on an average value for all products, regardless of whether the UFP is aimed at children.

In analysis conducted in this study, it was found that when comparing the %DV packaging values from the mean value established with reference values for individual age and sex, the %DV even presented values two or three times higher than described on package to energy, carbohydrate, sodium, and protein.

It can be seen that FG4 had twice as sodium as described on package. According to Reis et al., 2020, salt presence in formulation of these products is not limited only to flavor characteristic, being used as a preservative by industry in form of sodium chloride (NaCl).

Therefore, in all food groups the amount of this nutrient was high. Furthermore, daily intake of large sodium amounts has been shown to be a risk factor for hypertension [32]. In Brazil, Food Guide for children under two years old does not recommend the foods inclusion with sugars levels and derivatives, including UFP, in children's eating routine [33]. The same is true for salt consumption in children diet up to one year old [34], which reinforces the controlling importance intake of these products in children's eating routine.

For protein %DV, it was found that was increased in food groups where there were dairy products, such as yoghurts and dairy drinks (FG3) and where they contained meat, such as nuggets and breaded (FG5), which may justify the protein amount is increased in these food groups. But despite this, the FG5 group also presented sodium values twice as high as the packaging statement in both age groups and genders. Allied to this, Cócaro et al., 2016 showed amounts of saturated fat elevated by 22% in commercialized chicken breaded products.

Data from this study are even more concerning, considering that consumption by children often does not correspond only to amount of the portion stated on the label. In cases of consumption the whole package, the nutrients amount ingested becomes even greater than the reference value, which may overestimate the reference nutritional limits in children with inclusion of these products in food routine [36].

As a marketing regulating way of these products consumed by children, other Latin American countries such as Peru, Uruguay and Chile already adopt warning models on front of packages in relation to critical nutrients [37,38]. In Brazil, legislation has not yet been regulated to specify critical nutrients on food label, but regulation has already been approved with new criteria on labeling information and nutritional information, which include

warning symbols for high amounts not only of sugars, but also saturated fats, sodium and even greater readability of information on labels [39].

It is also worth mentioning that parameters for comparing %DV results with other studies were limited, since methodologically, the literary analyzes were different from those presented in current study. But, on other hand, this allowed this study to show a new research proposal, about the average caloric value of products being the same in any food category, without considering individualities.

When analyzing the ingredients list of the products by food group, it was observed that meat group (FG5) had the highest number of ingredients in both classes in this study, followed by group of filled and unfilled cookies (FG4) for infant class and the breakfast cereal group (FG1) for adult class. UPFs in general were developed with processing methods that alter nutritional composition by adding several ingredients. Thus, such foods have a longer shelf life, change in color, flavor, aroma and texture [2,3,40,41].

In case of UPF intended to children, it is observed that industry tends to favor the development of products that attract more attention, that is, more palatable, colorful, and crunchy. Although ingredient information is not same for all products, some food additives are generally easy to identify on labels, such as flavor enhancers, emulsifiers, stabilizers, artificial colors and [4,40].

At the present study, food group that had the highest ingredients number was the one that encompassed products such as nuggets and breaded products, stuffed biscuits, and packaged snacks. These products, in turn, are made with raw materials made from mixtures of cereals, flours and other components that serve to intensify their properties and provide higher yields for industry, which may justify the large amount of components on ingredients list of these products [42].

Used parameter to determine ingredients on label is related to amount, since ingredients appear on label in descending order of their proportion, that is, the largest amount is listed before the component in the smallest amount [10].

5. Conclusions

Analyzes conducted in this study show that nutritional content of products with children's characteristics, compared to related products without proper characteristics, present significantly different values. In UFP with children's characteristics, carbohydrate content per serving of package is higher. With regard to UPF intended for adult consumption, protein and total fat contents are higher.

Despite this, its clary that %DCV for children's age group when compared to reference percentage on package, may overestimate individual children needs in terms of calorie, carbohydrate, protein and sodium values, and underestimate needs for dietary fiber . Nutritional UPF quality for children is often not in line with what is advised for this group, mainly because these products can replace a complete and balanced meal, due to characteristic of being more colorful, crunchy, and presenting a lively character on package.

Given the above, importance of implementing regulations in UFP aimed at children is perceived, both for packaging marketing, and for nutritional values of %DCV, since the consumption of these products becomes more present when they present a child claim. With regulations for these products and proper inspection for their sale on supermarket shelves, food industry can develop products with better nutritional quality.

The social implications should also be noted that food and nutrition education actions are important for population to recognize nutritional composition of these products and, therefore, can help consumers make more assertive food choices. Practical perspectives could include future research aimed at understanding consumers about recent changes in food labeling is recommended to expand the evidence on nutritional quality in accordance with the objectives of new Brazilian labeling.

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Statement of Competing Interests

Authors have no conflicts of interest, or other relationships with people or organizations that could influence the present article.

List of Abbreviations

%DCV, percentage of daily caloric value
ANVISA, National Health Surveillance Agency
CNI, Complementary Nutritional Information
DRIs, Dietary Reference Intakes
FG, Food Group
Kcal, Kilocalories
RDC, Resolution of the Collegiate Board
UPF, Ultra-processed foods

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