Marketing techniques, health, and nutritional claims on processed foods and beverages before and after the implementation of mandatory front-of-package warning labels in Peru

Lorena Saavedra-Garcia*, Ximena Taboada-Ramirez, Akram Hernández-Vásquez and Francisco Diez-Canseco

CRONICAS Center of Excellence in Chronic Diseases, Universidad Peruana Cayetano Heredia, Lima, Peru

In June 2019, mandatory front-of-package warning labels (FOPL) were implemented in Peru. The aim of the study was to describe changes in marketing strategies on packaging: marketing techniques (MT), health claims (HC), and nutritional claims (NC) on the packaging of products frequently consumed by children before and after the FOPL implementation. Product photos were taken pre- (March 2019) and post-implementation (March-October 2020) in three supermarkets in Lima, Peru. Following INFORMAS protocols and Peruvian Technical Norms, the presence of MT, HC, and NC was assessed on all package sides. Products were classified as "high-in" and "not high-in" based on the regulation threshold for critical nutrients. Differences in the proportion of products with each strategy in both periods were evaluated. Also, a subsample of products was matched according to the barcode and exact McNemar test was used to compare proportions of strategies pre/post-implementation. We included 883 and 1,035 products in pre- and post-implementation, respectively. In both periods, MT appeared on almost 70% of all products. The presence of HC increased significantly only for beverages (24.5–38.1%, \( p < 0.001 \)). In both phases, NC were commonly used on beverages (>80%). Overall, the prevalence of "high-in" products using MT increased (73.6–82.1%, \( p = 0.007 \)), while use of HC increased among "not high-in" products (32.9–41.6%, \( p < 0.001 \)). There is a high frequency of
MT on all products and NC on beverages. The increase in MT in “high-in” products may be an industry response to minimize the impact of the FOPL on food choices and sales. New regulatory aspects regarding labeling should be implemented to strengthen the current policy.

**KEYWORDS**
food marketing, front-of-package warning labels, marketing techniques, health claims, nutritional claims, Peru

---

**Introduction**

Worldwide, traditional dietary patterns are being replaced by unhealthy patterns, characterized by the consumption of ultra-processed food, driven by food marketing strategies, and other factors (1). Marketing and other strategies used by the food industry have been effective in making ultra-processed food sales grow exponentially and consequently, increasing their consumption. This rise has been associated with an increase in obesity, higher waist circumference, lower levels of high-density lipoprotein (HDL) cholesterol, and more negative health effects such as metabolic, cardiovascular, and cerebrovascular diseases (2, 3). According to the Pan American Health Organization, Peru has the highest growth in per capita sales of ultra-processed food in Latin America, increasing from 179 kcal per capita/day in 2009 to 207 kcal per capita/day in 2014 (4).

Food and beverage packaging is commonly used for marketing purposes. Marketing techniques such as cartoons, games, and gifts (i.e., toys) (5) as well as claims (affirmations regarding properties or benefits about the product or ingredients) are often used to influence consumers’ food choices (6). Children are especially vulnerable to such techniques because of their inability to distinguish marketing from other content (7), and susceptibility to marketing and peer perceptions, which influences their food perception and choices (8). For instance, children tend to perceive products that include cartoons as more fun than those without cartoons and to like those with cartoons better (5, 9). Moreover, children show higher taste preferences for food packaging with the presence of characters, granting this marketing technique a positive influence over their purchase intentions (10). On the other hand, adults are more influenced by information cues on the package (8), and the evidence shows that parents tend to assess the healthfulness of a product based on nutritional claims (11). Unfortunately, marketing strategies in food and beverage packaging are more frequently used for promoting energy-dense and nutrient-poor foods than nutrient-dense ones (12); for instance, cartoons are more prevalent on products with a less healthy nutritional profile (13–15). In addition, the presence of health and nutritional claims can create a “health halo” effect when consumers generalize the benefit claimed to the overall healthfulness of the product (16), like fruit drinks that claim to have no artificial sweeteners or to be 100% natural, but contain high amounts of sugar, which often misleads parents to choose products that appear to be healthy for their children, when objectively they are not (17).

In response to the potentially negative impact of food industry marketing on the population’s diets and health, some countries have linked food and beverage marketing regulations to mandatory “front-of-package warning labels” (FOPL) requirements for products “high-in” nutrients of concern, such as sugar, saturated fat, and sodium. In 2012, Chile banned child-directed prices and advertising attractive to children under 14 years old on products “high-in” energy and nutrients of concern (18). After this policy’s implementation, a reduction in child-directed advertising strategies was seen on cereal products, decreasing from 36 to 21% (19). More recently, Mexico (20) and Argentina (21) passed similar policies, banning the use of cartoons and games in products that have FOPL. Additionally, Argentina restricted the use of health and nutritional claims on products carrying a FOPL (21).

In 2013, the Peruvian Government passed the “Law of Promotion of Healthy Eating for Children and Adolescents” (Law 30021) (22). According to the Law, products that exceed specific thresholds for nutrients of concern such as sugar, saturated fat, or sodium, or contain trans-fat, must carry a black octagon-shaped FOPL with the phrase “high-in” (sugar/saturated fat/sodium) or “contains trans-fats”, accompanied by the message “avoid excessive consumption” or “avoid its consumption”, respectively, on the packaging and all types of advertisements about them (e.g., tv, social media, radio). The thresholds established by the law are being implemented in two phases; the first phase became effective in June 2019 and the second phase in September 2021 (Supplementary Table 1, 23). Although the law includes some regulations focused on food advertising (e.g., prohibiting claims about improving physical strength or popularity, or suggesting parents will be more intelligent if they purchase the product), it does not extend...
to banning marketing techniques and health and nutritional claims on packaging.

The introduction of mandatory FOPL in the Peruvian market requires many processed products to carry them, which may potentially decrease sales of some foods and beverages, and could potentially motivate the food industry to use different marketing strategies to promote their products. Given that Peruvian Law does not ban marketing techniques, or health, and nutritional claims, we hypothesized that the Peruvian food industry may change the type or frequency of marketing strategies on food and beverage packaging, especially on products that will carry a FOPL, in order to maintain their sales. This study aims to identify and describe the changes in marketing techniques, health, and nutritional claims in the packaging of food and non-alcoholic beverages after the implementation of the FOPL in Peru, and to evaluate those differences according to the nutritional quality of the products (“high-in” or “not high-in”). Findings will may inform advocates and policymakers about the strategies frequently used by industry that could negatively affect the achievement of the FOPL policy objective.

Materials and methods

Study design and setting

We compared data from two cross-sectional collections (before and after the implementation of the FOPL policy) from processed products sold in supermarkets in Lima, the capital city of Peru. Additionally, a subsample of products was matched according to the barcode that allowed a pre/post-implementation analysis. For the pre-implementation period, we collected pictures of all the available packaged foods and non-alcoholic beverages in three supermarkets, between March and April 2019, 3 months before the implementation of the FOPL policy. The three supermarkets had a nationwide presence and each one targeted different socioeconomic levels of the population (high, medium, and low). In the post-implementation period, our team went back to the same stores between March and October 2020 to carry out the post-implementation data collection.

Outcome variables

The outcomes of interest in this study were the pre- and post-implementation differences in the proportion of products using the following marketing strategies on packaging: (i) nine marketing techniques, based on the INFORMAS (International Network for Food and Obesity / Non-communicable Diseases Research, Monitoring and Action Support) protocol (24), and (ii) four health, and (iii) four nutritional claims adapted from the Peruvian Technical Norms for food claims (25), a document that establishes features from products and services. These 17 variables, their definitions, and examples of each can be found in Table 1. Of the 17 marketing strategies, only gifts are prohibited in advertisements of products directed to children less than 16 years old (22).

Moreover, the status of products according to the FOPL policy ("high-in" and "not high-in") was assessed based on the parameters of Peruvian Law No. 30021 (Supplementary Table 1).

Food and beverages sample

Photographs of all sides of each product sold in the supermarkets were taken by trained nutritionists. After each round of data collection, quality control for every photo was conducted to verify that the text and images were clear. If not, new photographs were taken. Then, the label data from the pictures were recorded in the REDCap database hosted at the University of North Carolina at Chapel Hill (26). Product name, brand, weight, container, and nutritional composition per portion or per 100 g or 100 mL were entered in the database.

For this study, we selected the eight categories of foods and beverages most consumed by children and adolescents (5, 27, 28; Supplementary Table 2):

(a) Beverages: (i) nectars, (ii) flavored drinks ("refrescos"), (iii) carbonated drinks, and (iv) dairy drinks.
(b) Foods: (i) bakery products, (ii) breakfast cereals, (iii) desserts, and (iv) snacks.

The selected categories included data from a total of 1,153 processed products collected before the implementation (in 2019) and 1,238 after the implementation (in 2020). If a product had two or more packaging types, only the smallest one was selected, considering that these are frequently directed to children and offered at school cafeterias and kiosks. As a result, 270 and 203 products were excluded in 2019 and 2020, respectively. Finally, we evaluate the use of marketing techniques and health and nutritional claims on 883 products in 2019 and 1,035 in 2020.

To determine the status of products according to the FOPL policy, it was necessary to evaluate the nutritional composition. Products without a nutrition facts panel were excluded and multipacks with more than one nutrition facts panel were excluded (179 in 2019 and 203 in 2020). Also, products requiring reconstitution were excluded from this analysis (126 in 2019 and 102 in 2020) because many packages did not provide preparation instructions or exact amounts of added ingredients, or the weight or portion size of the prepared product were not available.

To identify inconsistencies, the Atwater System calculation was used to check the total energy declared in the label with the sum of energy provided by each macronutrient using Atwater’s constants (i.e., fats = 9 kcal/g, proteins = 4 kcal/g, carbohydrates = 4 kcal/g). This validation was applied to
### TABLE 1 Variables: Marketing strategies assessed.

| Marketing strategy on packaging | Description | Examples |
|---------------------------------|-------------|----------|
| **Marketing techniques**        |             |          |
| Characters                       | Images, photographs, drawings, and caricatures of real or fictional characters | Cartoons, athletes, celebrities, images, or photos from boys and girls < 18 years |
| Sports                          | Any character playing sports, an invitation for sports events or event sponsorship, presence of any object that refers to a sport | Children playing sports, a logo indicating the brand sponsors a team |
| Donations                       | Products whose packaging shows messages from public welfare organizations | The brand’s charitable foundation |
| Price                           | Promotions referring to the price | Messages such as “get more for less,” an additional percentage of the product, discount coupons, and low price |
| Gifts                           | Packaging includes the free delivery of an object with the purchase of the product | Chocolate eggs with a surprise, toys, or stickers inside the package |
| Contests                        | Packaging announces that the consumer can access a contest, redemption, raffle, or similar competitions through an additional action after the product purchase | Scan the QR code on the box to participate or subscribe to a contest for a trip |
| Logos                           | The packaging contains a food system labeling or an endorsement logo of a certain scientific society | GDA logo, the logo with the approval of the Dietician’s Society |
| Lifestyles                      | Motivational phrases, advice, and tips in the packaging to lead a healthy lifestyle | Messages promoting a healthy lifestyle such as “It is good to exercise” |
| Marketing directed to children  | Packaging intended to appeal to children | Games, playful products, products shapes, messages related to fun, fonts, or graphics allusive to fun, special lines such as “mini” |
| **Health claims**               |             |          |
| Nutrient message and function   | Messages that describe and focus on the physiological role of a nutrient in growth, development, normal functions, or biological activities of the body, and not on disease reduction. The message must include the nutrient plus the specific function | “Mixture of malt with vitamins and minerals that help the release of energy, muscular function, and maintenance of bones,” or “With probiotics and fiber that help you regulate your intestinal transit” |
| Disease risk reduction message  | Messages that emphasize the relationship between a specific food consumption (without specifying a particular nutrient or ingredient) and reducing the risk of developing a disease | “Can Help Lower Cholesterol as part of a Heart Healthy Diet” |
| General health message          | Messages associated with specific food consumption (without specifying a particular nutrient or ingredient) with general health benefits | “Brings you energy” |
| Fantasy terms                   | Invented words that refer to the product’s nutritional content | “Calcifem” (product enriched with calcium oriented to women) |
| **Nutritional claims**          |             |          |
| Ingredient related message      | The packaging shows messages indicating that the product contains healthy ingredients or messages that indicate the product does not contain unhealthy ingredients | “With Andean grains” and “0% artificial colors” |
| Nutritional content             | The packaging mentions a nutrient, mentions the amount of a nutrient, mentions the energy value, or mentions that the product has no specific nutrient | “With omega 3 and 9,” “0% trans-fat,” “High in dietetic fiber,” “It is a protein source,” and “Provides Calcium and Phosphorus” |
| Nutritional comparison          | Messages that compare the nutrient level or energetic value of two or more foods with terms that indicate one product has more or less of a nutrient | “95% reduced in fat, compared to a whole yogurt” |
| Non-caloric sweetener addition  | Messages that indicate the product has the addition of non-caloric sweeteners, apart from the ingredient list | “Partially sweetened with Stevia” |

All products that declared each of the three macronutrients and energy. Foods with total energy values that equaled or were within 20% of the Atwater calculation for energy were included (29). Eight products from the 2019 collection and 16 from 2020 did not comply and were excluded from the nutritional composition analysis. Total sugar was compared to total carbohydrates for each product that provided both values. Products with total sugar greater than total carbohydrates were omitted from the analysis (two in 2019 and no products in 2020). Likewise, products with an amount of saturated fat that exceeded the amount of total fat were also reviewed, but no product was excluded from the analysis (Figure 1). Dairy drinks were excluded from the analysis of trans-fat content because a determination could not be made as
to whether the trans-fat amount declared in the nutritional information table was added or intrinsic in dairy products.

Coding of marketing techniques and claims

The methodology aimed to identify the presence of different marketing techniques, health claims, and nutritional claims on each product. First, two trained Peruvian nutritionists coded a random sample of 20% of products from the pre- and post-implementation period. The nutritionists coded the absence or presence of each type of marketing technique or claim, and where it was located (front or side/back). The presence of a marketing technique or claim was recorded only once, even if it was repeated multiple times on the same product. The percentage of agreement for each of the 31 variables was calculated. The agreement ranged from 93 to 100%. The lowest agreement was for nutrition claims related to nutritional messages. The discrepancies were reviewed and resolved by the two nutritionists. In the second stage, one nutritionist coded all remaining products.

Categorization of products according to the law

To determine if a product was categorized as “high-in” or “not high-in,” the information declared in the nutrition facts panel was compared to the thresholds established for the first phase of implementation of the FOPL policy, in June 2019 (Supplementary Table 1). Products from the pre- and post-implementation period were considered “high-in” if they exceeded thresholds for any of the nutrients of concern: sugar, saturated fat, or sodium, or contained trans-fat, thus receiving at least one octagon. All products with nutrients below the thresholds were categorized as “not high-in”.

Data analysis

The frequency of each marketing technique and claim was calculated overall and by food and beverage category. Chi-squared and Fisher’s exact tests were used to evaluate differences in proportions between the pre- and post-implementation periods. The proportion of marketing techniques and claims in each period was compared according to the product’s regulation categorization (“high-in” or “not high-in”) based on the nutrient thresholds for the first phase of Peru’s FOPL regulation. For the subsample of matched products, we used exact McNemar test to compared proportions pre- and post-implementation in the outcomes of interest.

Analysis was conducted using the statistical software package Stata v15 (STATA Corp, College Station TX, USA). A p-value of less than 0.05 was deemed statistically significant.

Ethics

This project was approved by the Institutional Ethical Committee at Universidad Peruana Cayetano Heredia, Lima, Peru (project 102750). Additionally, the supermarkets granted permission to collect information.

Results

For the analysis of the marketing techniques and health and nutritional claims in the present study, a total of 883 products in the pre-implementation phase (2019) and 1,035 in post-implementation (2020) were included for the cross sectional analysis. Almost one-third of the products in each phase were beverages, 31.0% (n = 274) and 32.5% (n = 336) in the pre- and post-implementation phases, respectively. The category with the most products in the beverage group was “Nectars” in the pre- and post-implementation (28.5%, n = 78, and 38.0%, n = 104), while among foods, “Bakery products” predominated in both collections (48.9%, n = 298 and 57%, n = 350; Table 2). A total of 321 products were collected in both phases and considered for the longitudinal analysis, 29.6% (n = 95) were beverages and 70.4% (n = 226) were foods.

In both periods, almost seven out of ten products displayed at least one of the ten marketing techniques, with an average
### TABLE 2  Marketing techniques, health, and nutritional claims before and after front-of-package warning labels policy implementation, cross sectional analysis.

| Category                | Total products | Any marketing technique | Any health claim | Any nutrition claim |
|-------------------------|----------------|-------------------------|------------------|---------------------|
|                         | Pre-impl. n (%) | Post-impl. n (%) | Pre-impl. n (%) | Post-impl. n (%) | Pre-impl. n (%) | Post-impl. n (%) | Pre-impl. n (%) | Post-impl. n (%) | P-value | Pre-impl. n (%) | Post-impl. n (%) |
| Beverages               | 274 (100.0)    | 336 (100.0)         | 182 (66.4)       | 217 (64.6)       | 0.635   | 67 (24.5)       | 128 (38.1)       | -0.001 | 227 (82.9)    | 282 (83.9)      | 0.721 |
| Nectars                 | 78 (28.5)      | 104 (31.0)          | 31 (39.7)        | 53 (51.0)        | 0.133   | 14 (18.0)       | 40 (38.5)        | 0.003  | 65 (83.3)     | 87 (83.7)       | 0.954 |
| Flavored drinks         | 69 (25.2)      | 58 (17.3)           | 54 (78.3)        | 45 (77.6)        | 0.927   | 11 (15.9)       | 11 (19.0)        | 0.654  | 64 (92.8)     | 56 (96.6)       | 0.350 |
| Carbonated drinks       | 57 (20.8)      | 83 (24.7)           | 36 (63.2)        | 53 (63.9)        | 0.933   | 7 (12.3)        | 9 (10.8)         | 0.793  | 40 (70.2)     | 56 (67.5)       | 0.735 |
| Dairy drinks            | 70 (25.5)      | 91 (27.0)           | 61 (87.1)        | 66 (72.5)        | 0.024   | 35 (50.0)       | 68 (74.7)        | 0.001  | 58 (82.9)     | 83 (91.2)       | 0.111 |
| Foods                   | 609 (100.0)    | 699 (100.0)         | 427 (70.1)       | 507 (72.5)       | 0.335   | 101 (16.6)      | 130 (18.6)       | 0.341  | 255 (41.9)    | 308 (44.1)      | 0.425 |
| Bakery products         | 298 (48.9)     | 350 (50.1)          | 175 (58.7)       | 252 (72.0)       | <0.001  | 18 (6.0)        | 31 (8.9)         | 0.176  | 84 (28.2)     | 103 (29.4)      | 0.728 |
| Breakfast cereals       | 117 (19.2)     | 144 (20.6)          | 101 (86.3)       | 121 (84.0)       | 0.605   | 77 (65.8)       | 84 (58.3)        | 0.216  | 106 (90.6)    | 123 (85.4)      | 0.204 |
| Desserts                | 58 (9.5)       | 61 (8.7)            | 54 (93.1)        | 49 (80.3)        | 0.041   | 2 (3.5)         | 5 (8.2)          | 0.440  | 22 (37.9)     | 29 (47.5)       | 0.29  |
| Snacks                  | 136 (22.3)     | 144 (20.6)          | 97 (71.3)        | 85 (59.0)        | 0.031   | 4 (2.9)         | 10 (6.9)         | 0.171  | 43 (31.6)     | 53 (36.8)       | 0.361 |

Comparisons of proportions of marketing techniques, health, and nutritional claims in products from pre- vs. post-implementation period were made using Chi-squared and Fisher's exact tests. Bold values represent $p < 0.05$. 
of 1.3 (range 0–5) and 1.4 (range 0–5) in the pre- and post-
implementation phase, respectively. However, the prevalence 
was higher in some categories, such as “Desserts” in the pre-
implementation period and “Breakfast cereals” in the post-
implementation, in which almost nine out of ten products 
displayed a marketing technique (Table 2). The findings 
presented in Figure 2 show that in both phases, the most used 
marketing technique was “Logos” (most products carried a GDA 
logo), followed by “Marketing directed to children”, which were 
both used on around 40% of the products (Figure 2). The 
least commonly used techniques were “Gifts” and “Contests” 
(Supplementary Table 3). Three categories (“Dairy drinks,” 
“Desserts,” and “Snacks”) significatively reduced the prevalence 
of marketing techniques after the FOPL implementation 
(p < 0.05). Notably, the reduction of marketing techniques 
on “Dairy drinks” was due to the lower number of products 
carrying a marketing technique directed to children (48.6–
27.5%, p = 0.006). On the other hand, some categories increased 
the use of marketing techniques, with a significant increase 
on “Bakery products” (p < 0.001; Table 2), the same trend 
was observed in the longitudinal analysis in this food category 
(p < 0.001; Supplementary Table 4).

In regard to claims, health claims were used less frequently 
than nutritional claims, with a mean of 0.3 (range 0–3) and 
0.5 (range 0–3) health claims per product in the pre- and post-
implementation phase, respectively. Two categories had a higher 
proportion of products with health claims in comparison to 
other categories: “Dairy drinks,” and “Breakfast cereals,” in which 
50 to almost 75% of products had health claims in both phases. 
Few products in “Carbonated drinks” and “Desserts” displayed 
health claims (Table 2). As shown in Figure 3, in both phases, 
the most used health claims were “General health message” and 
“Nutrient message and function”, while fewer products used 
“Fantasy terms”. Changes in the prevalence of any health claims 
were observed among beverages, where they increased by almost 
15% (24.5–38.1%, p < 0.001) between phases, in contrast to 
the cross-sectional analysis, the longitudinal analysis showed 
increases in the use of this type of claim only in “Nectars” 
(p = 0.016; Supplementary Table 4). Only one food category, 
“Breakfast cereals” had a reduction in the use of one type of 
health claim (“Nutrient message and function”) (46.2–33.3%, 
p = 0.035; Supplementary Table 5).

In contrast to health claims, nutritional claims were 
frequently used, with a mean of 1.0 claim (range 0–4) per 
product in both periods. These claims were especially common 
on beverages, where almost four out of five products in each 
period presented any nutritional claim. In both phases, the 
category with the most claims was “Flavored drinks”, while 
“Bakery products” was the category with fewest claims of this 
type (Table 3). In addition, the most used nutritional 
claims were “Nutritional content” and “Ingredient related” 
(Figure 3). It is worth noting that a large number of pre-
implementation period products already used nutrition claims 
(particularly ingredient-related claims). Although no changes 
were observed in the proportion of products carrying a 
nutritional claim, when examining changes by specific claim, 
“non-caloric sweetener added” (NCS) claims increased notably 
among beverages, raising from 11.7 to 21.7% (p = 0.001) in the post-implementation phase (Supplementary Table 6).

In the analyses based on FOPL policy status, the use of 
marketing techniques on foods and beverages classified as “high-
in” increased by almost 10% (73.6–82.1%, p = 0.007). Among 
“not high-in” products, the use of these strategies on beverages 
decreased by almost 20% (82.6–63.0%, p-value < 0.001); in 
contrast, marketing strategies on foods increased almost 10% 
(72.9–82.5%, p = 0.058). The prevalence of health claims on 
“not high-in” foods and beverages increased by 8.7% (32.9–
41.6%, p = 0.037) and on “high-in” beverages by 29% (18.5–
47.5%, p < 0.001). No statistically significant changes in the 
use of nutritional claims were observed when products were 
categorized according to FOPL policy status (Table 3). In the 
longitudinal analysis we confirmed that products “high-in” 
in the pre-implementation phase (2019) increase the use of 
marketing techniques after the implementation (p = 0.007), in 
in addition “high-in” products increase the use of health claims 
(p = 0.012; Supplementary Table 7).

Discussion

The present study analyzed a wide range of marketing 
strategies on food and beverage packaging, including marketing 
techniques, and health, and nutritional claims. Findings suggest 
an extended use of marketing techniques and nutritional 
claims, and to a lesser extent, of health claims, before and 
after the implementation of the FOPL policy in Peru. After 
the implementation, some changes, including increases and 
decreases, were observed in the use of marketing techniques 
and claims among the studied food and beverage categories. Of 
particular concern, the use of marketing techniques increased 
among “high-in” products.

Of the three types of marketing strategies on packaging 
analyzed, marketing techniques were more commonly used 
in all food and beverage categories; in contrast, claims were 
more prevalent in some specific categories. This is an expected 
result given that marketing techniques include a large variety of 
strategies that can be used on any product, ranging from the use 
of logos to specific colors on the packaging. In contrast, health, 
and nutritional claims require that the product contains specific 
ingredients or components that confer certain properties and 
benefits (6). Additionally, it is important to note the high 
percentage of products—especially beverages—using nutritional 
claims even before the FOPL policy implementation (30), and 
at the same time the lower use of health claims. Our results 
from the pre-implementation phase are similar to those found 
in Mexico. In both countries, nutritional claims were used more
than health claims (57 vs. 25% in Peru, and 33.8 vs. 3.4% in Mexico, respectively), with “Nutritional content” claims being the most common nutritional claims (31).

Among the different marketing techniques assessed, the “Logos” and “Marketing directed to children” were the most used in both periods. Most of the “Logos” used on the products analyzed in this study were from the GDA system, a front-of-package label system (32) frequently promoted by the food industry (33). It could be interest to study in further studies if the presence of both systems (GDA and FOPL octagons) interact and influence food choices. Another marketing technique used frequently in our sample is “Marketing directed to children” (around 40% overall products in both phases). The prevalence of the use of this technique was similar in Chile (36%) before the implementation of the Chilean FOPL policy in 2016 (19). This similarity may be due to geographic context (both are South American countries) and shared food suppliers. It has been reported that “marketing directed to children” techniques are frequently used on products “high-in” nutrients of concern, promoting the selection of those products (17). Similarly, a previous study in Peru warned about the frequent use of marketing directed to children on products high in sugar (14).

In both phases, two product categories that frequently use marketing strategies, especially marketing techniques and health claims, were “Dairy drinks” and “Breakfast cereals”. This aligns with a study in Costa Rica (13), where “Breakfast cereals” had the highest use of promotional marketing strategies. Traditionally, these products have been considered healthy, especially for children, because they often use marketing techniques and claims that create a “health halo” effect that makes parents believe that a product is healthy and based their food selection on that impression (11). Interestingly, these two categories experienced changes in the use of marketing strategies after the implementation of the FOPL policy. For instance, in the post-implementation period, the proportion of “Dairy drinks” using marketing techniques decreased, but the percentage using health and nutritional claims increased. One possible explanation is that the industry increased the use of claims to reinforce the idea that their products are healthy, and to counter customer concerns about the nutritional composition of packaged foods during the months close to the implementation of the FOPL policy.

Even though we found no changes in the use of nutritional claims overall, when we analyzed each type of claim separately,
we observed a significant increase in the use of messages related to NCS. This could reflect a greater use of NCS instead of added sugar in beverages, in order to avoid the “high-in sugar” octagon. Importantly, in some contexts, such as Mexico (34), the use of NCS could be perceived as positive because it signifies a reduction of (or no increase in) calories (35), and in some cases, the addition of a natural NCS could be perceived as healthier due to its natural origin (36). However, considering their possible adverse health effects (35), countries such as Mexico, are implementing warning messages for products using NCS (20).

After the implementation of the FOPL in Peru, the use of some strategies rose among “high-in” products. Cross-sectional and longitudinal analysis shown that marketing techniques increased overall products, but also, we observed a large increase in the use of health claims among “high-in” beverages in the cross sectional analysis and overall products in the longitudinal one. The increased use of those strategies on “high-in” products could be interpreted as a food industry response to minimize the impact of the octagons. Moreover, in the cross-sectional analysis the “not high-in” products were using more health claims to highlight the “healthy” properties of their products, as they are not carrying an octagon and could represent a healthier alternative. This could also be explained by the growth and development of the health food market nowadays, due to consumers’ growing interest in healthy lifestyles and wellness (37).

**Strengths and limitations**

Our study included a large sample of processed products from different food and beverage categories. Additionally, our evaluation included all package sides, since the whole package can include marketing strategies; in contrast, previous studies were limited to the front of packages (13, 14).

The study also has some limitations. First, the set of products included were those available in the three supermarkets. Products from small retailers and other points of sales such as kiosks and **bodegas** were not collected. However, the stores visited are nationwide supermarkets targeting different socioeconomic groups. Additionally, only some categories of food and beverages were included, and we limited our sample to one type of packaging per product. In that sense, our results...
### TABLE 3  Differences in the percentage of products using marketing techniques, health, and nutritional claims according to the front of package warning labels policy status, cross sectional analysis.

|                      | 2019 (n) | Pre-implementation (2019) | 2020 (n) | Post-implementation (2020) | Difference (%) | P-value |
|----------------------|----------|---------------------------|----------|---------------------------|----------------|---------|
| (1) Marketing techniques |          |                           |          |                           |                |         |
| % of “not high-in” products with at least one marketing technique |          |                           |          |                           |                |         |
| Beverages            |          | 77.8                      |          | 363                       | 72.2           | -5.6    | 0.136   |
| foods                |          | 72.9                      |          | 171                       | 82.5           | 9.6     | 0.058   |
| % of “high-in” products with at least one marketing technique |          |                           |          |                           |                |         |
| Beverages            |          | 73.6                      |          | 351                       | 82.1           | 8.5     | 0.007   |
| foods                |          | 55.6                      |          | 61                        | 68.9           | 13.3    | 0.107   |
| % of total products with at least one marketing technique |          |                           |          |                           |                |         |
| Beverages            |          | 75.0                      |          | 714                       | 77.0           | 2.0     | 0.407   |
| foods                |          | 79.0                      |          | 200                       | 84.8           | 5.8     | 0.071   |
| (2) Health claims |          |                           |          |                           |                |         |
| % of “not high-in” products with at least one health claim |          |                           |          |                           |                |         |
| Beverages            |          | 32.9                      |          | 363                       | 41.6           | 8.7     | 0.037   |
| foods                |          | 30.8                      |          | 171                       | 39.8           | 9       | 0.132   |
| % of “high-in” products with at least one health claim |          |                           |          |                           |                |         |
| Beverages            |          | 18.2                      |          | 351                       | 18.2           | 0       | 0.986   |
| foods                |          | 18.5                      |          | 61                        | 47.5           | 29      | <0.001  |
| % of total products with at least one health claim |          |                           |          |                           |                |         |
| Beverages            |          | 23.8                      |          | 714                       | 30.1           | 6.3     | 0.011   |
| foods                |          | 27.9                      |          | 253                       | 44.3           | 16.4    | <0.001  |
| (3) Nutritional claims |          |                           |          |                           |                |         |
| % of “not high-in” products with at least one nutritional claim |          |                           |          |                           |                |         |
| Beverages            |          | 79.2                      |          | 363                       | 81.3           | 2.1     | 0.537   |
| foods                |          | 71.0                      |          | 171                       | 69.6           | -1.4    | 0.799   |
| % of “high-in” products with at least one nutritional claim |          |                           |          |                           |                |         |
| Beverages            |          | 52.8                      |          | 351                       | 47.6           | -5.2    | 0.163   |
| foods                |          | 87.7                      |          | 61                        | 78.7           | -9.0    | 0.151   |
| % of total products with at least one nutritional claim |          |                           |          |                           |                |         |
| Beverages            |          | 62.9                      |          | 714                       | 64.7           | 1.8     | 0.492   |
| foods                |          | 87.4                      |          | 253                       | 88.5           | 1.1     | 0.707   |
| *High-in* products are products exceeding at least one parameter in sugar, saturated fats or containing trans-fat according to the first phase of the Peruvian law. Comparisons of proportions of marketing techniques and claims in products from pre- vs. post-implementation period were made using Chi-squared and Fisher’s exact tests. Bold values represent *p* < 0.05.

Finally, the second data collection was carried out during the COVID-19 pandemic and was extended for 8 months due to the lockdown and social restrictions. Thus, some products from 2020 differ from those of 2019, especially seasonal products (e.g., baked products, ice creams, Easter chocolate eggs), and imported products that had limited availability in the Peruvian market during the lockdown.

### Impact on public health

There have been some relevant changes to the marketing strategies on packages used by the food industry after the implementation of the FOPL policy in Peru. The increased use...
of marketing techniques among products carrying the "high-in" warning label is especially relevant for the aim of the Law of Promotion of Healthy Eating. Notably, NCS claims rose significantly, providing evidence of the increased use of these ingredients. Currently, the Peruvian Law restricts some advertising strategies of products directed to children less than 16 years; however, all of the strategies assessed in this study, only gifts are restricted by the law.

To boost the effects of the Peruvian law, policymakers could ban the use of some marketing techniques and claims assessed in this research on “high-in” products and add warning messages for NCS to avoid misunderstandings regarding the nutritional value of products and better inform consumers. Other Latin American countries such as Chile, Mexico, and Argentina have implemented these policies. In Chile, after restricting child-directed marketing for “high-in” products, a study found a decrease in the proportion of “high-in” breakfast cereals that used child-directed strategies and an increase in the “not high-in” products that used child-directed strategies ($p < 0.005$ for both cases) (19).

Finally, even though the study found significant changes in some food categories and marketing strategies after the implementation of FOPL policy, the results show that most “high-in” products already used either marketing techniques or claims, and that it is increasing. So, it is important to inform and raise public awareness about how to evaluate the nutritional quality of a product, not only based on the content of nutrients of concern, which may be insufficient for some populations to identify healthy products (28), but also based on different traits such as ingredients, processing, and labeling. In Peru, the current public policies like the Law of Promotion of Healthy Eating (22), the Healthy Eating Guidelines (38) and the National Multisectoral Health Policy to 2030 (39) allow the implementation of other actions such as implementing communication-based or educational interventions for the clear interpretation of product healthfulness and informed decision-making regarding healthy food purchases.

**Conclusion**

This study found a high use of marketing on beverages and food packaging, especially for marketing techniques and nutritional claims, before and after the implementation of the FOPL policy in Peru. Some decreases in the use of marketing techniques were observed among specific food categories, but an increase in health claims was observed for beverages. Additionally, the use of marketing techniques on “high-in” products increased, while the prevalence of health claims increased on “not high-in” products after the implementation.

To support the aim of promoting healthy eating among children and adolescents, we recommend developing communication and educational campaigns to inform the public about food labeling features such as FOPL, and nutritional facts panel. Additionally, new regulatory measures to limit the use of marketing techniques, health, and nutritional claims on “high-in” products should be implemented to strengthen the current FOPL policy.

**Data availability statement**

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

**Author contributions**

LS-G and XT-R: conceptualization, methodology, and writing – original draft preparation. AH-V: data curation and formal analysis. LS-G: supervision. FD-C, LS-G, and AH-V: resources and funding acquisition. FD-C: project administration. All authors contributed to revising the manuscript for important content, edit, read, and agreed to the published version of the manuscript.

**Funding**

This work was part of the Ancillary Study of the Urban Health in Latin America project (SALURBAL) “Evaluating the Implementation and Effects of Warning Advertising in Food Labels in Peru: A mixed-method Study.” The SALURBAL project is funded by the Wellcome Trust (grant number: 205177/Z/16/Z). This research was also supported by grant numbers 46129 and 2019-71181 from Bloomberg Philanthropies and by the National Center for Advancing Translational Sciences (NCATS), National Institutes of Health, through Grant Award Number UL1TR001111. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders.

**Acknowledgments**

The authors acknowledge the contribution of all SALURBAL project team members. For more information on SALURBAL and to see a full list of investigators see https://drexel.edu/lac/salurbal/team/ (accessed on 21 July 2022). The authors offer special gratitude to Lindsey Smith Taillie and Caitlin Lowery for the review and feedback.
Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher’s note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fnut.2022.1004106/full#supplementary-material

References

1. Martinho VI. Food marketing as a special ingredient in consumer choices: the main insights from existing literature. Foods. (2020) 9:1651. doi: 10.3390/foods9111654

2. Fraga RS, Silva SLR, dos Santos LC, Titonelle LR, Carmo A. The habit of buying foods announced on television increases ultra-processed products intake among schoolchildren. (2020). Available online at: http://www.scielo.br/j/cap/a/skBCq5icn7TM/vLWvSSh8sK5I/lang-en/ (accessed March 21, 2022). doi: 10.1590/0102-311x20091419

3. Pagliai G, Duna M, Madarena MP, Bonaccio M, Iacoviello L, Sofi F. Consumption of ultra-processed foods and health status: a systematic review and meta-analysis. Br J Nutr. (2021) 125:308–18. doi: 10.1017/S0007114520002688

4. Pan American Health Organization. Ultra-processed food and drink products in Latin America: sales, sources, nutrient profiles and policy implications. Washington, DC: Pan American Health Organization (2019).

5. Elliott C, Truman E. The power of packaging: a scoping review and assessment of child-targeted food packaging. Nutrients. (2020) 12:958. doi: 10.3390/nu12040958

6. Kaur A, Scarborough P, Rayner M. A systematic review, and meta-analyses, of the impact of health-related claims on dietary choices. Int J Behav Nutr Phys Act. (2017) 14:93. doi: 10.1186/s12966-017-0548-1

7. Ludvigsen A, Scott S. Real kids don’t eat quiche. Food Cult Soc. (2009) 12:417–36. doi: 10.2752/175174409X456728

8. Haller L, Quetaine Y, Raedschelders M, Boen F, Smits T. That’s my cue to eat: a systematic review of the persuasiveness of front-of-pack cues on food packages for children vs. Adults. Nutrients. (2020) 12:1062. doi: 10.3390/nu12041062

9. Arria A, Vidal L, Antínez L, Machín L, Martínez J, Curutchet MR, et al. Influence of label design on children’s perception of 2 snack foods. J Nutr Educ Behav. (2017) 49:211–7. doi: 10.1016/j.jneb.2016.10.021

10. Packer J, Russell SJ, McLaren K, Siovolgyi G, Stansfield C, Viner RM, et al. The impact on dietary outcomes of licensed and brand equity characters in marketing unhealthy foods to children: a randomized trial in a virtual convenience store. Am J Clin Nutr. (2022) 18:ncac008. doi: 10.1093/ajcn/ncac008

11. Abrams KM, Evans C, Duff RRL. Ignorance is bliss. How parents of preschool children make sense of front-of-package visuals and claims on food. Appetite. (2015) 87:20–9. doi: 10.1016/j.appet.2014.12.100

12. Lapiere MA, Brown AM, Houtzerv HV, Thomas TJ. Child-directed and nutrition-focused marketing cues on food packages: links to nutritional content. Public Health Nutr. (2017) 20:765–73. doi: 10.1017/S1368980016002317

13. Gamboa-Gamboa T, Blanco-Metzler A, Vandeuvre S, Ramírez-Zea M, Kosker-Lobos MP. Nutritional content according to the presence of front of package marketing strategies: the case of ultra-processed snack food products purchased in costa rica. Nutrients. (2019) 11:2738. doi: 10.3390/nu11112738

14. Torres-Schaffino D, Saavedra-Garcia L. Relationship between marketing to children on food labeling and critical nutrient content in processed and ultra-processed products sold in supermarkets in Lima. Peru. Nutrients. (2020) 12:3666. doi: 10.3390/nu12123666

15. Kraal VI, Story M. Influence of food companies’ brand mascots and entertainment companies’ cartoon media characters on children’s diet and health. A systematic review and research needs. Obes Rev Off Int Assoc Stud Obes. (2015) 16:107–26. doi: 10.1111/obr.12237

16. Moore JB, Sutton EH, Hancock N. Sugar reduction in yogurt products sold in the UK between 2016 and 2019. Nutrients. (2020) 12:171. doi: 10.3390/nu1210171

17. Hall MG, Lazard AJ, Higgins ICA, Blüstein JL, Duffy EW, Greenthal E, et al. Nutrition-related claims lead parents to choose less healthy drinks for young children: a randomized trial in a virtual convenience store. Am J Clin Nutr. (2022) 18:ncac008. doi: 10.1093/ajcn/ncac008

18. Laredo B, Biblioteca C. Bienvenidos a ley chile. (2012). Available from: https://www.bcn.cl/leychile (accessed March 21, 2022)

19. Mediano Stoltze F, Reyes M, Smith TL, Correa T, Corvalán C, Carpenter FRD. Prevalence of child-directed marketing on breakfast cereal packages before and after chile’s food marketing law: a pre- and post-quantitative content analysis. Int J Environ Res Public Health. (2019) 16:4501. doi: 10.3390/ijerph16104501

20. Def - Diario Oficial. Modificación a la norma oficial mexicana NOM-051-SCFI/SSA1-2010, especificaciones generales de etiquetado para alimentos y bebidas no alcohólicas preverificados-Información comercial y sanitaria, publicada el 5 de abril de 2010. (2020). Available online at: https://www.dol.gov.mx/nota_detalle.php?codigo=55906688&fecha=27/03/2020 (accessed March 21, 2022)

21. Congreso de la Nación Argentina. Ley 27642: promoción de la alimentación saludable. (2021). Available online at: https://www.argentina.gob.ar/ (accessed March 21, 2022)

22. Congreso de la República del Perú. Ley N° 30021: ley de promoción de la alimentación saludable para niños, niñas y adolescentes. (2013). Available online at: https://www.gob.pe/institucion/congreso-de-la-nacion/bienvenidos-a-ley-chile (accessed March 21, 2022)

23. Congreso de la República del Perú. Decreto supremo que modifica el reglamento de la ley no 30021, ley de promoción de la alimentación saludable para niños, niñas y adolescentes, y el manual de advertencias publicitarias-decreto supremo n-015-2019-SA. (2019). Available online at: http://busquedas.elperuano.pe/normales/Decreto-supremo-que-modifica-el-reglamento-de-la-ley-no-30021-decreto-supremo-n-015-2019-sa-1779615-4/ (accessed March 21, 2022)

24. Rayner M, Wood A, Lawrence M, Mburu-Chun A, Albert J, Barquera S, et al. Monitoring the health-related labelling of foods and non-alcoholic beverages in retail settings. Obes Rev. (2013) 14:70–81. doi: 10.1111/obr.12077

25. Instituto Nacional de Calidad [INACAL]. Norma técnica peruana 209.652.2017 alimentos envasados. etiquetado nutricional. (2017). Available online at: https://extranetwho.int/nutrition/gma/en/node/58286 (accessed March 21, 2022)

26. Harris PA, Taylor R, Thieleke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. (2009) 42:377–81. doi: 10.1016/j.jbi.2008.08.010

27. Giménez A, de Saldamando L, Curutchet MR, Ares G. Package design and nutritional profile of foods targeted at children in supermarkets in Montevideo, Uruguay. (2017). Available online at: http://www.scielo.br/j/cap/a/NgrrmpBq4czXW6GI13D75F3C/lang-en/ (accessed May 4, 2022)

28. Saavedra-Garcia L, Meza-Hernández M, Yahiku-Soto K, Hernández-Vásquez A, Kesar HV, Mejía-Victorio C, et al. Oferta y publicidad de alimentos y bebidas no alcohólicas enenvasados. etiquetado nutricional, y el manual de advertencias publicitarias decreto supremo n°162/2021 (accessed March 21, 2022).
29. Watt BK, Merrill A. Composition of Foods: Raw, Processed, Prepared. Washington, DC: Consumer and Food Economics Institute (1965). p. 196.

30. Duffy EW, Hall MG, Carpentier FRD, Muscic AA, Meyer ML, Rimm E, et al. Nutrition claims on fruit drinks are inconsistent indicators of nutritional profile: a content analysis of fruit drinks purchased by households with young children. *J Acad Nutr Diet.* (2021) 121:36–46.e4. doi: 10.1016/j.jand.2020.08.009

31. Cruz-Casarrubias C, Tolentino-Mayo L, Vandejijvere S, Barquera S. Estimated effects of the implementation of the mexican warning labels regulation on the use of health and nutrition claims on packaged foods. *Int J Behav Nutr Phys Act.* (2021) 18:76. doi: 10.1186/s12966-021-01148-1

32. Temple NJ. Front-of-package food labels: a narrative review. *Appetite.* (2020) 144:104485. doi: 10.1016/j.appet.2019.104485

33. Mialon M, Chary D, Cediel G, Crosbie E, Scagliusi FB, Tamayo EMP. ‘Have never seen so many lobbyists’: food industry political practices during the development of a new nutrition front-of-pack labelling system in colombia. *Public Health Nutr.* (2021) 24:2737–45. doi: 10.1017/S1368980020002268

34. Aldrete-Velasco I, López-García R, Zúñiga-Guajardo S, Roibó-Serván P, Serra-Majem L, Suverza-Fernández A, et al. Análisis de la evidencia disponible para el consumo de edulcorantes no calóricos. Documento de expertos. *Med Int México.* (2017) 33:61–83.

35. Gardener HE, Elkind MSV. Artificial sweeteners, real risks. *Stroke.* (2019) 50:549–51. doi: 10.1161/STROKEAHA.119.04456

36. Christofides EA. Artificial sweeteners and obesity—not the solution and potentially a problem. *Endocr Pract.* (2021) 27:1052–5. doi: 10.1016/j.eprac.2021.08.001

37. Ebert AW. Sprouts and microgreens—novel food sources for healthy diets. *Plants.* (2022) 11:571. doi: 10.3390/plants11040571

38. Salud PM. Documento técnico: lineamientos para la promoción y protección de la alimentación saludable en las instituciones educativas públicas y privadas de la educación básica. (2019). Available online at: https://repositorio.minedu.gob.pe/handle/20.500.12799/6636 (accessed May 5, 2022).

39. de Gestión D. Política nacional multisectorial de salud al 2030. (2022). Available online at: https://www.gob.pe/institucion/minsa/informes-publicaciones/1127209-politica-nacional-multisectorial-de-salud-al-2030 (accessed May 5, 2022).