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ORIGINAL ARTICLE

Analysing persuasive marketing of ultra-processed foods on Brazilian television

Marina O. Santana[1] · Julia S. Guimarães[2] · Fernanda Helena M. Leite[3] · Laís A. Mais[4] · Paula M. Horta[5] · Ana Paula Bortoletto Martins[3,4] · Rafael M. Claro[5]

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Abstract

Objectives This study investigated the use of persuasive advertising strategies in ultra-processed food (UPF) advertisements broadcast on the three most popular free-to-air television channels in Brazil.

Methods The programming of the selected channels was recorded on eight non-consecutive days from April 2018 (6:00 am–12:00 am). Information from each advertising piece was collected through an electronic questionnaire based on the INFORMAS protocol. Food products were classified according to the NOVA classification system. Marketing strategies were investigated in UPF advertisements and stratified into three groups. Principal component analysis was used to identify patterns of strategies. Linear regression models were employed to investigate the association between the patterns and food groups.

Results In total, 90.77% of the food-related advertisements contained at least one UPF, and 96% of them included one or more persuasive advertising strategies. Five advertising patterns were identified and associated with the UPF food groups.

Conclusions The results showed that food advertising on Brazilian free television is marked by UPF, with the predominant use of persuasive advertising strategies, demonstrating a lack of enforcement of the current regulatory legislation in the country.

Keywords Food marketing · Advertising · Persuasive communication · Ultra-processed foods · Food choice · INFORMAS

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✉ Marina O. Santana
marinasantana2@gmail.com

Julia S. Guimarães
julia.soares.gui@gmail.com

Fernanda Helena M. Leite
fernandahml@gmail.com

Laís A. Mais
lais.amaral@idec.org.br

Paula M. Horta
paulamhorta@gmail.com

Ana Paula Bortoletto Martins
anapaula@idec.org.br

Rafael M. Claro
rafael.claro@gmail.com

[1] Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

[2] University of Ottawa, Gatineau, QC, Canada

[3] Center for Epidemiological Studies in Health and Nutrition (Nupens), University of São Paulo, São Paulo, Brazil

[4] Brazilian Institute for Consumer Defense (Idec), São Paulo, Brazil

[5] Nutrition Department, Federal University of Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

Introduction

Obesity has become a major global health challenge, affecting all age groups (Who 2018). In 2015, overweight and obesity were responsible for four million deaths and for the loss of 120 million of disability-adjusted life years (DALYs) worldwide (4.9%) (Afshin et al. 2018). In Brazil, data from the Surveillance System of Risk and Protective Factors for Chronic Diseases by Telephone survey (Vigitel) indicate an expressive increase in the prevalence of obesity among adults (≥ 18 years old) in all state capitals and in the Federal District, from 11.8% in 2006 to 19.8% in 2018 (Brasil 2019).

Sedentary behaviours, along with inadequate food consumption—particularly of diets high in ultra-processed food (UPF) products (Monteiro 2009)—are important drivers of excessive weight gain, obesity and related Non-Communicable Diseases (NCDs) (Who 2018). Although several factors may influence food choices, food marketing and food advertising are considered major drivers of unhealthy eating behaviours based on the consumption of ultra-processed products. For years, food industry combines marketing strategies to promote these products—such as linking its consumption to licensed characters, famous individuals from show business or sport, a movie, promotions and awards—increasing the persuasiveness and the effectiveness of its advertisements (ads) (Federal Trade Commission 2009). Evidence indicates that although marketing is specially capable to influence food consumption among children and adolescents (Zimmerman and Bell 2010; Sadeghirad et al. 2016), people of all ages are somehow impacted by it (Moses and Baldwin 2005). Meanwhile, it is worth keeping in mind that besides this direct influence over food choice, exposure to food advertising and general media consumption also affect obesity risk through several other pathways in a complex set of interrelationships (Government Office for Science 2007). Thus, tackling these factors represents an important step towards increasing population's diet quality and reducing the prevalence of obesity.

In Brazil, any kind of abusive advertising is prohibited by the CDC (Código de Defesa do Consumidor, National Consumer Protection Code) (Brasil 2017) and reinforced by the Conanda's Resolution (Conselho Nacional dos Direitos da Criança e do Adolescente, National Council for the Rights of Children and Adolescents) (Brasil 2014). According to the CDC, all advertising strategies that take advantage of children's lack of knowledge or maturity are abusive and therefore illegal. The National Council for the Self-Regulation of Advertising (*Conselho Nacional de Autorregulamentação Publicitária*—CONAR), a civil society organization founded by the Brazilian advertising companies, is responsible for making formal complaints to the Public Prosecutor's Office when identifying any irregularities. The CONAR is composed of the Brazilian Association of Advertiser representatives and marketing and communication agencies (Conar 2018). For this reason, the Council's reliability to regulate advertising is questionable, especially given that the members are not chosen by the civil society, making it hard to believe that the CONAR does not focus on their own interests (Maria Clara Monteiro 2015).

This study aimed to investigate the use of persuasive advertising strategies in food and drink ads broadcast on the three most popular Brazilian free-to-air television (TV) channels. First, we tested the hypothesis that individuals would be highly exposed to UPF ads. Second, we analysed the type and frequency of persuasive strategies, as well as their patterns of combination. Finally, we explored the association between these patterns of strategies and the food groups to proper characterize them.

Methods

Design and TV sampling

This was a cross-sectional study. TV broadcasts were recorded from the three free-to-air channels with the highest audience, according to the Brazilian Institute of Public Opinion and Statistics (IBOPE) (Ibope 2018a): *Rede Globo*, *Record* and *SBT*. Data were recorded by a media auditing service for eight non-consecutive days (four weekdays and four weekend days) randomly selected from 1 April to 30 April 2018 (excluding public holidays and school holiday periods) from 6 to 12 am. In total, 432 h of TV broadcast (144 h/channel) were recorded.

Data coding

The recordings from the eight sampled days were audited by trained researchers from the *Universidade Federal de Minas Gerais* (UFMG). All ads were coded in Epi Info™ (version 7.2.2.6) using the International Network for Food and Obesity/Non-Communicable Diseases (NCDs) Research, Monitoring and Action Support (INFORMAS) protocol (Kelly et al. 2013) to guide this process and to catalogue and organize all data. The following information was collected for each advertisement (ad): channel name, channel audience share in peak viewing times, date of recording, day of the week or weekend, program name and category, start and end time of the show, time slot of ad, ad type, company name, name and description of the product(s) advertised. The program category was classified into 15 different types as described elsewhere (Kelly et al. 2013). All ads were coded as food or drink product(s), food or drink companies/brand, food or drink retailers (e.g. supermarkets, fast food restaurants) and non-food or drink product(s).

For ads involving foods and/or drinks, further details were investigated, including description of the food product(s) advertised, power of the advertising strategies (e.g. use of licensed character, celebrities, awards, etc.), premium offers type (e.g. pay 2 take 3 or more, gifts or collectable, limited edition, etc.), brand benefit claims (e.g. sensory-based characteristics, suggested use, etc.), marketing partnership with other brands (yes/no) and ad's targeted audience.

All food and/or drink ads were classified, according to the NOVA classification system (used in the BDGs) into four groups (and twelve subgroups): (1) unprocessed or minimally processed foods, (2) processed culinary ingredients, (3) processed foods and (4) ultra-processed food and drink products (Monteiro et al. 2010). Data coding was completed by trained researchers, and the results and/or any divergence was compared on a regular basis. All data sets passed through three crosschecks to standardize all values and correct any data collection/entering error. The inter-coder reliability was calculated, ranging from 90.37 to 99.74% at the beginning of data collection, which was considered high (Vandevijvere et al. 2018).

Use of persuasive marketing strategies

Persuasive marketing strategies are defined as a set of actions to convince consumers to buy a product, based not exclusively on rational factors, but specially on emotional and sentimental ones (Marketing-School.org 2012). According to the INFORMAS protocol, 27 marketing strategies will be investigated and classified into three major groups: power of advertising strategies ($n = 10$), use of the prize offering ($n = 9$) and use of brand benefit claims ($n = 8$) (Table 1).

Statistical analysis

For the descriptive analysis, our study unit was a cluster of ads corresponding to each of the 432 h of recordings [this accounts for the fact that the number of ads may vary according to channel, period of the day and day of the week (Kelly et al. 2013)]. The absolute and relative frequency of ads belonging to each type (according to the INFORMAS) and to each food group and subgroup was estimated in each study unit. Weighting factors were associated with each unit of study in order to allow them to represent exactly the different number of weekdays and weekend hours during the reference period (1 April to 30 April) (Kelly et al. 2013).

Absolute and relative frequencies, as well as a 95% confidence interval (95% CI), were used to describe food or drink ads by food category (according to the NOVA classification system). The same was done for the use of persuasive advertising strategies in food or drink ads according to the INFORMAS protocol. First, frequencies were applied to describe both the use of different groups of strategies and the combinations among these groups. Second, the mean of each strategy was assessed for the UPF food group. Third, a principal component analysis (PCA) was employed to identify patterns of strategies used in food advertising. Variables with factor loadings ≥ 0.30 were considered significantly associated with the component. In addition, negative factor loads indicated that the strategy was inversely associated with the component, while positive factor loads indicated a direct association. Therefore, the greater the magnitude of the factor load, the greater its contribution to the pattern. Fourth, linear regression models were used to analyse the association between the resulting components from the PCA analysis (from now on

Table 1 Persuasive food advertising strategies according to three categories

Categories*		
Power of advertising	Premium offers	Brand benefit claims
Cartoon/company-owned character	Game and app downloads	Sensory-based characteristics
Licensed character	Contests	New brand development
Amateur sportsperson	Pay 2 take 3 or other	Suggested use (e.g. great for lunch boxes)
Celebrity (non-sports)	20% extra or other	Suggested users are children or whole family
Movie tie-in	Limited edition	Emotive claims (fun, feelings, popularity)
Famous sportsperson/team	Social charity	Puffery (claiming to be advantageous over other products)
Non-sports/historical events/festivals	Gift or collectable	Convenience
'For kids' messaging	Price discount	Low price
Awards	Loyalty programs	
Sports event		

*These categories were defined in INFORMAS protocol (Kelly et al. 2013)

described as patterns) and each food group. The patterns were used as dependent variables and the food groups as the independent ones. All statistical analyses were conducted using the Stata statistical software package (version 14.2). Any difference in the values was considered statistically significant when $p < 0.05$.

Results

A total of 7991 ads, 14.16% ($n = 1156$) of them nutrition related, were identified in the 432 h of recordings. About 11.00% ($n = 922$) of all the ads were for food and/or drink products announced by food companies/brands, while 1.25% ($n = 94$) and 0.62% ($n = 40$), respectively, were for food and/or drink retailers classified as restaurant/takeaway/fast food or supermarket/convenience store depicting a food and/or drink product. The percentage of food brand/company and food/drink retailer advertising (without depicting a specific food and/or drink in the ad) was low (0.31% and 0.94%, respectively).

The NOVA classification system only classifies food items; thus, dietary supplements ads ($n = 218$), food company/brand ($n = 21$) or food/drink retailer ads (supermarket or convenience store) not depicting a specific product ($n = 59$) were excluded from the analyses. A final sample of 858 food-related ads classifiable by the NOVA system was obtained. We found that over 90% of the food and/or drink ads ($n = 780$, 90.77%) broadcasted on the three major TV channels included at least one UPF. Further, soft drinks (28.9%), alcoholic drinks (14.23%) and fast food meals (13.8%) represented more than half of all the food and/or drink ads shown during the selected period (Table 2).

More than 96% of the UPF ads included at least one of the persuasive advertising strategies investigated in this study (power of advertising, premium offers and brand benefit claims). Overall, around 31% and 23% of the UPF ads included brand benefit claims or combined strategies to boost the power of advertising with brand benefit claims, respectively. Furthermore, we found that one in every four UPF ads used two or three persuasive strategies, and one in every six UPF ads combined the three types of marketing strategies within the same ad (Table 3).

Brand benefit claims were the most common advertising strategy (77.38%) used in UPF ads and were mainly performed by emphasizing the sensory characteristics of the advertised product (57.25%). The use of messages implying that the final consumers of a certain product were children or their family accounted for more than 18% of the persuasive techniques displayed in UPF ads, followed by 'new brand development' (14.02%). The second most popular strategy was the use of persuasive appeals to increase the power of advertising (54.77%), such as non-sport celebrities (18.23%), brand characters (14.55%), strategies related to sports events (14.52%) or any message implying that the product was made for children (13.34%). Premium offers were displayed in less than 30% of the UPF ads and consisted mostly of price discounts (10.16%), contests (8.96%), limited edition (7.97%) and gifts or collectables (7.95%) (Table 4).

Five advertising patterns were identified in the PCA and named according to their main characteristics (Table 5). The first one, described as 'Distinction', was most strongly correlated with 'limited edition', 'licensed character', 'gifts or collectables' and 'new brand development'. The second pattern, 'For kids', was associated with the use of 'For kids' messaging, 'suggested users', 'non-sports events' and 'company-owned characters'. The third one was correlated with 'low price' and 'price discounts' in the same magnitude and was identified as 'Price and discount'. The fourth pattern, titled 'Sportive', was positively associated with the 'use of sports events' and 'contests', while it showed an inverse association with 'puffery'. Finally, the last pattern, classified as 'Innovation', demonstrated a positive correlation with 'sensory-based characteristics', 'puffery' and 'new brand development', while it was inversely associated with 'celebrity non-sports'. The PCA explained 69.17% of the combined variability, considered sufficient to explain the original variance.

The 'Distinction' pattern was positively associated with fast food items ($\beta = 1.63$; $p < 0.01$), demonstrating that the marketing strategies correlated with this pattern were more frequently used in ads promoting ready-to-eat products. The 'For kids' pattern, on the other hand, was positively associated with ads depicting foods high in fat, sugar and sodium (e.g. sweetened beverages, fast food items, sweet biscuits, ultra-processed meat products) that are appealing to children. Margarine ads were specifically associated with the 'For kids' pattern due to the feature of a popular YouTuber celebrity having breakfast with the family. The 'Price and discount' and the 'Sportive' patterns were positively associated with fast food ($\beta = 1.04$; $p < 0.01$) and soft drink ads ($\beta = 0.72$; $p < 0.01$), respectively. The latter could be explained by the fact that all TV recordings were carried out two months before the 2018 World Cup. Ads promoting sauces, sweetened beverages, crackers and salty snacks, ultra-processed meat products and fast food items were highly associated with the 'Innovation' pattern (Table 6).

Table 2 Absolute and relative (and 95% CI) frequency of food and drink ads in the three main free-to-air TV channels, according to the NOVA classification system

Food product category	Total		
	n	%	95% CI
Unprocessed or minimally processed foods	*67*	*7.63*	*5.95–9.74*
Processed culinary ingredients	*7*	*0.98*	*0.46–2.09*
Processed foods	*4*	*0.61*	*0.23–1.62*
Ultra-processed food and drink products	*780*	*90.77*	*88.48–92.65*
Soft drinks	246	28.90	25.77–32.25
Alcoholic beverages	133	14.23	11.97–16.85
Fast food meals	109	13.80	11.46–16.51
Nuggets and other ultra-processed meat products	83	9.99	8.03–12.37
Ice cream, chocolate and candies	57	6.54	4.98–8.53
Other sweetened beverages	53	5.75	4.32–7.61
Pastries, cakes and cookies	37	4.44	3.17–6.18
Margarines	35	3.69	2.59–5.24
Sauces	15	1.86	1.09–3.14
Savoury packaged snacks	8	1.05	0.51–2.15
Breakfast cereals	2	0.31	0.08–1.22
Ready-to-heat meals	2	0.22	0.05–0.97
Total	*858*	*100.00*	

Brazil, April 2018 (n = 858)

CI, confidence interval

Table 3 Relative frequency of number and type of persuasive strategies used in ultra-processed food ads in the three main free-to-air TV channels

Number of strategies	%	95% CI
One strategy		
Brand benefit claims only	31.05	27.68–34.63
Power of advertising only	15.03	12.62–17.8
Premium offers only	1.37	0.73–2.57
Two or three strategies		
Power of advertising + brand benefit claims	22.81	19.84–26.08
Power of advertising + premium offers + brand benefit claims	14.19	11.74–17.04
Premium offers + brand benefit claims	9.34	7.32–11.86
Power of advertising + premium offers	2.75	1.71–4.37
None	*3.47*	*2.3–5.21*
Total	*100.0*	

Brazil, April 2018 (n = 780)

CI, confidence interval

Discussion

The findings of this study evidence the high presence of unhealthy food advertising on Brazilian free-to-air TV. Over 90% of the food and/or drink ads promoted UPFs. Soft drinks were the most frequently advertised product, followed by alcoholic beverages, fast food meals and other products high in fat, sugar and sodium (i.e. nuggets and other ultra-processed meat products, ice creams, chocolate and candies and other sweetened beverages). Persuasive strategies were widely employed (96.5%). Five patterns of strategy use were identified, allowing to understand the different strategies related to each food group.

UPFs are highly palatable and convenient, sold in large portions and publicized with aggressive marketing strategies, which, most of the time, leads to excessive energy consumption. Marketing strategies often use highly charged and seductive ideas, language and images that undermine the desire and ability to make rational and healthy choices, and are particularly effective when targeting children, adolescents and other vulnerable groups (Moubarac et al. 2015). A diet rich in UPFs contributes

Table 4 Relative frequency (and 95% CI) of advertising strategies used in UPF ads in the three main free-to-air TV channels, according to the type of strategy

Advertising strategies	%[a]	95% CI
Power of advertising	*54.77*	*51.03–58.51*
Celebrity (non-sports)	18.23	15.42–21.04
Cartoon/company-owned character	14.55	11.87–17.23
Sports event	14.52	11.88–17.17
'For kids' messaging	13.34	10.78–15.91
Famous sportsperson/team	5.32	3.66–6.99
Licensed character	5.30	3.55–7.04
Non-sports/historical events/festivals	5.13	3.46–6.80
Amateur sportsperson	4.60	3.10–6.10
Premium offers	*27.65*	*24.25–31.05*
Price discount	10.16	7.82–12.51
Contests	8.96	6.80–11.12
Limited edition	7.97	5.89–10.05
Gift or collectable	7.95	5.84–10.05
Loyalty programs	3.71	2.19–5.23
Pay 2 take 3 or other	1.93	0.83–3.02
Brand benefit claims	*77.38*	*74.28–80.49*
Sensory-based characteristics	57.25	53.53–60.96
Suggested users are children or the whole family	18.04	15.17–20.91
New brand development	14.02	11.39–16.64
Low price	10.16	7.82–12.51
Puffery	6.02	4.27–7.77
Suggested use	2.36	1.21–3.51
Convenience	1.16	0.33–1.99
Emotive claims	1.06	0.28–1.84

CI, confidence interval

Strategies included in the INFORMAS protocol but not observed in the study were suppressed (movie tie-in, awards, game and app downloads, 20% extra or other and social charity)

Brazil, April 2018 (n = 780)

[a]Each advertising piece can contain one or more strategies; however, it does not necessarily contain one of each group (power of advertising, premium offers, brand benefit claims). Thus, the proportion of advertising strategies exceed 100% and does not add up to 100% in each group

directly to weight gain (Hall et al. 2019) and, consequently, to the development of obesity and other NCDs, which have been considered a global public health problem (Who 2018). Sales of ultra-processed products increased by 43.7% in a period of just over a decade in Latin America (from 328,055 kilotons in 2000 to 471,476 kilotons in 2013) (Moubarac et al. 2015). A global study, based on data from twenty-two countries, evaluating food-related television advertising identified ultra-processed foods as the most advertised products worldwide (Kelly et al. 2019). Most frequent categories involved sweetened drinks (15%); chocolate and confectionery (13%); ready meals and dishes (12%); breakfast cereals (9%); and cakes, biscuits and sweets (7%) (Kelly et al. 2019). Our results add to this pool, reinforcing the hypothesis that although countries have different food markets, UPF tends to be dominant regarding TV ads. It is worth mentioning that similar proportion of UPF was specially seeing in countries with development level like Brazil, such as Argentinian (93.7%) (Allemandi et al. 2018) and Costa Rica (91.1%) (Zamora-Corrales et al. 2019).

In 2018 TV channels were responsible for 71% of the advertising budget in the country (Ibope 2018b), which can demonstrate how significant advertising exposure through free-to-air TV can be. Evidence shows a positive association between unhealthy food advertising and the consumption of UPFs, especially in young individuals (Boyland et al. 2016). The bottom line is that these marketing strategies are not only used by the food industry to increase brand association, but also to influence the food

Table 5 Factor loadings for advertising strategies used in ultra-processed food ads in the three main free-to-air TV channels, according to five components

Advertising strategies	Strategies patterns				
	Distinction	For kids	Price and discount	Sportive	Innovation
Power of advertising					
Celebrity (non-sports)	0	− 0.1	− 0.18	− 0.14	− **0.68**
Cartoon/company-owned character	0.18	**0.36**	− 0.02	− 0.02	0.08
Sports event	0.11	− 0.17	− 0.08	**0.58**	0.12
'For kids' messaging	0.07	**0.52**	− 0.04	− 0.04	0.15
Famous sportsperson/team	0.15	− 0.21	− 0.08	0.22	0.08
Licensed character	**0.49**	0.09	− 0.01	− 0.01	− 0.05
Non-sports/historical events/festivals	− 0.15	**0.45**	0.05	0.1	0
Premium offers					
Price discount	0	− 0.02	**0.66**	− 0.02	0.05
Contests	− 0.06	0.03	− 0.02	**0.54**	0.17
Limited edition	**0.54**	− 0.05	− 0.05	0.09	0.01
Gift or collectable	**0.46**	0.08	0.11	0.03	− 0.07
Brand benefit claims					
Sensory-based characteristics	− 0.24	0.03	− 0.21	0.02	**0.42**
Suggested users	0.03	**0.48**	− 0.11	− 0.09	− 0.02
New brand development	**0.32**	− 0.13	− 0.11	− 0.28	**0.35**
Low price	0	− 0.02	**0.66**	− 0.02	0.05
Puffery	0	− 0.23	− 0.08	− **0.45**	**0.4**

The values in bold represent a correlation greater than 0.30

Brazil, April 2018 (n = 780)

preferences, purchases and eating behaviours (Jenkin et al. 2014), with expected effects in individuals from all ages. Fewer studies have investigated the effects of food advertising among adults (Boyland et al. 2016), when compared to children. This can be explained by the belief that an adult has a greater discerning ability to recognize the true intentions of the announcers in the ads. However, even adults are not able to make rational decisions all the time (Strayer and Drews 2007) and also may be considered vulnerable and unable to discern the persuasion behind the advertisements (Council for International Organizations of Medical Sciences (CIOMS) 2016). Several factors may influence vulnerability, as sociocultural conditions, psychic (mental disorders, intellectual deficits and stress), low education level, lack of economic resources and age group, which includes children and the elderly (Rogers and Ballantyne 2008).

Furthermore, it is important to consider also the 'power' of marketing. The 'power' of marketing can be investigated through the analysis of the use of strategies with a persuasive intent (Hebden et al. 2011), employed by the communicator to influence the recipients' behaviours, beliefs or attitudes (Daniel 2002). Although the use of persuasive marketing in TV food advertising has been reported by previous studies (Gómez et al. 2017; León-Flández et al. 2018), this is the first paper to correlate the advertising patterns identified in the PCA with specific food groups. Furthermore, this research was based on an international methodology (INFORMAS), which allows results to be compared across countries and over time. According to our findings, the proportion of food ads displaying at least one persuasive strategy on Brazilian TV was extremely high, especially those promoting unhealthy food and beverage products (96% of the UPF ads). Moreover, almost half of the UPF ads used multiple combinations of strategies, increasing the persuasive power of the marketing message.

Our study demonstrates that persuasive strategies were used by food advertisers in multiple combinations to persuade adults and children and to promote unhealthy food items on TV. For example, 'brand benefit claims' were featured in approximately 77% of the UPF ads, mainly through strategies that emphasized sensory-based characteristics of the products (e.g. good appearance, texture, aroma, taste), suggested that the product was made for children or the whole family (e.g. by depicting a family feeling pleased while consuming the product) or claimed that the product was a new brand development and crating the need for the consumers to try the new product. 'Power of advertising' strategies were also displayed in more than

Table 6 Regression coefficients (obtained in the linear regression models) for the association between patterns of persuasive strategies and food categories. Ultra-processed food ads in the three main free-to-air TV channels. Brazil, April 2018 (n = 780)

Food categories	Distinction			For kids			Price and discount			Sportive			Innovation		
	β	p	95% CI	β	p	95% CI	β	p	95% CI	β	p	95% CI	β	p	95% CI
Pastries, cakes and cookies	− 1.16	0.00	− 1.82 to − 0.51	0.84	0.00	0.31 to 1.36	− 0.72	0.01	− 1.29 to − 0.14	NS	NS	− 0.05 to 0.93	NS	NS	− 0.14 to 0.79
Ice cream, chocolate and candies	− 1.23	0.00	− 1.78 to − 0.69	NS	NS	− 0.26 to 0.62	NS	NS	− 0.83 to 0.12	NS	NS	− 0.14 to 0.67	NS	NS	− 0.05 to 0.73
Savoury packaged snacks	NS	NS	− 1.91 to 0.40	NS	NS	− 0.88 to 0.99	NS	NS	− 0.13 to 1.90	NS	NS	− 1.40 to 0.33	0.86	0.04	0.02 to 1.69
Soft drinks	− 1.26	0.00	− 1.66 to − 0.85	0.78	0.00	0.45 to 1.10	− 0.82	0.00	− 1.17 to − 0.46	0.72	0.00	0.41 to 1.02	NS	NS	− 0.43 to 0.15
Other sweetened drinks	− 0.87	0.00	− 1.43 to − 0.32	2.90	0.00	2.45 to 3.45	− 1.21	0.00	− 1.69 to − 0.72	− 0.55	0.01	− 0.97 to − 0.14	1.11	0.00	0.71 to 1.51
Nuggets and other ultra-processed meat products	− 1.12	0.00	− 1.61 to − 0.63	0.81	0.00	0.41 to 1.21	− 0.63	0.00	− 1.06 to − 0.20	NS	NS	− 0.24 to 0.49	0.35	0.05	0.00 to 0.71
Ready-to-eat meals	NS	NS	− 3.52 to 0.95	NS	NS	− 1.53 to 2.07	NS	NS	− 0.25 to 3.67	NS	NS	− 1.72 to 1.61	NS	NS	− 1.44 to 1.77
Sauces	− 1.49	0.00	− 2.37 to − 0.61	NS	NS	− 0.92 to 0.49	− 0.82	0.04	− 1.59 to − 0.05	− 1.07	0.00	− 1.72 to − 0.41	1.33	0.00	0.70 to 1.96
Breakfast cereals	NS	NS	− 3.76 to 0.71	NS	NS	− 1.43 to 2.17	NS	NS	− 2.76 to 1.16	NS	NS	− 1.64 to 1.70	NS	NS	− 1.20 to 2.00
Margarines	− 1.26	0.00	− 1.89 to − 0.63	1.28	0.00	0.76 to 1.79	− 1.00	0.00	− 1.55 to − 0.44	− 0.52	0.03	− 0.99 to − 0.04	− 1.24	0.00	− 1.70 to − 0.78
Alcoholic drinks	− 0.52	0.02	− 0.97 to − 0.08	− 0.39	0.03	− 0.75 to − 0.03	− 0.66	0.00	− 1.05 to − 0.26	− 0.36	0.03	− 0.69 to − 0.03	NS	NS	− 0.23 to 0.41
Fast food meals	1.63	0.00	1.18 to 2.08	1.30	0.00	0.93 to 1.67	1.04	0.00	0.64 to 1.44	NS	NS	− 0.20 to 0.48	0.35	0.04	0.02 to 0.68

β, linear regression coefficient; p, p value; NS, statistically non-significant

half of the UPF ads, including the use of non-sports celebrities, cartoon/company-owned character, reference to sport events or messages implying that the product was made for children.

Five advertising patterns were identified in the present study, contributing to a better understanding of the main strategies applied by food advertisers to promote unhealthy products. Each advertising pattern showed positive and negative associations with specific UPFs classified according to the NOVA classification system. As expected, the 'Distinction' pattern, characterized using 'licensed character', 'limited edition', 'gifts or collectables' and 'new brand development', was highly associated with ready-to-eat products. Interesting findings were also observed for the 'For kids' pattern, which was positively associated with ads announcing energy-dense and nutrient-poor products. Within this context, the World Health Organization (WHO) recommends that countries implement regulatory policies to reduce the exposure of children to the marketing of unhealthy foods (WHO 2012).

Globally, policy discussions relating to food marketing are focused on children rather than the adult population. Unfortunately, detailed information on age group audience is not publicly available for Brazil. However, evidence suggests that children audience follow peak viewing. Since children and adolescents in Brazil attend school part time (part at morning and part during afternoon), the high concentration of this public at home is limited to the evening. Thus, almost no shows dedicated to children are available at free-to-air channels (mostly restricted to a few hours in one channel during weekend mornings) (SBT 2018; Record 2018). As a result, a survey conducted by Kantar Media IBOPE already indicated that soap operas, series and live soccer games were the three most watched programs by the audience between 4 and 17 years old (Ibope 2014), all of which are broadcasted at peak viewing (from 7 to 12 pm) (SBT 2018; Record 2018).

Many countries already have general marketing regulations or guidance (WHO 2012). The same cross-national study mentioned in the beginning of this section (evaluating the extent and nature of marketing from twenty-two countries) also identified countries applying statutory government regulations. Five countries were highlighted: Australia, Mexico, South Africa, Thailand and the UK, with regulation implanted in Chile in 2016 after data collection. Canada (excluding Quebec), Colombia, Malaysia, New Zealand, Slovenia and Spain were self-regulated by the food industry for responsible marketing of children's food. Results showed that the frequency of exposition to inadequate food and beverages advertising [according to Europe Nutrient Profile Model (WHO 2015)] at peak times for children was significantly higher in countries with industry self-regulatory actions compared to countries with statutory government regulations (3.8 ads per hour vs 2.6) (Kelly et al. 2019). Given the scenario presented in our study, we could conclude that there is an inefficient enforcement of the existing regulations to protect consumers against unhealthy food marketing. This fact reinforces the need to measure, monitor and tackle the use of persuasive techniques in food advertising. According to Pasqualotto (2019), the creation of a multidisciplinary state regulatory body with a broad representation of civil society could be a more effective alternative to identifying and supervising irregularities (Pasqualotto 2019).

Another gap that needs to be bridged is the use of terms such as 'targeted at children' or 'aimed particularly to children' in the current regulatory legislation, which are vague and highly ambiguous. For example, we found that most of the persuasive strategies used in food advertising on Brazilian TV consisted of brand benefit claims, including 'sensory-based characteristics', 'suggested users', 'new brand development' and 'low prices'. Such tactics conveyed indirect messages not only for children but also to parents about the benefits of purchasing UPFs for their children and for adults. Therefore, further research to explore the potential effects of advertising unhealthy foods and a better understanding of their intention of purchase would help to address such gaps and to improve adherence to the current legislation (Hebden et al. 2011).

Our findings can serve as a starting point to discuss more effective actions to identify and tackle the use of misleading and persuasive marketing strategies. This identification is important because, when the use of illegal marketing strategies is detected, it can be reported for evaluation and appropriate decisions can be made. In this scenario, the Brazilian Institute for Consumers Defense (*Idec*) along with other civil society partners created the Food Advertising Observatory (OPA), a platform to receive reports and, after evaluation, forward those to the responsible agencies (IDEC 2019).

It is also important to highlight a few limitations. This study was specifically designed to obtain data on levels of food advertising on TV on both weekdays and weekend days, excluding public holidays and school holiday periods (as recommended by the INFORMAS protocol). Thus, seasonal publicity (such as Eastern related or Christmas related) is necessarily and intentionally excluded. In addition, the study was conducted in just one month of the year, once again artificially restricting seasonal influence over the results. Anyway, we believe that these limitations are more likely to impact the actual product advertised than the food groups in which it is inserted, with small impact at the analysis performed at the present study. Final limitation involves the fact that our sample only included free-to-air TV channels. Although these channels probably have different advertising profile when compared to pay TV, the

choice is justified by the fact that free-to-air TV is still the main source of information and entertainment in Brazil, reaching 93% of the national population, while pay TV is present in less than 25% of the households in Brazil (Ibope 2018a).

This study was able to investigate the main persuasive advertising strategies used in food and drink ads on the most popular Brazilian TV channels. The main group of persuasive tactics used by food advertisers to promote UPFs was 'brand benefit claims'. Additionally, we identified five patterns of persuasive advertising strategies associated with UPF ads, demonstrating a lack of enforcement of the current regulatory legislation in the country. Our findings contribute to discussions around the implementation of more effective actions to identify and tackle the use of misleading and persuasive marketing strategies used in Brazilian free-to-air TV, to protect consumers from misleading and abusive marketing strategies.

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Compliance with ethical standard

Conflict of interest The authors declare that they have no conflict of interest.

Ethics of human subject participation The study did not involve human subjects. Formal approval from the ethics committee is not required.

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