DOI: 10.1590/1413-81232023282.06932022EN

Healthy eating in supermarket circulars: reflections according to the food classification adopted in dietary guidelines for the Brazilian population

Caroline Camila Moreira (http://orcid.org/0000-0002-9189-901X) [1]
Ana Carolina Feldenheimer da Silva (http://orcid.org/0000-0001-5554-8856) [2]
Amanda de Oliveira Requena Leme (http://orcid.org/0000-0002-3585-7966) [1]
Thais Santos Silva (http://orcid.org/0000-0002-2472-7154) [2]
Flávia dos Santos Barbosa Brito (http://orcid.org/0000-0001-8476-8567) [2]
Alessandra Silva Dias de Oliveira (http://orcid.org/0000-0002-3232-5868) [2]

Abstract *The present study evaluated the promotion of natural/minimally processed foods (N/MPF) subgroups advertised in supermarket circulars by considering supermarket features and circular typology. We analyzed circulars published by five supermarket chains in the metropolitan region of Rio de Janeiro (June/2019-May/2020) and present data on the socioeconomic coverage and profile of the supermarkets and the types of circulars. Of the 68,110 types of foods, 30.6% were N/MPF. Meat/eggs were the most promoted ones (42.3%), followed by fruits/vegetables (20.2%), which were more often advertised by produce shop circulars. Dairy products, cereals/flours/pasta and beverages/infusions made up around 10.0% of the ads. Legumes (3.8%), spices and mushrooms (0.2%) and oilseeds (0.1%) were rarely promoted. Statistically significant differences were found in the promotion of subgroups according to supermarket coverage and their socioeconomic profiles. Fruits/vegetables were more often advertised by national chains and aimed at a high-income public than by local companies and aimed at a low/middle-income public. Promotion of N/MPF subgroups was disproportional due to differences among chains and types of circulars. As a result, a discussion on the regulation of food promotion in food retail is required.*

Key words *Unprocessed food, Dietary guidelines, Food advertising, Food retail*

[1] Faculdade de Ciências da Saúde, Universidade Federal da Grande Dourados. Rod. Dourados/Itahum, Km 12, Cidade Universitária. 79804-970 Dourados MS Brasil. carolinemoreira@ufgd.edu.br
[2] Departamento de Nutrição Social, Instituto de Nutrição, Universidade do Estado do Rio de Janeiro. Rio de Janeiro RJ Brasil.

Introduction

The Dietary Guidelines for the Brazilian Population (DGBP) provides official dietary guidelines for an adequate and healthy diet. A healthy, nutritionally balanced diet should be based on natural or minimally processed foods (N/MPF) such as roots and tubers, legumes, oilseeds, flours, fruits, vegetables, milk, eggs, meat and fish. Animal source foods are good sources of protein, vitamins and minerals, contain a low amount of fiber and, in some cases, a high amount of fat, whereas foods of plant origin are good sources of fiber and micronutrients, such as vitamins and minerals. Legumes are also a source of protein. An N/MPF-based diet is considered one of the main factors for preventing diseases, especially chronic non-communicable diseases[1].

Changes in dietary habits have been taking place fast in most countries, particularly in low- and middle-income countries such as Brazil. Main changes include replacing N/MPF and culinary preparations based on these foods with ultra-processed foods (UPF)[1,2].

Although DGBP recommends that N/MPF be the basis of nutrition, this does not happen in Brazil. Food consumption habits have been changing fast, especially in the last 15 years[3,4]. The analysis of food purchase data performed by the Household Budget Survey shows that UPF rose from 12.6% in 2002-2003 to 18.4% of total calories in 2017-2018, whereas the purchase of N/MPF represented 53.3% of total calories in 2002-2003 and it decreased to 49.5% in 2017-2018[4]. DGBP defines that a healthy diet should not only be predominantly made up of N/MPF, but also be varied, culturally referenced and mainly contain foods of plant origin[1].

Adopting a healthy diet is not merely a matter of individual choice. Places with stores that sell N/MPF positively influence the adoption of healthy eating habits. However, other factors can make it difficult to adopt them, such as the high cost of food and intense exposure to unhealthy food ads[5-7]. Food supply varies according to socioeconomic factors. Places with higher incomes and educational levels tend to have larger supplies of N/MPF, while areas with poorer populations, especially those with a higher prevalence of blacks and migrants, tend to have a larger supply of unhealthy foods[8]. The promotion of food by supermarket chains possibly follows the same logic.

Supermarkets are the main places of access to food. In 2013, in Brazil, 49.0% of the food available in households was purchased in supermarkets[9]. They are known as an important factor influencing food choices and behaviors[10], as they use sales strategies that influence access, availability, prices and desire for food, which may influence the population in terms of nutrition[11]. Among these strategies, promotional circulars play a special role[12,13]. They are a popular retail tool used to advertise products, to influence consumer behavior and to increase sales in stores[14,15]. They rely on a wide range of tactics, such as offering discounts, temporary price reductions, volume-based offers, among others[16,17]. Circulars are widely read[18] and are currently available both online and in print[19]. They are so efficient in stimulating demand that supermarkets cannot do without[12].

Studies have examined what kind of foods are frequently promoted by circulars, pointing to a lower number of N/MPF compared to UPF[7,18,20,21]. We found three studies on this topic in Brazil, two of which were developed in the South[13,22] and one in the Southeast[23], corroborating that fact. Camargo *et al.*[13] and Botelho *et al.*[22] analyze food promotion considering only the large food processing groups and collecting circulars for a short period of time, i.e. around two months, disregarding a possible seasonality of circulars and food promotions. In turn, Botelho *et al.*[22] compared N/MPF and UPF merely of the health food section of circulars. Only the study developed by Mendes *et al.*[23] is based on a one-year data collection process and shows the ratio of N/MPF subgroups. However, differences among subgroups are not described in detail. None of the studies evaluated food promotion considering the typology of circulars published by supermarket chains.

Hence, there is a lack of research that could encourage a reflection process on the promotion of food subgroups that should make up an adequate and healthy diet by considering the types of circulars and the specific features of supermarket chains. Thus, the present study aims to evaluate the promotion of N/MPF subgroups advertised in supermarket circulars by taking into account not only supermarket chain features, but also the typology of circulars.

Methods

We performed a descriptive cross-sectional study with a quantitative approach to analyze data of promotional circulars published by five supermarket chains in the metropolitan region of Rio

de Janeiro (RJ) from June 2019 to May 2020, i.e., one year.

Supermarket chain selection criteria included data on their popularity and annual gross sales, according to data supplied by the Brazilian Supermarket Association (ABRAS in Portuguese) and the Supermarket Association of the State of Rio de Janeiro (ASSERJ in Portuguese)[24,25]. Brazil's four largest companies in terms of revenue were selected, as well as the most popular one of the metropolitan region of Rio de Janeiro.

Were included all printed circulars that applied to the metropolitan region of Rio de Janeiro. Circulars were not different among neighborhoods or locations, the same version applied to all stores of every chain. We also collected their digital versions on supermarket websites and apps and/or direct consumer communication channels, such as WhatsApp®. Circulars published online only were excluded, as well as those that exclusively promoted rotisserie culinary preparations. Circular frequency varied according to supermarkets, but all selected companies publish at least one weekly circular.

Only data on food and beverage promotion were collected; they were obtained through product description and/or pictures found in circulars. Data were entered into the system by trained team members and standardized according to a data extraction manual. All data were recorded twice. After data extraction, information was organized in a Microsoft Excel spreadsheet containing the following information: food name and brand, supermarket chain identification, and circular type (traditional, fruits and vegetables, other food sectors, and special foods).

Foods were categorized according to the NOVA classification system[26], with a focus on N/MPF groups. Natural foods are obtained directly from either plants or animals and are not altered in any way. Minimally processed foods are natural foods that were cleaned, whose inedible or undesirable parts were removed, that were fractioned, milled, dried, fermented, pasteurized, refrigerated, frozen or submitted to similar processes that do not involve addition of salt, sugar, oils, fats or any other substances[1,26].

After that, N/MPF were recategorized based on DGBP and their subgroups include: (a) Beverages and infusions (tea, coffee, water); (b) Dairy products (pasteurized milk, ultra-pasteurized milk, powdered milk, sugar- and additive-free yogurt); (c) Fruits and vegetables (fresh or frozen fruits and vegetables, dried fruits, fruit/vegetable juices and pasteurized fruit/vegetable juices free of added sugar or any other substances); (d) Beans and other legumes (beans of all colors, lentils, chickpeas and other legumes); (e) Cereals, flours and pasta (white rice, whole grain rice, parboiled rice, by weight or packaged, corn [cobs or in grains], wheat and other cereal grains, manioc, corn or wheat flour, and fresh or dried noodles and pasta made with flour and water); (f) Fresh/frozen meat and eggs (red meat, pork meat, poultry; fish and seafood, eggs of all types); (g) Oilseeds (nuts, walnuts, peanuts and other oilseeds free of salt or sugar); (h) Spices and mushrooms (spices such as cloves, cinnamon, saffron, pepper; dried herbs such as oregano and rosemary; fresh or dried mushrooms).

For the purpose of our analysis, supermarket chains were grouped according to local coverage (chains A and B) and national coverage (chains C, D, E), as well as their target audience's low/middle socioeconomic profile (chains A, B, D and E) and high socioeconomic profile (chain C). Local chains are found in Rio de Janeiro only, whereas national chains run stores in more than one Brazilian state. The type of neighborhoods in which the stores are located were used to define the socioeconomic profiles of the target audiences. The only chain that was classified as aimed at a public with a higher purchasing power was the one that only runs stores in neighborhoods with a high purchasing power. Circulars were classified into four categories: traditional, fruits and vegetables, other food sectors and special editions. The traditional ones follow a publishing pattern that is related to the chain they belong to, such as frequency, circular validity, number of pages. They promote a wide variety of foods and rely on a large range of marketing strategies associated with food (e.g.: take X pay Y, discount from two items of the same article, freebies, multipacks). Fruit and vegetable circulars are published once a week, usually on a day defined by the supermarket chain and they prioritize the promotion of fruits and vegetables. Most of them are simple, offer a reduced number of foods, have few pages, are of short duration (one to two days), and rely on few marketing strategies. Circulars classified as "other food sectors", such as the bakery or the meat and fish sector, contain most of the foods of that category. They are also published weekly on a set day. The special editions are the most varied ones, even within a single chain. They promote foods for special occasions, such as holidays and festivals (Carnival, Easter, Christmas) or niche products on promotion, such as seasonal foods or their own brands.

N/MPF groups and their respective subgroups were characterized by using absolute (n) and relative (%) frequencies. After that, the differences between the subgroups and features of chains and circulars were evaluated by means of the chi-square test. To analyze data, the statistical software program Stata® version 12.0 was applied with a significance level of 5%[27].

Since our research did not involve human beings, approval by the Research Ethics Committee was not required, according to the guidelines of the Brazilian National Health Council[28].

Results

The present study analyzed 621 circulars and identified 68,110 different types of food. Supermarket chain A published the largest number of circulars, i.e., 198 circulars (31.9%) and 35,758 food items (52.5%), followed by chain E [124 circulars (19.9%) and 9,703 food items (14.3%)], chain D [119 circulars (19.2%) and 10,842 food items (15.9%)], chain B [108 circulars (17.4%) and 8,124 food items (11.9%)] and chain C [72 circulars (11.6%) and 3,683 food items (5.4%)]. N/MPF made up nearly one third of all foods advertised (n=20,804; 30.5%). The ratio of N/MPF ranged from 36.3% (chain D) to 28.2% (chain A) (Graph 1).

Overall, the meat and eggs subgroup was the most promoted one by circulars (42.3%), ranging from 36.6% (chain B) to 45.0% (chain A). Foods that make up this subgroup are mostly beef and poultry (84.9%). The fruit and vegetable subgroup came in second (20.2%), but varied greatly among supermarkets, from 4.6% (chain A) to 37.0% (chain E). Subgroups of dairy products, cereals, flours and pasta, beverages and infusions showed similar frequencies in circulars. Dairy accounted for 12.2% of N/MPF ads (ranging from 19.6% in chain A to 3.8% in chain E). Cereals, flour and pasta accounted for 11.4% of N/MPF (ranging from 14.2% in chain A to 5.3% in chain E). The beverages and infusions subgroup made up 9.8% of N/MPF (ranging from 11.3% in chain A to 5.8% in chain D). The legume subgroups (3.8%), basically represented by beans, spices and mushrooms (0.2%), and oilseeds (0.1%) were the least promoted ones and show similar ratios among supermarket chains (Table 1).

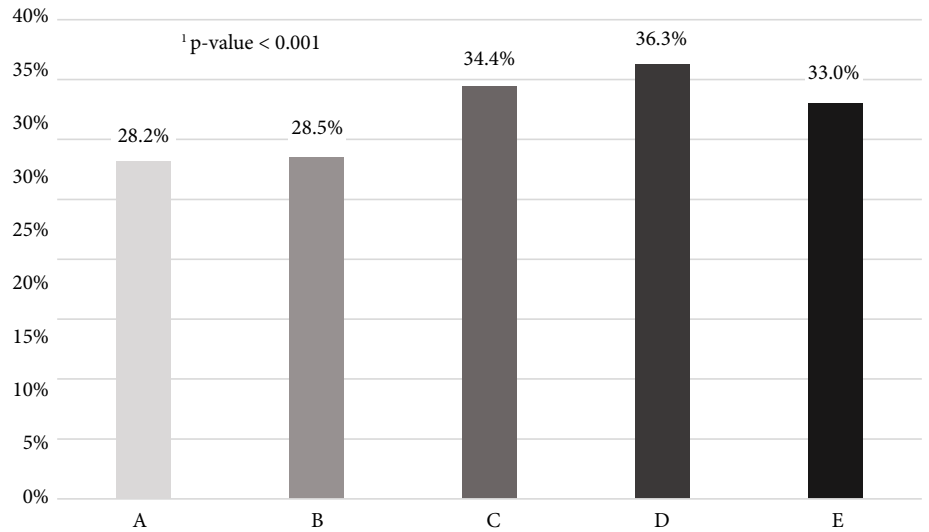
Statistically significant differences were found in the promotion of N/MPF among the types of circulars we analyzed. This group was more often promoted by fruit and vegetable circulars, i.e., more than 60.0% of all foods, whereas Other Food Sectors made up almost 30.0%. In the remaining types, the N/MPF ratio made up nearly a quarter of all ads (Table 2).

Comparison of frequencies of N/MPF subgroups according to supermarket chain features (range and socioeconomic profile) showed, for the most part, statistically significant differences (Table 3). Local supermarkets promote more dairy products (16.9% vs. 5.3%; p<0.01); legumes (4.8% vs. 2.3%; p<0.01); cereals, flours and pasta (13.5% vs. 8.3%; p<0.01); meat and eggs (43.4% vs. 40.6%; p<0.01) in relation to national supermarkets, which advertised more often fruits and vegetables (34.8% vs. 10.2%; p<0 .01) and spices and mushrooms (0.4% vs. 0.1%; p<0.01). No significant differences were found between local and national supermarkets regarding the promotion of beverages and infusions or oilseeds. Chains aimed at high-income customers advertised more often beverages and infusions (14.2% vs. 9.5%; p<0.01); fruits and vegetables (25.5% vs. 19.9%; p<0.01); oilseeds (0.4% vs. 0.1%; p<0.01), and spices and mushrooms (0.8% vs. 0.2%; p<0.01) when compared to chains aimed at customers of a middle/low socioeconomic status, which only advertised the dairy and legumes subgroups more often. The cereal, flour and pasta, meat and eggs subgroups showed no significant differences among the target audience profiles of supermarket chains (Table 3).

Discussion

The present study shows that N/MPF represent less than a third of the foods advertised by supermarket circulars. Among the subgroups, meat and eggs rank first in all chains and make up four out of ten advertised types of food, whereas the fruit and vegetable subgroup comes second. However, this subgroup is only half as much promoted than meat and eggs. There were large differences in the promotion of fruits and vegetables, as some supermarket chains promoted them up to eight times more often. Other groups that represent the basis of the Brazilian diet (dairy products, cereals, flours and pasta, beverages and infusions) were frequently included in the circulars of all investigated supermarket chains. The legume group, which is also an important part of the Brazilian diet, was less often found in circulars. The oilseeds and spices and the mushrooms subgroups were rarely advertised.

Studies have shown that N/MPF are poorly promoted according to general analyses of supermarket circulars. In several Brazilian states,



Graph 1. Relative frequency of natural or minimally processed foods advertised by Brazilian supermarket chains. Rio de Janeiro, 2019-2020.

[1] p-value: obtained by means of a Chi-square test with a 5% significance level.

Source: Authors.

Table 1. Frequency of natural or minimally processed food subgroups advertised in promotional circulars by supermarket chains. Rio de Janeiro, 2019-2020.

N/MPF subgroups	Supermarket chain					Total
	A	B	C	D	E	
	n (%)	n (%)	n (%)	n (%)	n (%)	
Meat and eggs	4,533 (45.0)	847 (36.6)	536 (38.3)	1,553 (39.5)	1,376 (42.9)	8,845 (42.3)
Fruits and vegetables	458 (4.6)	807 (34.8)	356 (25.5)	1,429 (36.3)	1,186 (37.0)	4,236 (20.2)
Dairy	1,977 (19.6)	121 (5.2)	106 (7.6)	226 (5.7)	121 (3.8)	2,551 (12.2)
Cereals, flours and pasta	1,433 (14.2)	238 (10.3)	156 (11.2)	384 (9.6)	171 (5.3)	2,382 (11.4)
Beverages and infusions	1,134 (11.3)	219 (9.5)	198 (14.2)	227 (5.8)	273 (8.5)	2,051 (9.8)
Legumes	523 (5.2)	68 (2.9)	29 (2.1)	110 (2.8)	60 (1.9)	790 (3.8)
Other N/MPF	4 (0.1)	10 (0.4)	11 (0.8)	5 (0.1)	19 (0.6)	49 (0.2)
Oilseeds	14 (0.1)	7 (0.3)	6 (0.4)	3 (0.1)	1 (0.1)	31 (0.1)

N/MPF: Natural or minimally processed foods.

Source: Authors.

their ratio was around 20%, which is a smaller share than the one we found[13,23]. Camargo *et al.*[13] conducted the first study on circulars in the Brazilian context by collecting data in Florianópolis-SC and found that N/MPF made up only 23% of ads in supermarket circulars. However, their study did not take into account the food subgroups of that category. Mendes *et al.*[23], in a study performed in Belo Horizonte-MG, showed that only N/MPF made up only 19.9% of the foods advertised. A third study, carried out in Florianópolis, evaluated the nutritional composition of foods published in health-related sections of circulars only and revealed that N/MPF made up just 32.5%[22]. The low promotion of N/MPF is a cause for concern, as promotional circulars have notable impact on purchase preferences and patterns[12,29] and may result in a decrease in inter-

Table 2. Frequency of natural or minimally processed food subgroups advertised by type of promotional circulars. Rio de Janeiro, 2019-2020.

N/MPF subgroups	Traditional[1]	Fruits and vegetables[2]	Other food sectors[3]	Special[4]	p-value
	n (%)	n (%)	n (%)	n (%)	
Meat and eggs	6,482 (43.7)	1,295 (33.4)	623 (48.3)	445 (48.1)	<0.01
Fruits and vegetables	1,346 (9.1)	2,480 (63.9)	293 (22.7)	117 (12.7)	<0.01
Dairy	2,326 (15.7)	42 (1.1)	92 (7.1)	91 (9.8)	<0.01
Cereals, flours and pasta	2,110 (14.2)	18 (0.5)	118 (9.2)	136 (14.7)	<0.01
Beverages and infusions	1,798 (12.1)	30 (0.8)	117 (9.1)	106 (11.5)	<0.01
Legumes	712 (4.8)	8 (0.2)	42 (3.3)	28 (3.0)	<0.01
Other N/MPF	41 (0.3)	3 (0.1)	4 (0.3)	1 (0.1)	0.11
Oilseeds	23 (0.2)	7 (0.2)	0 (0.0)	1 (0.1)	0.51
Total	14,836 (27.4)	3,884 (63.2)	1,288 (29.0)	925 (24.4)	<0.01

[1]Traditional: distributed weekly; [2]Fruits and vegetables: distributed weekly, on a weekday previously defined by the supermarket chain. Contains mostly or exclusively foods referring to the category that entitles them; [3]Other sectors: contains mostly or exclusively foods referring to the category that entitles them; [4]Special: provided according to commemorative dates; foods advertised are typical of those dates. N/MPF: natural or minimally processed foods.

Source: Authors.

Table 3. Frequency of natural or minimally processed food subgroups advertised by supermarket chain coverage and socioeconomic profile. Rio de Janeiro, 2019-2020.

N/MPF	Supermarket chains									
	Coverage					Socioeconomic Profile				
	Local		National		p-value[1]	Low/middle		High		p-value[1]
	n	%	n	%		n	%	n	%	
Total	12,392	28.2	8,412	34.72	<0.01	19,535	30.3	1,269	3405	<0.01
Meat and eggs	5,380	43.4	3,465	40.6	<0.01	8,309	42.5	536	38.3	<0.57
Fruits and vegetables	1,265	10.2	2,971	34.8	<0.01	3,880	19.9	356	25.5	<0.01
Dairy	2,098	16.9	453	5.3	<0.01	2,445	12.5	106	7.6	<0.01
Cereals, flours and pasta	1,671	13.5	711	8.3	<0.01	2,226	11.4	156	11.2	<0.84
Beverages and infusions	1,353	10.9	698	8.2	0.07	1,853	9.5	198	14.2	<0.01
Legumes	591	4.8	199	2.3	<0.01	761	3.9	29	2.1	<0.01
Other N/MPF	14	0.1	35	0.4	<0.01	38	0.2	11	0.8	<0.01
Oilseeds	21	0.2	10	0.1	0.67	25	0.1	6	0.4	<0.01

Supermarket chain coverage: local (companies A and B) and national (companies C, D and E); Socioeconomic supermarket chain profile: low/middle (chain A, B, D, E) and high (chain C). N/MPF: Natural or minimally processed foods. [1]p-value: obtained by means of a chi-square test considering a 5% significance level.

Source: Authors.

est, purchase and consequently lower consumption by the population. For consumers, products advertised in circulars are more advantageous, especially considering price reduction, even if this statement is not always true[30,31]. Promoting healthy foods and reducing unhealthy food advertisements are strategies that seem to make healthier food choices easier[32].

In agreement with the international literature, the present study also showed that the promotion of animal protein food sources, especially beef and poultry, plays a prominent role in supermarket circulars[20,33,34]. At national level, a study conducted in Belo Horizonte-MG evaluated circulars of five supermarket chains over a year and found the same ratio as the present study re-

garding the promotion of meat and eggs among N/MPF[23]. This result is not surprising, considering that meat, especially red meat, is widely consumed by the Brazilian population[34-36].

In addition, Brazil is renowned as one of the largest meat producers worldwide[37]. However, DGBP recommends a moderate intake of meat and emphasizes that proteins should stem from both animal and plant sources. Despite the fact that red meat is an excellent source of proteins of high biological value and that it contains a high level of micronutrients, it tends to be rich in fats, especially saturated fats, which, when excessively consumed, increase the risk of chronic non-communicable diseases. Besides, reducing the consumption of food of animal origin means opting for a food system that is socially fairer and impacts the environment, animals and biodiversity in a reduced way[1].

Fish are excellent substitutes for red meat, as they are also rich in high-quality protein, micronutrients and a provide a high quantity of unsaturated fats. However, despite Brazil's extensive coastline and large rivers, fish supply is small and prices are relatively high compared to red meat and poultry, reducing their consumption in Brazil[1,2,4]. The low frequency of fish in circulars is significant. Our analysis revealed that fish were promoted approximately ten times less often than meat and eggs (data not shown).

Another alternative to replace red meat are foods based on vegetable protein, such as legumes. However, the legume subgroup was among the least advertised ones. The study conducted by Mendes *et al.*[23] also revealed that this subgroup shows a low frequency (2.2%) among N/MPF ads[23]. This is rather disturbing, since the quantity of rice and beans, which make up Brazil's most traditional dish, decreased considerably in terms of home consumption and since only a few bean varieties are actually consumed[36]. In the present study, the legume subgroup was also basically represented by beans, most of which were black turtle beans and pinto beans. DGBP recommends a varied consumption of legumes to improve the variety of nutrients and flavors[1]. Despite the fact that beans are an essential element of the Brazilian diet, a low variety of brands was advertised in circulars, especially when compared to meat and eggs. The low number of brands may also explain the lower promotion of legumes in circulars, since the greater the number of companies in a given food sector, the greater the competition in the market and the higher investments in marketing[38].

The fruit and vegetable subgroup was the second most advertised one in circulars. However, its advertising ratio is only half the ratio of the most publicized group (meat and eggs). Other studies also came across a low frequency of fruits and vegetables in circulars[7,18,20,21,39]. The study developed by Mendes *et al.*[23] found an even lower frequency of only 14.1% of N/MPF. The high difference in the promotion of fruits and vegetables among supermarket chains investigated in this study is noteworthy. Chains A and C, which do not publish either Fruits and Vegetables or Other Food Sectors circulars were the ones that least promoted this subgroup. Fruits and vegetables are mostly advertised by these types of circulars, which are undervalued by the chains. They contain few pages, are published less often than others, are only distributed once a week, and offer a reduced quantity of foods for a short period of time. They are mostly simple (few or no pictures) and rely on a limited number of marketing strategies to add value to products. Despite the recommendation of regular and varied consumption of fruits and vegetables, which are excellent sources of fiber, vitamins, minerals and bioactive compounds associated with disease prevention[1], national surveys reveal that these foods are not being sufficiently consumed and show a downward trend over the years[4,40]. This might also be due to government incentives that encourage the concentration of land in the hands of large landowners who cultivate monocultures for export, to the detriment of the production of healthy and varied foods for the Brazilian population[38]. Despite the fact that 70% of the food consumed in Brazil comes from family farming, financial incentives are higher for agribusinesses that supply foreign markets[41]. Besides, there is a higher investment in advertising aimed at increasing the consumption of ultra-processed foods rather than of N/MPF[38].

Oilseed promotion was insignificant in all supermarket chains. However, DGBP emphasizes that its regular consumption is essential[1]. Oilseeds are rich in unsaturated fats and contain antioxidant compounds that help prevent diseases. Considering that Brazil ranks among the largest producers of some nut species, such as cashew nuts and Brazil nuts[42], their low consumption rate is rather contradictory, as data obtained by the Brazilian Family Budget Survey in 2017-8 show that only 1.2% of respondents consume oilseeds[4]. This may be due to the fact that most of its production is exported, to the detriment of domestic trade. Availability of nuts on the national market is influenced by the U.S. dollar exchange rate. The

higher their price, the greater are exports and the lower are their offer on the domestic market[43].

Significant differences were found in the promotion of several N/MPF subgroups in terms of coverage and socioeconomic profile of supermarket chains. Local chains more frequently advertise foods that provide the highest quantity of energy to the diet of Brazilians, i.e., dairy products, legumes, cereals, flours and pasta, meat and eggs[4]. National chains announced more often fruits and vegetables, and spices and mushrooms. Camargo *et al.*[13] also found differences in food promotion according to chain coverage. National chains have greater market power over the food system, obtain lower prices and better terms from producers. They are economically more powerful and their distribution chain is better structured than that of local companies, which allows them to invest more in low-profit-margin products, such as fruits and vegetables, which are highly perishable and have a high waste rate[44].

Supermarket chains aimed at high-income consumers more frequently advertised expensive N/MPF associated with a high social or health status, such as coffee capsules, premium brands, fruits and vegetables, as well as mushrooms and oilseeds. A systematic review of national surveys showed that people with a higher socioeconomic status buy more foods that characterize a healthy diet and are more likely to follow a diversified and healthy diet[45]. Our results are also matched by those of an American study which found that supermarket circulars of high-income areas promote a higher rate of fruits and fruit juices than circulars distributed in low-income areas[39].

In general, circulars promote less healthy foods than unhealthy ones, such as UPF. Among the healthy ones, the meat subgroup is most often promoted, a kind of food with a high fat concentration and greater environmental impact during production. In addition, food promotion by circulars increases the unequal offer of N/MPF for lower-income consumers when compared to higher-income groups, especially regarding the fruit and vegetable subgroup.

The present study is limited insofar as we were only able to include one supermarket chain aimed at customers of a high socioeconomic profile that would meet our high-revenue inclusion criterion. An additional limitation refers to the fact that our research exclusively considered circulars of the metropolitan region of Rio de Janeiro, which may restrict applying our results at national scale. However, it should be noted that three of the five chains are present throughout Brazil, which may allow us to conclude that the same promotional profile applies to other regions as well.

It is noteworthy that the present study collected all the circulars published by the selected supermarket chains over a year, resulting in a database with a significant number of foods and circulars of different typologies. We believe that this strategy may have minimized possible biases related to seasonality of circulars. Scientific knowledge on this topic is still incipient and therefore, future studies will have to investigate seasonality in food promotion in a more detailed way.

Our research did not aim to investigate differences in the type of promotion used in N/MPF compared to other advertised products. However, we believe that this is a relevant approach to acquire deeper knowledge about food promotion in retail chains. Therefore, we recommend that future studies evaluate marketing strategies that are connected to the types of food advertised by supermarket circulars.

We feel that the present study provides important advances in the knowledge about food promotion in supermarket circulars, since it is the first one that reflects on the promotion of N/MPF in the light of DGBP[1] that was developed in one of Brazil's main urban centers.

Final considerations

The present study found differences in the promotion of some N/MPF subgroups in supermarket circulars that contradict the recommendations by DGBP. The meat and eggs subgroup, especially beef and poultry, was extensively promoted by all supermarket chains, whereas fruits and vegetables were more often promoted by some chains only, especially by those that publish exclusive fruit and vegetable circulars. We found important differences in the promotion of food subgroups in terms of supermarket chain coverage and socioeconomic profile of the consumers they are aimed at. These differences show how unequal promotion of N/MPF is in supermarket circulars, which can have a negative impact on access to food acquisition and its diversity, and consequently on the consumption and supply of a wide range of nutrients, such as vitamins and minerals by the population. This clearly shows that public programs and policies need to be developed by the federal, state and municipal governments. We further conclude that the responsibility of promoting consumer health is not in the

interest of either the productive sector or retailers. Governments need to regulate and supervise the advertising of unhealthy foods, in addition to create tax incentives to increase the promotion of N/MPF that are the basis of an adequate and healthy diet.

Collaborations

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by ASD Oliveira and CC Moreira. The first draft of the manuscript was written by CC Moreira. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

The present study was performed with the support of the Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ) by means of the following public notices: Recently-hired Researcher Support (E-26/010.002750/ 2019) and a master's degree scholarship (E-26/200.084/2021).

References

1. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Departamento de Atenção Básica. *Guia alimentar para a população brasileira*. 2ª ed. Brasília: MS; 2014.
2. Organização Pan-Americana da Saúde (OPAS). *Alimentos e bebidas ultraprocessados na América Latina: tendências, efeitos na obesidade e implicações para políticas públicas*. Brasília: OPAS; 2018.
3. Louzada MLC, Martins APB, Canella DS, Baraldi LG, Levy RB, Claro RM, Moubarac JC, Cannon G, Monteiro CA. Alimentos ultraprocessados e perfil nutricional da dieta no Brasil. *Rev Saúde Publica* 2015; 49(38):1-11.
4. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa de orçamentos familiares, 2017-2018: análise do consumo alimentar pessoal no Brasil*. Rio de Janeiro: IBGE; 2020.
5. The High Level Panel of Experts on Food Security and Nutrition (HLPE). *Nutrition and food systems. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security*. Rome: HLPE; 2017.
6. Downs SM, Ahmed S, Fanzo J, Herforth A. Food Environment Typology: Advancing an Expanded Definition, Framework, and Methodological Approach for Improved Characterization of Wild, Cultivated, and Built Food Environments toward Sustainable Diets. *Foods* 2020; 9(4):532.
7. Martin-Biggers J, Yorkin M, Aljallad C, Ciecierski C, Akhabue I, McKinley J, Hernandez K, Yablonsky C, Jackson R, Quick V, Byrd-Bredbenner C. What foods are US supermarkets promoting? A content analysis of supermarket sales circulars. *Appetite* 2013; 62:160-165.
8. Walker RE, Keane CR, Burke JG. Disparities and access to healthy food in the United States: A review of food deserts literature. *Health Place* 2010; 16(5):876-884.
9. Costa JC, Claro RM, Martins APB, Levy RB. Food purchasing sites. Repercussions for healthy eating. *Appetite* 2013; 70:99-103.
10. Pulker CE, Trapp GSA, Scott JA, Pollard CM. What are the position and power of supermarkets in the Australian food system, and the implications for public health? A systematic scoping review. *Obes Rev* 2018; 19(2):198-218.
11. Hawkes C. Sales promotions and food consumption. *Nutr Rev* 2009; 67(6):333-342.
12. Burton S, Lichtenstein DR, Netemeyer RG. Exposure to sales flyers and increased purchases in retail supermarkets. *J Advert Res* 1999; 39(5):7-14.
13. Camargo AM, Farias JP, Mazzonetto AC, Dean M, Fiates GMR. Content of Brazilian supermarket circulars do not reflect national dietary guidelines. *Health Promot Int* 2019; 35(5):1052-1060.
14. Tan PJ, Tanusondjaja A, Corsi A, Lockshin L, Villani C, Bogomolova S. Behavioural and psychographic characteristics of supermarket catalogue users. *J Retailing and Consumer Services* 2021; 60:102469.
15. Familmaleki M, Aghighi A, Hamidi K. Analyzing the influence of sales promotion on customer purchasing behavior. *Int J Econ Manag Sci* 2015; 4(4):1-6.

16. Hawkes C. Dietary implications of supermarket development: A global perspective. *Dev Policy Rev* 2008; 26(6):657-692.
17. Steenhuis IH, Waterlander WE, De Mul A. Consumer food choices: the role of price and pricing strategies. *Public Health Nutr* 2011; 14(12):2220-2226.
18. Cameron AJ, Sayers SJ, Sacks G, Thornton LE. Do the foods advertised in Australian supermarket catalogues reflect national dietary guidelines? *Health Promot Int* 2015; 32(1):dav089-dav089.
19. Gázquez-Abad JC, Martínez-López FJ, Mondéjar-Jiménez JA. Características dos folhetos publicitários como ferramenta promocional: hipermercados vs. Pequenos supermercados. *Innovar* 2010; 20(38):203-216.
20. Jahns L, Payne CR, Whigham LD, Johnson LK, Scheett AJ, Hoverson BS, Kranz S. Foods advertised in US weekly supermarket sales circulars over one year: a content analysis. *Nutr J* 2014; 13(1):95.
21. Charlton EL, Kähkönen LA, Sacks G, Cameron AJ. Supermarkets and unhealthy food marketing: An international comparison of the content of supermarket catalogues/circulars. *Prev Med* 2015; 81:168-173.
22. Botelho AM, Milbratz de Camargo A, Medeiros KJ, Irmão GB, Dean M, Fiates GMR. Supermarket circulars promoting the sales of 'healthy'foods: Analysis based on degree of processing. *Nutrients* 2020; 12(9):2877.
23. Mendes C, Miranda L, Claro R, Horta P. Food marketing in supermarket circulars in Brazil: An obstacle to healthy eating. *Prev Med Rep* 2021; 21:101304.
24. Associação Brasileira de Supermercados (ABRAS). *Ranking ABRAS 2019: o Retrato oficial do autosserviço brasileiro* [Internet]. 2019 [acessado 2021 dez 18]. Disponível em: https://emailmkt.abras.com.br/superhiper/pdf/514.pdf.
25. Associação de Supermercados do Estado do Rio de Janeiro (ASSERJ). *Associados da ASSERJ estão entre as cinco marcas mais lembradas pelos cariocas* [Internet]. 2018 [acessado 2021 dez 18]. Disponível em: https://asserj.com.br/supermercados/2018/12/associados-da-asserj-estao-entre-as-cinco-marcas-mais-lembradas-pelos-cariocas/.
26. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Rauber F, Khandpur N, Cediel G, Neri D, Martinez-Steele E, Baraldi LG, Jaime PC. Ultra-processed foods: what they are and how to identify them. *Public Health Nutr* 2019; 22(5):936-941.
27. StataCorp. *Stata Statistical Software: Release 12*. College Station (TX): Stata Corporation LP; 2011.
28. Brasil. Conselho Nacional de Saúde (CNS). Resolução nº 466, de 12 de dezembro de 2012. Que aprova as diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. *Diário Oficial da União* 2012; 12 dez.
29. Lino KS, Santos CC, Santos DB, Matsumoto MM, Cardoso PP, Yamamoto TM, Isabella G. A Promoção por meio de Panfletos e a Decisão de Compra do Consumidor: uma Pesquisa Quantitativa-Descritiva. *Rev Bras Pesq Mark Opi Midia* 2013; 13:67-87.
30. Volle P. The short-term effect of store-level promotions on store choice, and the moderating role of individual variables. *J Bus Res* 2001; 53(2):63-73.
31. Pérez MS, Abad JCG. Sobre la eficacia de la promoción de productos de gran consumo: folletus versus descuentos en precios. *Distribución Consumo* 2006; 16(86):5-14.
32. Jaime P, Campello T, Monteiro CA, Bortoletto AP, Yamaoka M, Bomfim M. *Diálogo sobre ultraprocessados: Soluções para sistemas alimentares saudáveis e sustentáveis* [Internet]. Cátedra Josué de Castro - NUPENS/USP; 2021 [acessado 2021 dez 18]. Disponível em: https://www.fsp.usp.br/nupens/wp-content/uploads/2021/06/Documento-Dia%CC%81logo-Ultraprocessados_PT.pdf.
33. Jahns L, Scheett AJ, Johnson LAK, Krebs-Smith SM, Payne CR, Whigham LD, Hoverson BS, Kranz S. Diet Quality of Items Advertised in Supermarket Sales Circulars Compared to Diets of the US Population, as Assessed by the Healthy Eating Index-2010. J Acad Nutr Diet 2016; 116(1):115-122.e1.
34. Associação Brasileira de Proteína Animal (ABPA). *Relatório anual* [Internet]. 2021 [acessado 2021 dez 18]. Disponível em: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fabpa-br.org%2Fwp-content%2Fuploads%2F2021%2F04%2FABPA_Relatorio_Anual_2021_web.pdf&chunk=true.
35. Rodrigues RM, Souza AM, Bezerra IN, Pereira RA, Yokoo EM, Sichieri R. Evolução dos alimentos mais consumidos no Brasil entre 2008-2009 e 2017-2018. *Rev Saude Publica* 2021; 55(Supl. 1):4s.
36. Antunes ABS, Cunha DB, Baltar VT, Steluti J, Pereira RA, Yokoo EM, Sichieri R, Marchioni DM. Padrões alimentares de adultos brasileiros em 2008-2009 e 2017-2018. *Rev Saude Publica* 202; 55(Supl. 1):8s.
37. Associação Brasileira de Indústrias Exportadoras de Carne (ABIEC). Perfil da pecuária no Brasil [Internet]. 2021 [acessado 2021 dez 18]. Disponível em: http://abiec.com.br/publicacoes/beef-report-2021/.
38. Palmieri Jr V. *Dinâmica e diferenças dos preços dos alimentos saudáveis e ultraprocessados no Brasil* [Internet]. 2021 [acessado 2021 dez 18]. Disponível em: https://actbr.org.br/uploads/arquivos/LO_ACT_relatorio-diferenca-e-dinamica-dos-precos_rev-05.pdf.
39. Ethan D, Samuel L, Basch CH. An analysis of bronx-based online grocery store circulars for nutritional content of food and beverage products. *J Community Health* 2013; 38(3):521-528.
40. Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Departamento de Análise em Saúde e Vigilância de Doenças Não Transmissíveis. *Vigitel Brasil 2019: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados* [Internet]. 2020 [acessado 2021 dez 18]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/vigitel_brasil_2019_vigilancia_fatores_risco.pdf.
41. Lima AF, Silva EGA, Iwata BF. Agriculturas e agricultura familiar no Brasil: uma revisão de literatura. *Retratos Assentamentos* 2019; 22(1):50-68.

42. Companhia Nacional de Abastecimento (CONAB). *Análise mensal de Castanha-de-caju* [Internet]. 2020 [acessado 2021 dez 18]. Disponível em: https://www.conab.gov.br/info-agro/analises-do-mercado-agropecuario-e-extrativista/analises-do-mercado/historico-mensal-de-castanha-de-caju.
43. Freitas KF, Thuler ME, Nigri D, Gomes CFS. Mercado da castanha do Pará no Brasil: análise e visão prospectiva de cenários. In: X*V Simpósio de Excelência em Gestão e Tecnologia – SEGeT* [Internet]. 2018 [acessado 2022 abr 2]. Disponível em: https://www.aedb.br/seget/arquivos/artigos18/23626416.pdf.
44. Parker C, Scrinis G. Out of the cage and into the barn: supermarket power food system governance and the regulation of free range eggs. *Griffith Law Review* 2014; 23(2):318-347.
45. Canuto R, Fanton M, Lira PIC. Iniquidades sociais no consumo alimentar no Brasil: uma revisão crítica dos inquéritos nacionais. *Cien Saude Colet* 2019; 24(9):3193-212.

Article submitted 21/01/2022
Approved 24/08/2022
Final version submitted 26/08/2022

Chief editors: Romeu Gomes, Antônio Augusto Moura da Silva