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RESEARCH ARTICLE

Healthiness, processing, and price discounts of foods advertised in supermarket flyers in Buenos Aires, Argentina

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ABSTRACT

Introduction: The food environment, encompassing factors such as food availability, advertising, and promotions, can significantly impact dietary choices. The main objective of this study was to characterize the profile of the advertised products in relation to the food groups defined by the Dietary Guidelines for the Argentine Population (GAPA), the degree of processing and their price discounts.

Methodology: This cross-sectional study analyzed 4,355 promotions of foods and beverages in supermarket circulars from seven supermarket chains over an 8-week period in Buenos Aires. Foods were classified into four categories based on the GAPA: 1) core food groups and water, 2) "optional" products (those to be limited), 3) alcoholic beverages, and 4) other foods. Additionally, NOVA classification was used to assess the degree and purpose of processing. The minimum purchase amount required for the discount and the unit price discount were analyzed by food group and degree of processing.

Results: Only 37.0% of advertised food products were from the core recommended food groups, while 45.3% and 11.7% were "optional/discretionary" products and alcoholic beverages. In addition, 56% of the food and non-alcoholic beverage promotions included ultra-processed (UP) products. The minimum purchase amount to obtain a discount and relative discounts were higher for "optional" products ($p<0.001$) and UP ($p<0.001$) compared to staple food groups and unprocessed or minimally processed foods, respectively.

Conclusions: Most advertisements and price promotions found in supermarket circulars were for UP and items that the GAPA recommend limiting, suggesting an environment that is conducive to promoting unhealthy eating behaviors.

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Propiedades saludables, procesamiento y descuento de precios de los alimentos anunciados en los volantes de supermercados en Buenos Aires, Argentina

PALABRAS CLAVE

Supermercados;

Alimentos y Bebidas;

Alimentos Procesados;

Mercadotecnia.

RESUMEN

Introducción: El ambiente alimentario, que abarca factores como la disponibilidad, publicidad y ofertas de alimentos puede influir significativamente sobre las elecciones alimentarias. El objetivo principal de este estudio fue caracterizar el perfil de los productos publicitados en relación con los grupos de alimentos definidos en las Guías Alimentarias para la Población Argentina (GAPA), el grado de procesamiento y sus descuentos en el precio.

Metodología: Este estudio transversal analizó 4.355 promociones de alimentos y bebidas en circulares de supermercados de siete cadenas de supermercados durante un período de 8 semanas en Buenos Aires. Los alimentos se clasificaron en cuatro categorías basadas en el GAPA: 1) grupos de alimentos básicos y agua, 2) productos "opcionales/discrecionales" (aquellos a limitar), 3) bebidas alcohólicas y 4) otros alimentos. Además, la clasificación NOVA se utilizó para evaluar el grado y la finalidad del procesamiento. La cantidad mínima de compra requerida para el descuento y el descuento en el precio unitario se analizaron por grupo de alimentos y grado de grado de procesamiento.

Resultados: Solo el 37% de los productos alimenticios anunciados pertenecía a los grupos de alimentos básicos recomendados, mientras que el 45,3% y 11,7% eran productos "opcionales/discrecionales" y bebidas alcohólicas. Además, el 56% de las promociones de alimentos y bebidas no alcohólicas incluían productos ultraprocesados (UP). La cantidad mínima de compra para obtener un descuento y los descuentos relativos fueron mayores para los productos "opcionales/discrecionales" ($p<0,001$) y los UP ($p<0,001$) en comparación con los grupos de alimentos básicos y los alimentos no procesados o mínimamente procesados, respectivamente.

Conclusiones: La mayoría de los anuncios y promociones de precios en los volantes eran para productos que las GAPA recomiendan limitar y UP, sugiriendo un entorno tendiente a promover conductas de alimentación poco saludable.

Financiación: International Development Research Center (IDRC; grant Number IDRC 108643-001).

KEY MESSAGES

1. Only 37.0% of advertised food products were from the core recommended food groups, while 45.3% and 11.7% were "optional/discretionary" products and alcoholic beverages. In addition, 56% of the food and non-alcoholic beverage promotions included ultra-processed products.
2. Minimum purchase amounts and relative discounts were higher for "optional/discretionary" products and ultra-processed foods, further highlighting the promotion of unhealthy eating behaviors in the food retail environment.
3. Improving the food environment is crucial to promote healthy eating habits. As Argentina is currently implementing a Healthy Eating Law, the findings presented in this study can serve as a baseline for future data comparison.

CITATION

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INTRODUCTION

Suboptimal diet is a leading contributor to poor health[1], increasing the risk of obesity and chronic conditions[2]. Argentina has high rates of adult and childhood obesity, with chronic diseases being the main cause of death, and diets distant from being healthful[3,4]. Similar to other Latin America countries[5], recent cultural changes and modifications in food accessibility and environments have led to a shift in the Argentine diet, with current patterns characterized by low consumption of some fresh foods such as fruits, vegetables, legumes, whole grains, and fish at all ages, and high consumption of bread and refined cereal products, red and processed meats, sugar-sweetened beverages, and confectionery among others[3]. The Dietary Guidelines for the Argentine Population (GAPA), updated in 2016 by the National Ministry of Health with the support of an interdisciplinary panel of experts who had to declare their potential conflicts of interest, represent a useful instrument for enhancing public health nutrition in the country. The GAPA, and their related documents encourage the daily intake of water and foods from five essential core groups, while cautioning against the consumption of a group of foods called "optional" –in the mean of discretionary–, which includes products with excess amounts of critical nutrient such as sodium, fat or added sugars[6].

In addition, the GAPA recommend choosing fresh or minimally processed foods, moderating the consumption of processed foods, and limiting or avoiding the consumption of alcoholic beverages and ultra-processed foods (UPF), which have been related to the risk of obesity, diabetes, hypertension, dyslipidemia, cardiovascular diseases, and all-cause mortality[7].

Food retail environments can impact food choices and are potential settings for interventions[8]. Research conducted in supermarkets in Buenos Aires has shown that the availability of healthy foods, measured as shelf space, was overcome largely by unhealthy products[9]. In addition to product availability, retail marketing activities may have a major influence on consumer food choices and food purchases[10]. A recent survey conducted in Latin American supermarkets highlighted the importance of circulars, prices and promotions shaping the adults purchasing behaviors in food retails[11]. In Buenos Aires and other cities in Argentina, the periodic supermarket circulars inform the promotions and temporary offers existing during certain periods (e.g., a week or a fortnight). They are available online on supermarket web pages and paper-based on the supermarket premises. Sometimes, they are also distributed paper-based with newspapers, and some of the promotions published in circulars are promoted on TV and social media. Econometric research findings using sales data indicate that sales promotions and temporary price discounting may influence consumption patterns by influencing the purchasing choices of consumers and encouraging them to eat more[12,13]. This is particularly relevant in Argentina and the region, where the cost of food is a significant concern, especially for lower-income populations who are more price-sensitive when making food choices[14,15].

Analyzing promotional flyers has been proposed for characterizing the food retail environment[16]. Previous research from countries outside of Southern Latin America (SLA) has found a range of healthy and unhealthy foods advertised in promotional flyers from supermarkets[17–25], with a few studies also examining the degree of food processing of those products[22–25]. In addition, little research from Europe comparing traditional and discount supermarkets has shown that discounters promotes a higher proportion of unhealthy products and UPF, had lower discount levels and lower minimum purchase amounts[19,22]. To our knowledge, there have been no published studies in SLA that analyze the healthiness, level of processing, and price promotions of the foods advertised in supermarket promotional flyers.

In addition, Argentina has recently passed the Law No. 27,642 to promote healthy eating. The law is currently being implemented, establishing the incorporation of warnings on the front-of-package (FOP) of containers, as well as regulations on marketing, promotion, sponsorship, and the availability of products high in sugars, fats, and sodium in schools[26]. In August 2022 marketing and promotion were regulated, which will be implemented after the FOP warnings are incorporated. Thus, analyzing the promotional flyers can be useful as a snapshot before the law, against which comparisons can be made after its full implementation.

Thus, this study aimed to investigate the groups and processing degree of foods advertised by supermarket chains in Buenos Aires City, to assess whether promotional flyers were promoting diets in agreement with the GAPA. Secondary objectives were a) to study the magnitude of discounts declared in those advertisements and the minimum purchase amount to obtain the discount by food group category and grade of processing, and b) to assess differences by type of supermarket (traditional vs. discount supermarkets), across supermarket chains, and between cover and inner pages.

METHODOLOGY

Study design and sample. This cross-sectional study was conducted in the seven supermarket chains that are in Buenos

Aires City (Carrefour, Día, Coto, Walmart, Jumbo, Disco, and Vea). One of the chains included in the study is a discount supermarket –Día–, which offers lower prices than the typical market value. The city has over 800 supermarket stores, representing 30% of all country's supermarket stores[27]. Each chain has the same circulars for every location in the city. Data were collected over eight weeks, from August to September 2018.

Procedures and Measures. Trained research personnel extracted and coded each promotion, which was then reviewed by a dietitian. Advertised items were initially classified as either food or non-food items. For food items, the variables of interest included the food group, degree of food processing, price discount, and minimum purchase amount (MPA) required to obtain the discount, as defined below. Additionally, it were recorded the supermarket chain, type of supermarket (traditional/discount), and page type (cover/inner), based on the Store Food Availability-Supermarket protocol proposed by the International Network for Food and Obesity / Non-communicable Diseases (NCDs) Research, Monitoring and Action Support (INFORMAS)[16].

Food groups. Food items were classified into four categories based on the GAPA and related materials[6,28]: a) Core food groups (foods and beverages recommended for daily consumption), b) "optional/discretional" group (foods and beverages categories that should be limited or avoided in a healthy diet), c) alcoholic beverages and, d) other products (not classified in any other category). The list of food groups and food items is shown in Supplementary Material (Table S1). Additionally, the frequency of promotions for junk (optional/discretionary food group) and fresh foods (fruit and vegetables, and meat and fish) from food and non-alcoholic beverages items were calculated based on the INFORMAS protocol16 (Supplementary Material, Table S2).

Degree of food processing. Foods and non-alcoholic beverages items were classified into four categories: 1) Unprocessed and minimally processed foods, 2) Processed culinary ingredients, 3) Processed foods, and 4) Ultra-processed foods (UPF), based on the NOVA food processing classification system[29].

Minimum purchase amount and price discount. For each promotion, it was registered the MPA needed to receive the advertised price discount. When data were available, the price discount was expressed as a percentage of the original price, per unit. The discount percentage declared in the circulars was recorded or calculated based on the original and the offer prices declared. In multi-buy promotions, that require buying more than one unit of the same or different product, the discount per unit was calculated (e.g., "70% discount in the second unit" was extracted as 35% discount per unit).

Data analysis. The proportion of promotions of each food group and food processing category, as well as the mean MPA and mean price discount (MPD) were described overall and by type of flyer page, supermarket type, and supermarket chain. The ratio of proportions between core and "optional/discretional" foods was calculated to allow comparisons with other studies[17]. Ninety-five percent confidence intervals (95%CI) were calculated. Chi-square tests were used to explore differences in proportions for each category by page type (cover vs. inner pages), supermarket type (traditional vs. discounter), and across supermarket chain. The differences in the MPA and magnitude of price discounts between promotions in food categories based on food groups and food processing were evaluated by simple linear regression analysis. A p-value <0.05 was considered statistically significant. The analyses were conducted using Stata/SE 12.0 for Windows (Stata Corp LP, College Station, TX, USA, 2011).

RESULTS

During the research period, 5,603 promotions were advertised in supermarket flyers and 4,355 involved food products.

Food group categories and food processing. Overall, only 37.0% of the promotions included core food groups and water. Among them "bean, cereal, potato and other starchy vegetables, bread and pasta" were the most frequently advertised, while the groups "fruits and vegetables", "vegetable oils, nut and seeds" and "water" the least promoted (Table 1). The ratio of core to optional food groups was 0.82. The INFORMAS indicators show that out of 3,829 advertisements, only 3.2% included fresh fruits and vegetables, 6.2% fresh meat and fish, while 48.7% promoted junk food. More than half of the promoted products (56.4%) were UPF. Table 2 displays the proportion of promotions according to food processing categories by food groups. More than 80% of the promotions for the core food groups and the category "other" were for NOVA's categories 1, 2 and 3. In contrast, 94.7% of the promotions of products from the "optional" group corresponded to UPF. All junk foods, as defined by INFORMAS, were UPF.

Mean price discount and minimum purchase amounts. The MPA ranged from 1 to 12 and 41.9% of promotions were multi-buy offers. The average MPA was of 1.62 units and the mean discount per unit of 28.4% (Table 3). When considering "core food groups" as the reference category, promotions for "optional" food products and alcoholic beverages required a higher MPA and offered a slightly higher mean discount. Promotions for junk food required a higher MPA on average but offered a higher MPD compared to non-junk food promotions. Additionally,

Table 1. Proportion of promotions dedicated to food categories and degree of food processing, in cover and inner pages and by type of supermarket in promotional flyers of seven supermarket chains in Buenos Aires City (n=4,355).

		Pages		Type of supermarket	
	Overall	**Cover**	**Inner**	**Traditional**	**Discounter**
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Food Groups Based on Argentine Dietary Guidelines					
Core Food Groups	37.0 (35.6; 38.4)	39.6 (37.3; 41.8)	35.3 (33.4; 37.1)	36.8 (35.2; 38.3)	39.1 (34.7; 43.5)
Fruits & Vegetables	5.1 (4.4; 5.7)	6.5 (5.3; 7.7)	4.1 (3.4; 4.9)	4.6 (4.0; 5.3)	8.7 (6.1; 11.2)
Beans, cereal, potato and other starchy vegetables, bread and pasta	10.9 (10.0; 11.9)	10.6 (9.1; 12.0)	11.2 (10.0; 12.4)	11.0 (10.0; 12.0)	10.6 (7.8; 13.3)
Milk, yogurt & cheese	9.3 (8.4; 10.1)	10.3 (8.9; 11.7)	8.6 (7.5; 9.7)	9.4 (8.5; 10.3)	8.5 (6.0; 11.0)
Meats and eggs	8.1 (7.3; 8.9)	8.9 (7.6; 10.2)	7.5 (6.4; 8.5)	8.3 (7.4; 9.1)	6.3 (4.1; 8.5)
Vegetable oils, nuts and seeds	1.8 (1.4; 2.2)	1.3 (0.8; 1.9)	2.1 (1.5; 2.7)	1.7 (1.3; 2.1)	2.7 (1.3; 4.2)
Water	1.9 (1.5; 2.3)	2.0 (1.3; 2.6)	1.8 (1.3; 2.3)	1.8 (1.4; 2.2)	2.3 (1.0; 3.7)
Optional, discretionary food groups	45.3 (43.8; 46.7)	45.7 (43.4 ;48.0)	45.0 (43.0; 46.9)	45.2 (43.6 ;46.8)	45.7 (41.2; 50.2)
Alcoholic beverages	11.7 (10.8; 12.7)	10.2 (8.8; 11.6)	12.8 (11.5; 14.1)	11.9 (10.9; 11.9)	10.1 (7.4; 12.9)
Other products[1]	6.0 (5.3; 6.7)	4.5 (3.6; 5.5)	7.0 (6.0; 8.0)	6.1(5.4; 6.9)	5.1 (3.1; 7.1)
Ratio core: optional/discretionary foods	0,82	0,87	0,78	0,81	0,87
Indicators based on INFORMAS[2] (n=3,829)					
Junk-food promotions	48.7 (47.1; 50.3)	48.8 (46.3; 51.2)	48.7 (46.6; 50.7)	48.8 (47.1; 50.4)	48.6 (43.8; 53.3)
Fresh fruits and vegetables	3.2 (2.6; 3.7)	4.6 (3.5; 5.6)	2.2 (1.5; 2.8)	2.7 (2.2; 3.2)	6.8 (4.4; 9.2)
Fresh meats and fish	6.2 (5.5; 7.0)	6.1 (5.0; 7.3)	6.3 (5.3; 7.3)	6.4 (5.6; 7.3)	4.7 (2.7; 6.7)
Based on Food processing (NOVA)[3] (n=3,844)					
Unprocessed or minimally processed foods	26.8 (25.4; 28.2)	28.0 (25.6; 30.0)	26.1 (24.3; 27.9)	27.1 (25.7; 28.6)	24.2 (20.1; 28.3)
Processed culinary ingredients	3.3 (2.7; 3.8)	2.4 (1.6; 3.1)	3.9 (3.1; 4.7)	2.9 (2.4; 3.5)	6.1 (3.8; 8.4)
Processed foods	13.5 (12.4; 14.6)	13.3 (11.6; 15.0)	13.6 (12.2; 15.0)	13.7 (12.5; 14.8)	11.8 (8.7; 14.8)
Ultra-processed foods	56.4 (54.9; 58.0)	56.5 (54.1; 59.0)	56.4 (54.3; 58.4)	56.2 (54.6; 57.9)	57.9 (53.2; 62.6)

95%CI: 95% Confidence interval; **SE:** Standard error.

[1] Products that could not be classified into any other category (e.g., infusions, infant food).

[2] The analysis excluded the following items: alcohol, baby food (baby formula and other baby foods), supplements and meal replacements (and related products).

[3] The analysis excluded alcoholic beverages.

promotions for processed culinary ingredients presented lower MPA and price discount, while those for UPF showed higher mean MPA and price discount, as compared to promotions of unprocessed or minimally processed foods. The results were similar after adjusting by the type of supermarket and the type of page (Table S3).

Comparisons between cover and inner pages, types of supermarket and across supermarket chains. The proportion of promotions for core food groups was slightly higher on the cover than on inner pages, whereas the opposite was true for the categories "alcoholic beverages" and "other" (p<0.001). Fresh fruits and vegetables were more frequently promoted on

Table 2. Proportion of promotions according to food processing categories by food groups in flyers of seven supermarket chains in Buenos Aires City (n=3,844).

Category	Food processing[3]			
	Unprocessed or minimally processed foods	**Processed culinary ingredients**	**Processed foods**	**Ultra-processed foods**
	% (95%CI)	% (95%CI)	% (95%CI)	% (95%CI)
Food Groups based on Argentine Dietary Guidelines				
Core Food Groups	51.9 (49.4; 54.3)	4.2 (3.2; 5.2)	28.2 (26.0; 30.4)	15.7 (13.9; 17.5)
Fruits & Vegetables	70.1 (64.8; 76.2)	-	29.4 (23.4; 35.4)	0.1 (13.9; 17.5)
Beans, cereal, potato and other starchy vegetables, bread and pasta	52.1 (47.6; 56.6)	0.8 (0.0; 1.7)	28.6 (24.5; 32.6)	18.5 (15.0; 22.0)
Milk, yogurt & cheese	14.4 (10.9; 17.8)	-	51.0 (46.1; 55.9)	36.7 (30.0; 39.3)
Meats and eggs	79.8 (75.6; 84.0)	-	13.7 (10.1; 17.3)	6.6 (4.0; 9.1)
Vegetable oils, nuts, and seeds	18.0 (9.4; 26.5)	82.1 (73.5; 90.6)	-	-
Water	100	-	-	-
Optional/Discretionary foods	-	2.1 (1.4; 2.7)	3.2 (2.4; 4.0)	94.7 (93.7; 95.7)
Other products [1]	74.3 (69.0; 79.6)	6.5 (3.5; 9.5)	-	19.2 (14.4; 23.9)
Indicators based on INFORMAS[2] (n=3,829)				
Junk-food promotions	-	-	-	100
Fresh fruits and vegetables	100	-	-	-
Fresh meats and fish	100	-	-	-

[1] Products that could not be classified into any other category (e.g., infusions, infant food).

[2] The analysis excluded the following items: alcohol, baby food (baby formula and other baby foods), supplements and meal replacements (and related products).

[3] The analysis excluded alcoholic beverages.

the cover than on inner pages (p<0.001), but little differences were found in the proportion of promotions by food processing categories between cover and inner pages (p=0.047). Both the average MPA and the magnitude of the price discount, were higher on the cover than on inner pages (Table 4).

In comparison to traditional supermarkets, the discounter showed a similar proportion of promotions by food categories based on the GAPA (p = 0.469), a higher proportion of promotions dedicated to fresh fruit and vegetables (p=0.007), lower price discount levels, and lower MPA (Table 4).

There were differences on promoted food categories across supermarket chains (p<0.001). The proportion of advertisements for core food groups and water varied from 30.1% to 39.4%, optional food products from 39.1% to 54.4%, alcoholic beverages from 6.7% to 14.5%, and "other" from 4.0% to 9.7%. The mean ratio of core/optional food groups varied from 0.55 to 1.00. Additionally, there were differences in the proportion of advertisements for junk foods (from 42.8% to 59.9%, p<0.001), fresh fruit and vegetables (from 0.6% to 4.0%, p<0.001) and fresh meats and fish (from 0.5% to 10.7%, p<0.001). The degree of food processing in promotions also differed across supermarket chains (p<0.001). Promotions for NOVA categories 1, 2, 3 and 4 ranged between 21.9% and 33.0%, 1.1% and 6.5%, 8.5% and 18.3%, and 50.0% and 65.9%, respectively. In addition, there were differences in the mean MPA (from 1.22 to 1.87 units, p<0.001) and the MPD (from 25.2% to 39.1%, p < 0.001) across supermarket chains.

Table 3. Mean minimum purchase amount and price discount level by food categories and food processing categories in promotional flyers of seven supermarket chains in Buenos Aires City.

Food categories / Food Groups	Minimum purchase amount (units)				Price discount level (%)[4]			
	Mean	b	SE	p-value	Mean	b	SE	p-value
Overall								
n	4,355				4,080			
	1.62		-0.02		28,4		-0,14	
Based on Argentine Dietary Guidelines								
n	4,355				4,080			
Core Food Groups	1.43	Ref.	0.02	-	27.4	Ref.	0.24	-
Optional / Discretionary foods	1.8	0.37	0.03	<0.001	29.2	1.88	0.32	<0.001
Alcoholic beverages	1.63	0.20	0.05	<0.001	28.6	1.21	0.48	0.011
Other products[1]	1.44	0.01	0.07	0.825	27.4	0.05	0.62	0.993
Indicators based on INFORMAS[2]								
n	3,829				3,584			
Non-junk-food promotions	1.43	Ref.	0.02	-	27.3	Ref.	0.22	-
Junk-food promotions	1.82	0.39	0.03	<0.001	29.4	2.16	0.31	<0.001
Other products (non-fresh fruits and vegetables)	1.64	Ref.	0.16	-	28.5	Ref.	0.15	-
Fresh fruits and vegetables	1.01	-0.63	0.09	<0.001	24.3	-4.19	-0.89	<0.001
Non-fresh meats and fish	1.66	Ref.	0.17	-	28.5	Ref.	0.16	-
Fresh meats and fish	1.08	-0.57	0.07	<0.001	26.0	-2.52	0.66	<0.001
Based on Food processing (NOVA)[3]								
n	3,844				3,599			
Unprocessed or minimally processed foods	1.38	Ref.	0.03	-	27,1	Ref.	0.30	-
Processed culinary ingredients	1.17	-0.21	0.09	0.023	23.8	-3.28	0.90	<0.001
Processed foods	1.38	-0.00	0.05	1.000	26.6	-0.48	0.51	0.350
Ultra-processed foods	1.82	0.44	0.04	<0.001	29.6	2.48	0.36	<0.001

Ref.: category of reference in the simple linear regression model; **b:** Coefficient; **SE:** Standard error.

[1] Products that could not be classified into any other category (e.g., infusions, infant food).

[2] The analysis excluded the following items: alcohol, baby food (baby formula and other baby foods), supplements and meal replacements (and related products).

[3] The analysis excluded alcoholic beverages.

[4] The sample size is smaller than the original due to non-available data (the price was reported, but not the magnitude of the discount nor the original price).

DISCUSSION

To our knowledge, this is the first study of its kind to analyze supermarket circular's data in a city in SLA and one of the first to examine the degree of food processing of the advertised products. The analysis of promotional flyers from seven supermarket chains in Buenos Aires showed that the majority of the advertised food items were in the groups of "optional/discretionary food products" and "alcoholic beverages", as well as UPF. On average,

Table 4. Minimum purchase amount and price discount level by type of page and type of supermarket in promotional flyers of seven supermarket chains in Buenos Aires City.

	Minimum purchase amount (units) n=4,355				Price discount level (%) n=4,0801			
Variables	Mean	b	SE	p-value	Mean	b	SE	p-value
Type of page								
Inner	1.51	Ref.	0.02		25.9	Ref.	0.17	-
Cover	1.78	0.27	0.03	<0.001	32.1	6.18	0.28	<0.001
Type of supermarket								
Traditional	1.67	Ref.	0.02	-	28.7	Ref.	0.15	-
Discounter	1.23	-0.44	0.05	<0.001	25.7	-2.99	0.45	<0.001

Ref.: Category of reference in the simple linear regression model; **b:** Coefficient; **SE:** Standard error.

[1] The sample size is smaller than the original due to non-available data (the price was reported, but not the magnitude of the discount nor the original price).

price discounts and the mean MPA were higher for these majority categories than for core food groups and less processed foods, suggesting that sale flyers in supermarkets were mainly promoting the purchase of products that should be limited in a healthy diet.

Previous research conducted in North America, Europe, Asia, Australia, South Africa and Brazil, showed diverse results between foods promoted in dietary guidelines and those advertised in sale circulars[17,19–22,24]. For example, some studies reported that the ratio of core to discretionary foods in promotions was very low in retails in Hong Kong and Malaysia (0.5), ranged between 0.7 and 0.83 in Australia, South Africa, the UK, and the US[17,21], which is similar to our finding of 0.82, and ranged higher (from 1.0 to 6.3) in Canada, New Zealand, Singapore, Sweden, India, and the Philippines, even with one supermarket promoting only core food groups[17].

In contrast with our results, one study conducted in New Zealand reported that ¾ of food promotions in flyers were free of junk food, ranging from 59 to 100% among different chains[18]. Our findings shows that only 52% of promotions were dedicated to non-junk food with a range across supermarket chains between 40 and 57%.

In agreement with some of the studies[17,23], cover pages of the supermarket circulars in Buenos Aires presented a higher proportion of advertisements for the core food group category, in particular for fruit and vegetables, with fewer alcoholic beverages than in inner pages. Additionally, the finding that most of the advertised foods in supermarkets in Buenos Aires were classified as UPFs was consistent with previous studies reporting that UPFs represented more than a half of the advertised products in Belgium, the Netherlands and Brazil[18,22,24,25]. However, almost 12% of the products advertised in Buenos Aires were alcoholic beverages; which is higher than reported by studies conducted in several countries, except those from Australia, New Zealand, and the UK[17].

Our findings align with previous studies, indicating that less healthy products and UPF were promoted more often via volume-based promotions[19,22]; and the MPA was higher for the optional food group, the junk food and UPF in comparison with core food group items, non-junk foods, and unprocessed or minimally processed foods, respectively.

However, in contrast to other studies[19,22,25], we observed slightly higher price discounts per unit for optional food groups, junk foods, and UPFs in Buenos Aires. Also, our results showed that processed culinary ingredients had the lowest percentage of discount within the food processing classification categories; which is consistent with previous work conducted in Brazil[25].

Regarding the comparison by type of supermarket, interestingly, our results do not support previous research showing less healthiness of advertised products in discounters[19,22]. Instead, we found that the proportion of promotions in sales circulars including fresh fruits and vegetables and processed culinary ingredients was higher in the discounter than in traditional supermarkets. Nevertheless, our results consistently agreed with previous research about the lower magnitude of discounts and MPA in discount supermarkets than in traditional ones[19,22]. In

addition, we observed significant variation across supermarket chains, for instance, in terms of the ratio of core: discretionary food, consistent with previous research reporting differences in the relative availability of healthy vs. unhealthy foods and beverages in Buenos Aires[9], and for some of the studies in other countries[18,21,23].

Some policies to reduce the prevalence and influence of price promotions on unhealthy food and beverage price promotions are promising to improve diets across the populations[30] and further studies should be conducted to assess their implementation and results. In Argentina, the law 27,642 is being implemented to regulate front-of-package labeling, advertising, promotion, sponsorship of unhealthy food products, and other actions of promotion of the healthy eating. Our study allows valuable insights into how much healthy and unhealthy products were promoted by promotional flyers in this type of food retails before the regulation approval. We think that this work can be applied to inform the design of interventions oriented to promote healthy choices and develop educational materials targeting consumers that usually buy foods at supermarkets. Furthermore, it allows comparisons in the future after the fully regulation implementation.

Strengths and limitations: The study has several strengths, including a comprehensive collection of data from the seven major supermarket chains located in Buenos Aires, representing diverse consumer profiles, and both traditional and discount supermarkets. Another strength is that the study analyzed data from both cover and inner pages of the circular to prevent underestimation of promotions dedicated to less healthy foods[17]. Additionally, the study used indicators recommended by INFORMAS and the NOVA classification, which allows for standardized comparisons with other locations.

However, the study also has some limitations. Firstly, the seasonality of promotions may potentially influence the advertised food groups, and the eight-week data collection period may not be representative of the entire year. Nevertheless, other research has shown little variation in the frequency of advertised food groups by season throughout year[20,31], and our research did not include data from festive occasions in Argentina (e.g., Christmas, Valentin's Day, Easter, and the "Sweet Week"), which typically feature temporary promotions of products like pastries, chocolate, and confectionery. Secondly, the study did not adjust for the commercial brand when assessing the magnitude of price discounts.

CONCLUSIONS

While the GAPA recommend daily consumption of five core groups and water, with a preference for minimally processed foods, and limiting or avoiding the discretionary foods and alcohol, the content analysis of promotional flyers from seven supermarket chains in Buenos Aires city found that more than half of the promotions were for discretionary foods, alcohol, and UPFs. Additionally, promotions for these unhealthy products often presented a slightly higher price discount. They also required consumers to buy more units to receive the discount, which could incentivize the purchase of even more unhealthy products. Inner pages: The discounter showed a higher proportion of promotions dedicated to fresh fruit and vegetables, lower price discount levels, and lower minimum purchase amount. Advertised food groups, the minimum purchase amount and price discounts also differ between cover and inner pages, and across supermarket chains. These findings highlight the need for interventions to improve the nutrition environment in general and particularly the full implementation of the Argentine Law 27,462 regulating this channel. This study also provides a baseline to compare data after its complete implementation.

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AUTHORS' CONTRIBUTIONS

N.E. contributed to the creation and design of the study, coordination of the field work, data analysis, interpretation and writing of first and subsequent drafts of the paper. A.S.C. contributed to the data analysis, interpretation and writing of the first draft. D.L.M. contributed to the design, data collection and supervision of the field work. V.T. and M.F. contributed to data collection and data extraction. V.I. contributed to the creation and design of the study. All authors critically reviewed this and previous versions of the paper.

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COMPETING INTERESTS

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