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Food Promotion in Circulars of Different Supermarket Chains in Brazil According to the NOVA Classification

Thais Santos Silva[1,*], Alessandra Silva Dias de Oliveira[1], Ana Carolina Feldenheimer da Silva[1], Caroline Camila Moreira[2], Milena Miranda de Moraes[3], Flávia dos Santos Barbosa Brito[1]

[1]Department of Social Nutrition, Nutrition Institute, State University of Rio de Janeiro (UERJ), Rio de Janeiro, Brazil
[2]Faculty of Health Sciences, Federal University of Grande Dourados (UFGD), Dourados, Brazil
[3]Faculty of Nutrition and Food Sciences, University of Porto (FCNAUP), Porto, Portugal
*Corresponding author: thaissantosnut@gmail.com

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Abstract Supermarkets play a prominent role in the interface between consumers and the food system. Circulars influence buying behavior and may excessively promote foods that contradict nutritional guidelines. This cross-sectional study aimed to evaluate food promotion in circulars of five different supermarket chains according to the NOVA classification in Rio de Janeiro, Brazil, from June 2019 to May 2020. Foods were grouped and analyzed according to the NOVA classification and the scope, target audience, and type of circle used. Absolute frequencies, relative frequencies, positions, and dispersion measurements were described according to the distribution of the data. Differences between groups were evaluated using the chi-square test with Bonferroni correction. Of the 68,110 items, 52.0% were ultra-processed foods (UPF), 30.5% were fresh or minimally processed foods (UP/MPF), 14.0% were processed foods (PF), and 3.5% were processed culinary ingredients (PCI). The special and traditional circular were the ones that most promoted UPF (57.7% and 54.6%, respectively). Vegetables and fruit circulars promoted 63.2% of UP/MPF, but one quarter was UPF. Statistically significant differences were found between NOVA groups and supermarket chain profiles (coverage and target audience). Those with local coverage promoted more UPFs (53.9%) than those with national coverage (48.3%). The supermarket chain focused on a high purchasing power target audience promoted more UP/MPF (34.5%) than the medium/low target audience (30.3%). Circulars display a high promotion of UPF, with differences between chains. Interventions are needed to restrict the promotion of UPFs and to stimulate consumption of healthy foods.

Keywords: *supermarket, industrialized food, circulars, food guide, food marketing*

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1. Introduction

The increasing prevalence of overweight and obesity has occurred worldwide and contributes to chronic noncommunicable diseases (NCDs) [1]. These diseases constitute seven of the top 10 causes of mortality worldwide [2]. NCDs are becoming increasingly severe public health issues and result in a major reduction in people's quality of life and spending on the health system [3,4,5,6]. Dietary practices contribute to the current scenario and involve the substitution of healthy foods with ready-to-eat foods, with values above the optimum in energy density, sodium, trans fats, refined carbohydrates, and low nutrient [7,8].

The NOVA classification of foods, created in 2009, classifies food according to the nature, extent, and purpose of industrial processing and not according to the type of ingredient predominant in food, classifying them into four groups: unprocessed or minimally processed foods (UP/MPF), processed culinary ingredients (PCI), processed foods (PF), and ultra-processed foods (UPF) [9,10]. Brazil was the first country to recommend this classification in its Food Guide and advise that healthy eating should be based on a wide variety of UP/MPF, which should be seasoned with PCI. It also aims to limit the consumption of PF and avoid UPF [11,12]. Systematic reviews have shown that UPF are harmful to health and are associated with numerous diseases, such as cardiometabolic and gastrointestinal disorders, cancer, overweight, and obesity [13-16].

Supermarkets are the main locals of food sales and are considered important influencers of consumer behavior [17,18,19]. These establishments have been described as having unprecedented and disproportionate leverage in the food system, with important repercussions on public health in different nations [20].

In Brazil, a study by Machado et al. (2018) [21] showed that 60.4% of the energy consumed by UPFs comes from

supermarkets. These establishments use a number of strategies for the promotion of food, such as promotional circulars. They aim to increase the purchase of targeted items, are widely used, and reach the most varied consumer profiles [17,22].

Several studies have noted that supermarket circulars promote foods that do not comply with the guidelines for healthy eating in their respective countries [17,19,22-29]. However, the data are still incipient, considering the small number of studies, especially in Latin American countries, the particularities related to the localities in which they were developed, the profile of the supermarket chains investigated (scope, promotion strategy, and profile of the target audience to which they are targeted), data collection time, and how food is classified and analyzed. Accordingly, the present study aimed to evaluate the promotion of food in the region of Rio de Janeiro (RJ) according to the NOVA classification in circulars of different supermarket chains.

2. Methods

This was a cross-sectional, descriptive study using data from promotional circulars of five supermarket chains located in the metropolitan region of Rio de Janeiro from June 2019 to May 2020. The five largest supermarket chains in the region were selected, taking into account data on annual gross revenue and popularity according to the Brazilian Supermarket Association (*Associação Brasileira de Supermercados*, ABRAS) and the Association of Supermarkets of the State of Rio de Janeiro (*Associação de Supermercados do Estado do Rio de Janeiro*, ASSERJ), respectively [30,31].

Local supermarket chain A was founded in 1950, and from the 2000s, its operations expanded significantly. It is considered one of the most well-known brands by RJ residents and reaches low-income classes [32]. Supermarket chain B, founded in 2002 and incorporated in 2011 by an international group, have stores only in RJ [31].

The nationwide supermarket chains C and D belong to the same commercial group. The C chain was founded in 1959 and is known to sell imported and gourmet products. This chain mainly serves as a high-income public, as it is present only in neighborhoods with high purchasing power. On the other hand, the D supermarket chain, founded in the other hand, is a retailer with large coverage in the national territory, founded in the 1980s [33].

Supermarket chain E, founded in France in 1959, has international coverage. It is considered a retail giant and is currently classified as the highest grossing retail chain in Brazil. It is present on three continents in several countries [33].

Regarding promotional circulars, all printed versions that were valid for the metropolitan region of RJ during the research period were considered eligible. Circulars published solely online and those that exclusively promoted culinary preparations from the chain's rotisseries were excluded. The frequency of the circulars varies according to the chosen chain. However, all selected chains ensured the circulation of at least one weekly circle.

Only data on the promotion of food and beverages were extracted, which were obtained through the description and/or images of circular products. After extraction, the information was organized in a Microsoft Excel spreadsheet containing the following information: identification of the supermarket chain, type of circle, and total number of pages of the circle.

The circular types were classified into four categories: traditional, vegetables and fruits, other foods, and special sectors. Traditional circulars are provided weekly to promote the consumption of a wide variety of foods. Typically, they follow a publishing pattern related to the chain to which they belong, such as the validity and number of pages. Vegetable and fruit circulars are also provided weekly, usually on a single day pre-established by the supermarket chain. They prioritize the promotion of fruits and vegetables. Most are simpler circulars with a reduced number of foods and pages and a short duration (1-2 days).

Circulars classified as "other food sectors," such as bakery, butchery, and fishmonger, contains most foods relating to the category indicated, also provided weekly, on a day pre-established by the chain. Special circulars have the highest variability in food patterns even within a single chain. They are produced to promote foods typical of the dates, times of the year, or promotional niches to which they refer. For example, those provided on commemorative and festive dates, such as carnival, Easter, and Christmas, highlight foods related to the seasons or those that are exclusive to the promotion of own-brand products of the supermarket chain.

The first stage of database processing consisted of categorizing food according to the NOVA classification, based on the coding already used in the list of foods of the Family Budget Survey (*Pesquisa de Orçamento Familiar* - POF) [34,35]. Doubts and inconsistencies were discussed and resolved by expert panels held periodically throughout the database typing and processing processes. A conservative criterion [36] was applied when there was disagreement, and a lower degree of processing was allocated to the product.

Foods were grouped according to NOVA classification [8]. The UP/MPF group comprised those obtained directly from plants or animals, without having undergone any alteration after leaving nature or subjected to minimal changes (including leaves, fruits, dried grains, polished and packaged or ground in the form of flours, washed roots and tubers, cold or frozen cuts of meat, eggs, and pasteurized milk). The second group, called PCI, corresponds to products extracted from fresh food or directly from nature and used by people to season, cook food, and create culinary preparations (such as oils, fats, sugar, and salt). The third category corresponds to PF, which are products manufactured with the addition of salt or sugar to a UP/MPF (such as pickled vegetables, fruit syrup, cheeses, and breads). The UPF group corresponds to products whose manufacture involves several stages, processing techniques, and food substances not used in culinary preparations, many of which are exclusively used industrially (flavorings, colorants, sweeteners, emulsifiers, and other additives). This group includes soft drinks, stuffed biscuits, "packet snacks" and "instant noodles" [36].

For analysis purposes, supermarket chains were grouped according to the scope (local and national/international) and socioeconomic profile of the target audience to which they were targeted (medium/low and high).

In summary, the variables analyzed were: NOVA classification to the foods ((unprocessed or minimally processed foods (UP/MPF), processed culinary ingredients (PCI), processed foods (PF), and ultra-processed foods (UPF)), type of circulars (traditional, vegetables and fruits, other foods, and special sectors), scope of markets (local and national/international), socioeconomic profile of the target audience (medium/low and high).

The data were described as absolute and relative frequencies for categorical variables and as means and standard deviations (SD) or medians and interquartile intervals, represented by the 25th and 75th percentiles, for continuous variables according to data distribution. The normality of the variables was evaluated using the Shapiro-Wilk test. The chi-square test was used to test for possible differences between the NOVA classification groups and the profile of supermarket chains. To identify possible differences between the groups, the chi-square test with Bonferroni correction was used using WINPEPI.

Excel software was used to organize the database, and statistical analysis was performed using Stata statistical software, version 12.0, and WINPEPI, version 11.65, with a significance of 5%.

The assessment and approval of the study by the Research Ethics Committee with Human Beings was not necessary, since the object of the study did not involve humans, according to the guidelines recommended by the Brazilian National Health Council [37].

3. Results

A total of 621 promotional circulars were analyzed. The traditional circle was the most frequent in all chains (58.8%), and chain A contributed the most (31.6%) (data not shown). Chain B presented more vegetables and fruit circulars (38.8%), chain E promoted other sectors more (46.7%), and chain D promoted the special sectors (34.4%) (Table 1).

A total of 68,110 food items were identified, with an emphasis on chain A, which represented 52.5% (n=35,758) of the items evaluated (data not presented). Chain C least advertised food in the period assessed, representing less than 6% (n=3,683) of the sample (data not shown). In relation to the NOVA classification, most of the foods promoted in the circulation were UPF (51.9%), followed by UP/MPF (30.5%). PF (14.0%) and PCI (3.5%) were the least promoted in the circulation (Table 2).

With regard to the promotion of foods according to NOVA in supermarket chains, the PCI group showed a variation of 2.0% to 4.1%, a PF of 12.0% to 18.3%, a UP/MPF from 28.2% to 36.3%, and a UPF from 43.2% to 56.4%, revealing a different promotion profile between chains (Table 2).

Table 1. Profile of the types of circulars according to supermarket chain (N= 621) in Rio de Janeiro, Brazil, 2019-2020

Types of Circulars	Supermarket chains										Total	
	A		B		C		D		E			
	N (%)	N Pages Med (P25-P75)	N (%)	N Pages Med (P25-P75)	N (%)	N Pages Med (P25-P75)	N (%)	N Pages Med (P25-P75)	N (%)	N Pages Med (P25-P75)	N (%)	N Pages Med (P25-P75)
Traditional[1]	198 (100)	8 (4-12)	37 (34.3)	12 (8-12)	65 (90.2)	4 (2-8)	39 (32.8)	4 (4-6)	26 (20.1)	12 (7-16)	365 (58.8)	8 (4-12)
Vegetables and fruits[2]	-	-	42 (38.8)	2 (2-2)	-	-	33 (27.7)	2 (2-2)	30 (24.1)	2 (2-2)	105 (16.9)	2 (2-2)
Other Sectors[3]	-	-	26 (24.0)	2 (1-2)	4 (6.2)	3 (2-3)	6 (1,6)	4 (2-4)	58 (46.7)	4 (2-4)	94 (15.1)	4 (2-4)
Special[4]	-	-	3 (2.7)	12 (2-12)	3 (4.6)	12 (2-12)	41 (34.4)	2 (2-4)	10 (8.0)	22 (8-28)	57 (9.2)	2 (2-8)

Med: median; **P25:** percentile 25; **P75:** percentile 75.
[1]**Traditional:** provided weekly; [2] **Vegetables and fruits:** provided weekly, on a weekday previously established by the chain and contains most or only food related to vegetables and fruits; [3]**Other sectors:** contains most or only food related to other sectors; [4]**Special:** provided according to commemorative dates and the food disclosed is typical of the festive date.

Table 2. Distribution of the NOVA Classification of foods according to supermarket chain in Rio de Janeiro, Brazil, 2019-2020

NOVA	Supermarket chains										Total	
	A		B		C		D		E			
	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95%CI))	N	% (95% CI)	N	% (95% CI)
UP/MPF	10074	28.2 (27.7-28.6)	2318	28.5 (27.5-29.5)	1269	34.4 (32.9-36.0)	3937	36.3 (35.4-37.2)	3206	33.0 (32.1-34.0)	20804	30.5 (30.2-30.9)
PCI	1466	4.1 (3.8-4.3)	250	3.0 (2.7-3.4)	152	4.1 (3.5-4.8)	311	2.8 (2.5-3.1)	194	2.0 (1.7-2.2)	2373	3.5 (3.3-3.6)
PF	5125	14.3 (14.0-14.7)	969	12.0 (11.2-12.6)	672	18.3 (17.0-19.5)	1344	12.4 (11.7-13.0)	1452	15.0 (14.2-15.6)	9562	14.0 (13.8-14.3)
UPF	19093	53.4 (52.8-54.0)	4587	56.4 (55.3-57.5)	1590	43.2 (41.6-44.8)	5250	48.4 (47.4-49.3)	4851	50.0 (49.0-60.0)	35371	52.0 (51.6-52.3)

UP/MPF, unprocessed or minimally processed foods; **PCI,** processed culinary ingredients; **PF,** processed foods; **UPF,** ultra-processed foods
95% CI: 95% confidence interval.

Table 3. NOVA classification of foods according to type of circular in Rio de Janeiro, Brazil, 2019-2020

	Type of circular							
	Traditional[1]		Vegetables and fruits[2]		Other sectors[3]		Special[4]	
NOVA	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)	N	% (95% CI)
UP/MPF	14707	27.4 (27.0-27.7)	3884	63.2 (62.0-64.3)	1288	29.0 (27.6-30.3)	925	24.4 (23.0-25.8)
PCI	2088	3.9 (3.7-4.0)	82	1.3 (1.0-1.6)	96	2.1 (1.7-2.5)	107	2.8 (2.2-3.3)
PF	7600	14.1 (13.8-14.4)	627	10.2 (9.4-11.0)	764	17.2 (16.1-18.3)	571	15.0 (14.0-16.2)
UPF	29339	54.6 (54.2-55.0)	1556	25.3 (24.2-26.3)	2289	51.6 (50.1-53.0)	2187	57.7 (56.1-59.2)
Total	**54112**	**100**	**6149**	**100**	**4437**	**100**	**3790**	**100**

[1]**Traditional:** provided weekly; [2]**Vegetables and fruits:** provided weekly, on a weekday already previously established by the chain and contains most or only vegetables and fruits; [3]**Other sectors:** contains most or only food related to other sectors; [4]**Special:** provided according to commemorative dates and the food disclosed are typical of the festive date.
UP/MPF, fresh or minimally processed foods; **PCI**, processed culinary ingredients; **AP**, processed foods; **UPF**, ultra-processed foods
IC 95%: 95% confidence interval.

Table 4. NOVA classification by subcategories of supermarket chains: by scope and profile of the target audience in Rio de Janeiro, Brazil, 2019-2020

	Supermarket									
	Scope					Audience profile				
	Local		National/International		P-value	Medium/Low		High		P-value[1]
NOVA	N	%	N	%		N	%	N	%	
UP/MPF	12392	28.2	8412	34.7	0.001	19535	30.3	1269	34.5	0.001
PCI	1716	4.0	657	2.7	0.001	2221	3.4	152	4.1	0.049
PF	6094	14.0	3468	14.3	0.046	8890	13.8	672	18.3	0.001
UPF	23680	53.9	11691	48.3	0.001	33781	52.4	1590	43.1	0.001

UP/MPF, fresh or minimally processed foods; **PCI**, processed culinary ingredients; **PF**, processed foods; **UPF**, ultra-processed foods.
Coverage of supermarket chains: local (chains A and B) and national/international (chains C, D, and E).
[1]**P-value:** obtained by chi-square test with Bonferroni correction, with a significance of 5%.

When looking at the types of circulars, UPFs were the most promoted foods by the special circular, followed by those of the traditional types and other food sectors (57.7%, 54.6%, and 51.6%, respectively). Vegetable and fruit circulars promoted more UP/MPF (63.2%) than the others. Nevertheless, they display 25.3% of UPF (Table 3).

Statistically significant differences were found ($p < 0.05$) between the NOVA classification and the scope and socioeconomic profile of the target supermarket audience. Local supermarket chains (A and B) promoted more UPFs (53.9%) and PCI (4.0%) than national/international supermarket chains (C, D, and E) (48.3% and 2.7%, respectively). Supermarket chains aimed at a public with medium/low socioeconomic profiles (A, B, D, and E) displayed a higher promotion of UPF (52.4%) and a lower promotion of UP/MPF (30.3%) compared to those aimed at a target audience of high purchasing power, chain C (43.1% and 34.5%, respectively) (Table 4).

4. Discussion

This study evaluated promotional circulars from five supermarket chains in the metropolitan region of RJ, with the traditional circular being the most frequent type, representing more than half of the circulars evaluated. Regarding food promotion, the study revealed a prevalence of approximately 52% for UPF. This finding corroborates other studies that show that supermarkets promote unhealthy foods more often, represented here by the UPF [17,19,22-25,29,38,39,40].

A study conducted in Belgium evaluated the promotional circulars of five large supermarket chains over 1 year and observed a prevalence of UPFs (52.2%), similar to the present study [40]. In the Netherlands, Hendriksen et al. (2021) [25] evaluated promotional circulars from 13 supermarkets for 2 months, and observed a high promotion of UPF (56.6%), followed by UP/MPF (20.4%), PF (14.5%), and PCI (0.5%), similar to the present study.

In Brazil, Camargo et al. (2019) [23] evaluated 16 promotional circulars of four supermarket chains over 1 month, with different scopes (one national, one international, and two regional), located in Florianópolis, SC. Their study revealed that UPFs were the most promoted (63%) in the evaluated circulars. In 2021, Mendes et al. [29] collected circulars from five supermarket chains in Belo Horizonte (Minas Gerais) over 1 year, showing a UPF prevalence of 66.9 %. In the present study, the prevalence of UPF was 52% lower than that reported in the two national studies. However, direct comparisons are limited because of possible differences in the location and characteristics of the supermarket chains investigated (scope, type of circle, profile of the target audience, and quality of the promoted foods).

The high prevalence of UPFs in promotional circulars demonstrates how much supermarket chains stimulate and

contribute towards eating habits that contradict recommendations for adequate and healthy eating. In Brazil, the Food Guide for the Brazilian Population recommends avoiding the consumption of UPFs [12]. Systematic reviews and meta-analyses have demonstrated numerous deleterious health effects associated with the high consumption of this type of food [13-16].

One likely explanation for the predominance of UPFs in circulars is the centralized acquisition system of these products, enabling the reduction of coordination costs and increasing bargaining power over suppliers [41]. This process involves higher promotion of packaged and easy-to-stock food items, which favors price reduction [18]. It is easier to centralize the acquisition of products that do not require strict temperature control, and none of the challenges inherent in handling fresh products. Thus, as for-profit entities, supermarkets tend to earn more by promoting products for which they can more easily cut costs. Hawkes (2008) [18] notes that it is relatively easy to increase efficiency by dealing with large corporations in the food industry. Another potential factor is the establishment of commercial contracts between supermarket chains and food manufacturers. The decision on which types of food to promote in the circulars is usually based on these contracts. Accordingly, because they have ample financial resources, multinational food companies ensure that their products are profiled and promoted more frequently and are highlighted in the circulation [22].

Hawkes (2008) [18] points out that consumers are more likely to buy foods perceived as having "good value" compared to others. This value includes not only the price but also all other marketing strategies present in circulars, as well as those developed internally and externally to the point of purchase [42]. As shown, foods produced by large corporations in the food industry are valued the most by the food retail sector. This has important implications for the increasing consumption of these foods, as supermarket operators highlight the advantages and qualities of these foods to consumers much more than fresh foods [18]. From the point of view of public health, this is worrisome, since it has already been reported that circulars promote high-calorie foods in regions where the obesity rate is higher, unlike regions where the obesity rate is lower, where circulars present a predominance of fruits and vegetables [28].

In agreement with Vandevijvere and Van Dam (2021) [40], this study observed different strategies for promoting food in each supermarket chain. A lack of standardization in the number of advertised circulars, pages, and foods was identified. For instance, the circulars of vegetables and fruits displayed differences in food promotion, especially the UP/MPF (63.1%), differentiating them from other types of circulars regarding the NOVA classification. They stand out for having a greater promotion of UP/MPF in circulars but are simpler and with few associated marketing strategies; some do not display the image of the products and are only promoted on a single day of the week. Although the promotion of fruits and vegetables is the main goal, these circulars also display UPF, which is a quarter of the advertised foods.

Statistically significant differences were observed in the promotion of all food groups. A higher promotion of UPF occurs in the supermarket chain aimed at a target audience with medium/low purchasing power (52.4%) and lower promotion of UP/MPF compared to the high purchasing power supermarket chain (30.3% and 34.5%, respectively). This result corroborates the existing literature that indicates that socioeconomically favorable areas have easier access to establishments with greater promotion, availability, variety, quality, and lower prices of food, especially fruits and vegetables. On the other hand, areas with low socioeconomic levels are places where there is a higher promotion of unhealthy foods and establishments that offer little variety of products, lower quality, and higher prices for UP/MPF foods [17,22,43-46].

Regarding coverage, the national/international chains promoted more UP/MPF foods (34.7%) and less UPF foods (48.3%) than the local chain (28.2% and 53.9%, respectively). Camargo et al. (2019) [23] reported similar results, noting that nationwide chains promote a higher proportion of UPF than local chains. One possible explanation may be related to the different consumer targets of the supermarket chains.

Brazil needs to improve food advertising by considering the different means of disseminating information, including supermarket circulars. Currently, we experience an absence of regulatory action from agencies that should have a legal mandate to supervise abusive promotion of foods that promote health disorders.

One limitation of this study is that no supermarket chains available only in RJ were included, especially other local chains with a medium/low target profile, which may have underestimated the prevalence of UPF. The results of the study show that a certain local supermarket chain promoted 56.4% of UPFs, a higher prevalence than the general one of the study. However, the decision to include the five largest supermarket chains with different coverages may have contributed to a broader scenario of food promotion according to the NOVA classification in RJ. Another issue to be considered is that the consumers choices are guided by different aspects as brand, products localization on the market, other promotions, and personal preferences and the circulars are only one strategy that could be used by the retailers.

5. Conclusion

This study contributes to an under-evaluated subject in Brazil, being the first to describe the quality of food promoted in circulars from different supermarket chains in RJ. The results show that promotional circulars encourage the consumption of UPFs and devalue the importance of healthy, varied, and balanced eating. In addition, different profiles were identified in the promotion of food among supermarket chains, concluding that the choice for a given chain can expose individuals in a greater or lesser proportion to unhealthy foods. Therefore, it is expected that the results can serve as a justification for fostering political discussion on the regulation of unhealthy food promotion in food retail markets. It is illusory to believe that establishments can lead to discussions on the control of practices that contribute to the obesity epidemic.

Statement of Competing Interests

The authors of this study declare no conflict of interests.

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Conflicts of Interest

None declared.

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