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Consumer Perception of Front-Of-Pack Nutrition Labeling on a Real Product High in Saturated Fat and Sodium

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ABSTRACT

The consumption of sugars, saturated fat, and sodium is high throughout the world and one of the main causes is the difficulty in identifying the presence of these components in commercialized foods. Different front-of-package (FOP) labeling models have been proposed globally to solve this problem; however, due to a legislation gap, some products, even those high in sodium and saturated fat, are not required to use front-of-pack labeling, which can create a false impression of healthiness for the consumer, such as instant noodles. In this context, the objective was to investigate how packaging with FOP nutrition labels affects perceptions, emotions, purchase intention, and consumer choice of real commercial instant noodles with high saturated fats and sodium levels. The online questionnaire was administered to 521 instant noodle consumers. We found that the presence of traffic lights and magnifying glass FOP labels did not affect the perception of healthiness but significantly reduced the intention to purchase the product. Packaging with FOP labels allowed consumers to identify less healthy products and make healthier choices more easily. The magnifying glass FOP was the most efficient for this purpose. These results indicate how FOP could enable consumers to make healthier choices. It is up to the industry to work on reformulating products that meet consumer needs and preferences and a revision of FOP criteria by Legislation.

1 | Introduction

Many processed foods are developed to be hyper-palatable and attractive, with a long shelf life and practicality so that they can be consumed anywhere (Harvard 2023). On the other hand, they usually have excessively high energy densities and are rich in added sugars, saturated fat, and sodium. If consumed frequently, they can increase the risk of obesity and other diseases (Poti et al. 2017). Traditionally, the nutritional table on the label reports the high levels of these constituents.

The nutritional table is an essential communication tool that provides information about the composition, nutritional profile,

and content of foods so that consumers can make comparisons and select the product they will purchase (Wingfield 2016). This information is present on the food label. However, it is considered difficult for consumers to understand it, limiting its effect (Magriplis et al. 2024). The most frequent reasons consumers do not read labels are a lack of time and difficulties reading and understanding them (Castillo et al. 2015).

In Brazil, the problems presented by the interpretation of labeling are due to the low level of nutritional knowledge, difficulty in understanding the nutritional table, doubts, and inconsistencies regarding the declared information (Brazil 2019). Therefore, it is imperative to provide clearer information regarding the

Abbreviation: FOP, front-of-package.

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Practical Applications

The study's results indicate that simple and informative front-of-package (FOP) nutrition labels, such as the traffic light and magnifying glass models, can effectively guide consumers toward healthier and more informed food choices. These labels may also encourage the food industry to reformulate products with improved nutritional profiles to avoid negative highlights on packaging, potentially increasing sales. Moreover, combining FOP information with educational campaigns about the risks of excessive fat and sodium consumption could further enhance consumers' ability to make informed decisions.

nutritional content of foods. By facilitating consumers' access and understanding of this information, individuals tend to make more health-conscious food choices (Ikonen et al. 2020; World Health Organization [WHO] 2021). In this context, front-of-package (FOP) nutrition labeling has been used in several countries.

FOP nutrition labeling aims to provide consumers with clear and accessible information about a food product's nutritional profile. It is located on the main panel of the packaging (front). It has the potential to capture consumers' attention, contribute to the understanding of specific nutrients, and assist in choosing healthier foods during the purchasing process (Miller et al. 2015; Kanter et al. 2018). Several FOP nutritional labeling models are being proposed around the world. The nutritional traffic light is the model proposed in the United Kingdom. It uses the colors green, yellow, and red to indicate to the consumer foods with low, medium, and high levels of constituents that are harmful to health when consumed in excess (Hieke and Wilczynski 2012; Hawley et al. 2013).

As of October 2022, the magnifying glass FOP nutrition labeling became mandatory in Brazil. It is a nutritional warning model, with the image of a magnifying glass and text informing whether the food has high levels of added sugars, saturated fats, and sodium (Brazil 2020a, 2020b). As there are different FOP nutrition labeling models, studies have been carried out on which is preferred by consumers in different countries and which have allowed the achievement of better informing them. Méjean et al. (2013) and Sant'Anna et al. (2022) observed that French and Brazilian adults, respectively, prefer nutritional traffic lights to other labeling systems. However, other studies suggest that a more straightforward and direct FOP nutrition labeling model may be more efficient in its intended use (Méjean et al. 2013; Tórtora et al. 2019).

The requirement for FOP in food products stems from specific quantities of sodium, added sugar, and saturated fat per 100 g of ready-to-eat product (Brazil 2020a, 2020b). However, some products, despite being rich in these ingredients, due to a gap in the legislation, end up not needing FOP, a fact that can promote a false sense of healthiness to the consumer, as is the case with instant noodles in Brazil. Then, updating and adapting nutritional labeling legislation can improve the population's understanding of the composition of foods and encourage the industry to reformulate its products. In this

context, the objective was to investigate how different front-of-package (FOP) nutritional labeling models (traffic light and magnifying glass) on actual commercial product packaging with high levels of saturated fats and sodium affect consumers' perceptions, emotions, purchase intentions, and choices. The real product chosen as the focus of the study was instant noodles. Our hypothesis is that implementing FOP in a more visual and practical model in a food product high in sodium can allow consumers to envision healthier choices.

2 | Material and Methods

This study was approved by the Human Research Ethics Committee of the Federal University of Espírito Santo (UFES)—ES, campus Alegre—ES, Brazil (CCAÉ—49263921.4.0000.8151).

We administered an online questionnaire to instant noodle consumers. The questionnaire was divided into three sections. In the first section, three product packages were evaluated in a monadic way. The only difference between the packages was the nutrition labeling (control—without FOP nutrition label, magnifying glass FOP nutrition label, and traffic light FOP nutrition label). In the second section of the questionnaire, participants evaluated five packages presented simultaneously: control, magnifying glass FOP nutrition label, traffic light FOP nutrition label showing high levels, traffic light FOP nutrition label showing medium levels, and nutritional claims “less saturated fat” and “less sodium.” The third section was composed of sociodemographic and behavioral questions.

2.1 | Product

The product selected was free-range chicken-flavored instant noodles. Instant noodles were chosen through research on the Internet, supermarkets, and a labeling application (“Desrotulando”). This product was selected because it contains high levels of saturated fat and sodium, is widely consumed in Brazil and around the world, and is sold in a large part of the Brazilian territory (Brazilian Supermarket Association (ABRAS) 2022; Brazilian Packaging Association (ABRE) 2021; Salihu et al. 2025). The most-sold flavor nationally is free-range chicken (Salihu et al. 2025).

The packaging of the selected product is plastic, sold in a rectangular format with no information on the sides, and in a yellow and red color. The front of the packaging carries an illustrative image of a chicken leg with carrots and parsley and an illustrative image of ready-to-eat pasta. The front of the packaging also contains the product brand, the information “with selected ingredients” and “contains synthetic flavoring identical to the natural one,” information on the preparation method (“prepared in 3 min on the stove after boiling water”), flavor information (“free-range chicken”), sales name (“Instant noodles with free-range chicken flavor seasoning”), and net weight of the product.

The back of the packaging consists of the nutritional information table, list of ingredients, information on the constituents of possible allergenic ingredients, storage instructions, barcode,

consumption suggestion, illustrated preparation method, and batch and expiration information.

The selected product contains 7.2 g of saturated fat and 1.41 g of sodium in an 85 g serving. If only the noodles' constituents were considered, this product would be classified as high in saturated fat and sodium according to the thresholds established for the application of FOP nutritional labeling using the traffic light and magnifying glass models (Brazil 2020a, 2020b; United Kingdom 2016). However, the industry recommends adding 450 mL of water during the preparation of the product, and Brazilian legislation considers the product's nutrient content in its ready-to-eat form (Brazil 2020a, 2020b). This addition of water dilutes the product's constituents, resulting in the absence of the magnifying glass FOP label on its packaging.

2.2 | Designing of the Packaging Image

The image of the instant noodle packaging was obtained from the Internet. The FOP nutrition label symbols were created and applied to the front of the packaging using the Canva graphic design platform. The only change to the packaging was the application of the FOP nutrition labels; the other original packaging characteristics were maintained.

2.2.1 | Front-Of-Packaging Nutrition Labeling

This research used traffic light, magnifying glass, and nutritional claims FOP nutrition labeling systems (Figure 1). The magnifying glass FOP nutrition labeling (Figure 1a) was applied in accordance with Brazilian legislation (Brazil 2020a, 2020b), and the traffic light FOP nutrition labeling system (Figure 1b,c) was prepared according to the Food Standards Agency guide (United Kingdom 2016).

In the case of the traffic light FOP nutrition label, each constituent was classified as high, medium, or low using the colors red, yellow, and green, respectively (Figure 1b). The magnifying glass FOP nutrition label informs about the high sodium content, while the traffic light FOP nutrition label informs the salt content. The salt content was calculated by multiplying the sodium content (informed in the nutritional table) by 2.5, as recommended by the Food Standards Agency guide (United Kingdom 2016).

We developed two instant noodle labels with fictitious nutritional information to give consumers the option of a product with reduced levels. These packages now have medium levels of saturated fat and sodium. Given this, we prepared two traffic light FOP nutrition labels, one informing of medium levels (Figure 1c) and another informing of reduced levels of these constituents (Figure 1d).

Considering that the magnifying glass FOP nutrition label is not applied to foods with medium and low levels of constituents, to replace it, two circles were applied to the packaging with the nutritional claims "65% less saturated fat" and "41% less sodium"

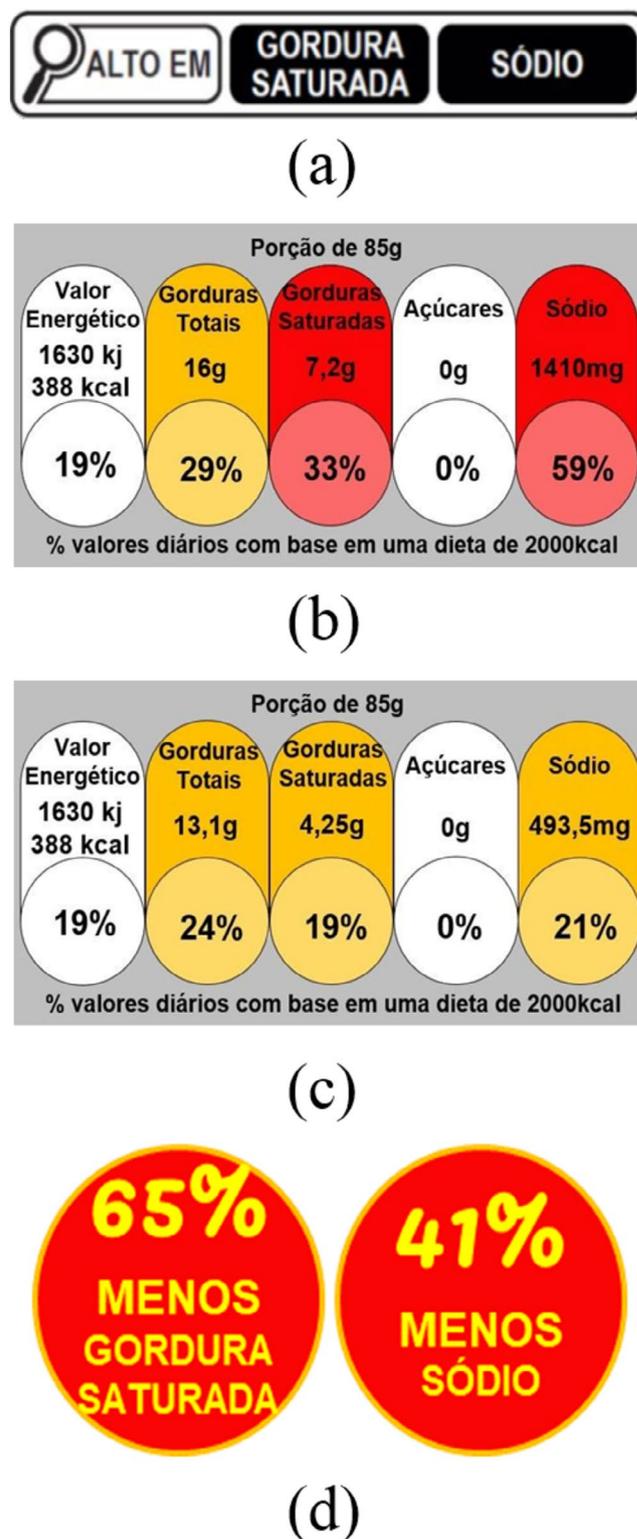


FIGURE 1 | Front-of-package (FOP) nutrition label used in instant noodle packaging. (a) Magnifying glass FOP nutrition label in accordance with Brazilian legislation (Brazil 2020a, 2020b); (b) traffic light FOP nutrition label according to the Food Standards Agency guide (United Kingdom 2016); (c) traffic light FOP nutrition label with medium levels (fictitious); (d) claim of reduction in saturated fat and sodium (fictitious).

(Brazil 2020a, 2020b). This reduction percentage was the same as that applied to the packaging with traffic light FOP nutrition label showing medium levels (Figure 1c).

2.3 | Online Questionnaire

The questionnaire was applied using Google Forms. Answering the questionnaire took an average of 20 min. During the study, the magnifying glass FOP nutrition label was not yet in force in Brazil. This research was the first time many consumers had access to the FOP nutrition label.

To select instant noodle consumers, people were invited to participate in the research through social networks, messaging applications, emails, and personal invitations. This promotion took place through the snowball technique, therefore being a convenience sampling. Therefore, we aim for greater participation from younger that are described in the literature as the main consumers of the product (instant noodles) and are therefore representative of the consumers of this product (Salihu et al. 2025). The questionnaire was designed, tested, and validated with 53 evaluators (10% of the sample population) to verify whether the research objectives would be achieved with the questions prepared, whether the vocabulary of the questions was suitable for the interviewees, and whether the questions were biased or ambiguous. After corrections, the questionnaire was applied.

2.4 | Application of the Questionnaire

Five hundred and twenty one regular consumers of instant noodles participated in the study.

2.4.1 | First Section of the Questionnaire

The first section of the questionnaire aimed to investigate how FOP nutrition labeling, through information on the high levels of saturated fat and sodium, influences instant noodle consumers' purchase intention, perceptions, feelings, and emotions.

The image of the control package (without an FOP nutrition label), the package with a magnifying glass FOP nutrition label (Figure 1a), and the package with a traffic light FOP nutrition label (Figure 1b) were presented in a monadic and random manner. For each package, three images were presented: the front image of the package, the image on the back, and an image of the product's nutritional table. The frontal image was the only image that varied between treatments (packaging).

Consumers analyzed the packaging and indicated their purchase intention, perception of healthiness, and the applicability of terms and emotions using the RATA (Rate-all-that-apply) scale.

Purchase intention was analyzed using a structured 5-point scale, ranging from 1—"definitely would not buy" to 5—"definitely would buy" (Meilgaard et al. 2015). The perception of healthiness was analyzed using a seven-point scale, anchored at the extremes by 1—"not at all healthy" to 7—"very healthy."

Using RATA, consumers were asked to indicate the terms, emotions, feelings, and phrases best applied to the products' images (Reinbach et al. 2014). The terms and phrases were collected through literature consultation (Sant'Anna et al. 2022), selecting

24 terms that denote consumers' perceptions regarding packaging with FOP nutrition labeling informing about high levels of constituents (Table S1).

The terms and phrases were presented randomly to consumers. Consumers analyzed the packaging and reported the application of each term and phrase, using a six-point scale (0—"not applicable," 1—"little applicable," 2—"slightly applicable," 3—"moderately applicable," 4—"very applicable," and 5—"extremely applicable") (Ares et al. 2014).

The results of purchase intention, health perception, and RATA were analyzed using analysis of variance in a randomized block design (RDB) and, when necessary, using Tukey's test at a 5% significance level.

2.4.2 | Second Section of the Questionnaire

The second part of the study aimed to verify whether the FOP nutrition label allows consumers to identify less healthy products and make healthier choices. To achieve this, it was necessary to present a healthier product packaging than the three previously presented.

In this second stage, five packages were presented simultaneously to consumers: the three packages from the previous stage and two more of the product, considering a fictitious reduction in saturated fat and sodium content (healthier options). One of these packages had a traffic light FOP nutrition label (informing medium levels—Figure 1c), and the other had nutritional claims informing about the reductions ("65% less saturated fat" and "41% less sodium") (Figure 1d).

Consumers analyzed the packaging and ordered them from least healthy to healthiest (1 being what they considered the least healthy and 5 being the healthiest). Subsequently, consumers reported which product they would choose to purchase.

The ordination results were analyzed using the Christensen test at a 5% significance level (Christensen et al. 2006). The results of product choice were analyzed using descriptive statistics and presented in a frequency distribution table.

2.4.3 | Third Section of the Questionnaire

The third and final stage consisted of applying the sociodemographic and behavioral questionnaire. The information collected was evaluated using descriptive statistics and presented in frequency distribution tables.

3 | Results

3.1 | Characterization of Consumers

The questionnaire was applied to 521 Brazilian instant noodle consumers aged between 18 and 70, 319 of whom were female, 202 male, 3 non-binary, and 3 who preferred not to declare (Table S2).

Most participants (39%) claimed to consume instant noodles one to three times a month. The majority also reported that they do not analyze the nutritional table on the food label (55%) and rarely evaluate the back of the packaging (41%), where the nutritional table is typically located.

Most consumers said they were concerned about the amount of saturated fat (60%) and sodium (63%) in their diet. Participants also stated that they were aware that high consumption of saturated fat (95%) and sodium (93%) could lead to diseases. However, the percentage of people decreases when asked if they do anything to reduce the saturated fat (52%) and sodium (56%) content in the foods they consume.

3.2 | Effect of FOP Nutrition Labeling on Purchase Intention and Consumer Perceptions

The presence of an FOP nutrition label (traffic light or magnifying glass) on the packaging did not have a significant effect ($p > 0.05$) on consumers' perception of the healthiness of instant noodles (Table 1). Regardless of the nutrition labeling, consumers considered the product unhealthy.

However, the presence of a traffic light and magnifying glass on the FOP nutrition label, warning about the high levels of saturated fat and sodium, reduced consumers' purchase intention for the product ($p \leq 0.05$). The magnifying glass FOP nutrition label had a more significant effect on reducing purchase intention than the traffic light FOP nutrition label (Table 1).

Of the 24 terms and phrases analyzed using RATA, only 5 did not change in applicability due to the presence of the FOP nutrition label on the packaging (healthy product, unhealthy product, weight on conscience, guilt, and easy-to-understand packaging) (Table 2).

There was a significant difference between the applicability averages for the terms "it seems to have a great flavor," "it seems to have a terrible flavor," "I liked it," "I disliked it," "high-calorie product," "sadness," "desire," "disgust," "well-being," "happiness," "curiosity," "deceived," "pleasure," "concern," "makes me want to eat it," "informative packaging," "this product seems more expensive," "polluted packaging (it has much

information)," and "I do not trust the information on this packaging" (Table 2).

In general, the presence of an FOP nutrition label increased the applicability of negative terms and decreased the applicability of positive terms. The magnifying glass FOP nutrition label was the one that most increased the applicability of negative terms, emotions, and feelings, such as "it seems to have a terrible flavor," "I disliked it," "sadness," "disgust," and "concern." The presence of the magnifying glass reduced the applicability of positive terms, such as "I liked it," "desire," "well-being," "happiness," "curiosity," "pleasure," and "makes me want to eat it" (Table 2).

3.3 | Effect of FOP Nutrition Label on Food Choice

The product considered the healthiest by consumers was the packaging with the claim "65% less saturated fat" and "41% less sodium," and the product considered the least healthy was the packaging with the magnifying glass FOP nutrition label (Table 3). These results demonstrate that the magnifying glass FOP nutrition label was more efficient in indicating to consumers the less healthy product when compared to the traffic light FOP nutrition label and the control one (Table 3).

Finally, consumers were asked to indicate which product they would buy. The product that had the highest purchase recommendation (indicated by 53.2% of participants) was the packaging with the claim "65% less saturated fat" and "41% less sodium" (Table S3), the same product that was considered the healthiest by consumers (Table 3). The product whose packaging had the magnifying glass FOP nutrition label presented the lowest purchase indication (7.7%), the lowest purchase intention (Table 1), and was considered the least healthy by consumers (Table 3).

4 | Discussion

The FOP nutrition label (magnifying glass and traffic light models) showing high saturated fat and sodium levels did not change how healthy consumers consider instant noodles ($p = 0.4805$). The explanation for these results may be the product studied, which consumers already considered unhealthy, regardless of the presence of the FOP nutrition label. The average healthiness of the traditional product (FOP nutrition label) was 2.4 on a scale ranging from 1, "not at all healthy," to 7, "very healthy"; therefore, it is considered unhealthy. The average healthiness of packaging with FOP nutrition labels ranged from 2.3 to 2.4.

Studies have verified the effects of the presence of the FOP nutrition label on reducing the perception of the healthiness of some products (Castronuovo et al. 2022). Khandpur et al. (2022) explain that as nutritional understanding increases, perceptions of the healthiness of the product decrease. Bandeira et al. (2021) evaluated the perception of healthiness regarding the packaging of nine different foods (cottage cheese, tomato sauce, sliced bread, crackers, cereal bars, breakfast cereal, nectar, corn, and mini bread rolls) commonly consumed in Brazil and usually

TABLE 1 | Means of purchase intention and perception of the healthiness of packaging and p -value.

Response variable	Packaging			p
	Control	Traffic light	Magnifying glass	
Healthiness ^a	2.4 a	2.4 a	2.3 a	0.4805
Purchase intention ^b	4.0 a	3.8 b	3.6 c	<0.0001

Note: Means followed by the same letter on the same line do not differ from each other in terms of Tukey's test ($\alpha = 5\%$).

^aPerceived healthiness: Seven-point scale, ranging from 1—"not at all healthy" to 7—"very healthy."

^bPurchase intention: Five-point scale, ranging from 1—"definitely would not buy" to 5—"definitely would buy."

TABLE 2 | Applicability averages of Rate-all-that-apply (RATA) terms for packaging and *p*-value.

RATA terms	Packaging			<i>p</i>
	Control	Traffic light	Magnifying glass	
It seems to have a great flavor	3.4 a	3.1 b	2.9 b	<0.0001
It seems to have a terrible flavor	0.9 b	1.0 b	1.2 a	<0.0001
I liked it	3.2 a	2.9 b	2.5 c	<0.0001
I disliked it	1.1 b	1.2 b	1.4 a	<0.0001
High-calorie product	3.4 a b	3.3 b	3.5 a	0.0034
Healthy product	0.9 a	1.0 a	0.9 a	0.3311
Unhealthy product	3.4 a	3.4 a	3.5 a	0.0728
Sadness	0.9 b	0.9 b	1.1 a	<0.0001
Desire	2.7 a	2.4 b	2.1 c	<0.0001
Disgust	0.9 c	1.1 b	1.3 a	<0.0001
Well-being	1.8 a	1.8 a	1.5 b	<0.0001
Happiness	2.4 a	2.2 b	1.9 c	<0.0001
Curiosity	2.1 a	2.0 a	1.9 b	0.0008
Weight on conscience	2.1 a	2.1 a	2.2 a	0.1623
Deceive	1.3 a	1.1 b	1.1 b	0.0009
Pleasure	2.6 a	2.3 b	2.0 c	<0.0001
Guilt	1.7 a	1.7 a	1.8 a	0.3862
Concern	2.1 b	2.0 b	2.3 a	<0.0001
It makes me want to eat it	3.3 a	2.8 b	2.5 c	<0.0001
Informative packaging	3.1 b	3.3 a	3.2 b	<0.0001
This product seems more expensive	1.2 a b	1.3 a	1.1 b	0.0405
Easy-to-understand packaging	3.2 a	3.2 a	3.2 a	0.7373
Polluted packaging (it has much information)	1.6 b	1.9 a	1.4 c	<0.0001
I do not trust the information on this packaging	1.7 a	1.5 b	1.4 b	<0.0001

Note: Means followed by the same letter on the same line do not differ from each other in terms of Tukey's test ($\alpha = 5\%$). Intensity of applicability of the term: Six-point scale (0—"not applicable attribute" to 5—"extremely applicable").

TABLE 3 | Significance of sums of orders of instant noodle packaging for healthiness.

Packaging	Sum of order
"65% less saturated fat" and "41% less sodium" claim	2142 A
Traffic light FOP nutrition label (medium saturated fat and sodium content)	1673 B
Control packaging (without FOP nutrition label)	1620 B
Traffic light FOP nutrition label	1258 C
Magnifying glass FOP nutrition label	1122 D

Note: The greater the sum of orders, the healthier consumers considered the product. Sums of orders followed by the same letter do not differ from each other using the Christensen test ($\alpha = 5\%$). Abbreviation: FOP: front-of-package.

perceived as healthy products. A control package (with FOP nutrition label) and five packages with different FOP nutrition label models (octagon, triangle, circle, magnifying glass, and traffic light) were studied. All FOP nutrition label models evaluated increased the understanding of nutritional content and reduced the perception of healthiness compared to the control packaging.

Castronuovo et al. (2022) found that the warning FOP nutrition label (black octagon) performed better in helping consumers make healthier choices and reducing their perceptions of healthiness in products such as yogurt, biscuits, and cottage cheese compared to packaging without the FOP nutrition label or with multiple traffic lights and Nutri-Score FOP nutrition label (Castronuovo et al. 2022). Furthermore, it was observed in a study with 2522 adults that obesity participants rated different front-of-package food labels (FOPLs) as more stigmatizing than control labels (Campos et al. 2025).

However, the present study demonstrated that the FOP nutrition label did not reduce the perceived healthiness of instant noodles. The likely reasons for this divergence of results are that, in this research, we investigated a product sold in the Brazilian market, and its consumers are already aware that instant noodles are not a healthy product. Marsola et al. (2021) evaluated the perceptions of instant noodle consumers about the effects of consuming this product on health. Consumers considered instant noodles very bad for their health (average -2.08 on a seven-point scale, ranging from -3 = very bad for their health to 3 = very good for their health), but they still continue to consume it.

Therefore, FOP nutrition labels appear to have a limited influence on consumers' perception of the healthiness of products that are already perceived as unhealthy, such as instant noodles. In contrast, when FOP nutrition labels indicate high levels of certain constituents in products commonly perceived as healthy, this information may lead consumers to reassess their healthiness.

Although the FOP nutrition label did not affect the perception of healthiness, its presence on the packaging reduced consumers' purchase intention for the product, regardless of the model applied (traffic light or magnifying glass). The magnifying glass FOP nutrition label resulted in a greater reduction in purchase intention than the traffic light one, possibly because it uses more direct and simple-to-understand language regarding high levels of specific constituents. Thus, the results indicate that more practical and educational FOP labels are associated with improved consumer perception and greater knowledge of the product.

Several studies, in many countries, have also verified the effect of FOP nutrition labels in reducing the intention to purchase products with a high content of sugar, saturated fats, and sodium (Hersey et al. 2013; Machin et al. 2018, 2017; Acton et al. 2019; Prates et al. 2022; Bopape et al. 2022; Sobaih and Abdelaziz 2022). In Brazil, Prates et al. (2022) evaluated industrialized products (cereal bars, whole grain cookies, and chips) in the presence of different warning models (octagon, triangle, and magnifying glass) in foods with high levels of added sugars, saturated fats, and sodium. In general, including the warning FOP label contributed to understanding nutritional information and reduced the intention to purchase the foods analyzed.

In South Africa, Bopape et al. (2022) evaluated the application of FOP nutrition labels in vanilla cookies, plain cookies, chocolate-filled cookies, popcorn, fried tortillas, and corn chips. The warning FOP nutrition label (high levels) was found to perform better than the Guideline Dietary Amounts and Multiple Traffic Light in reducing the purchase intention of packaging evaluated by consumers. In Austria, Kunz et al. (2020) found that the traffic light FOP nutrition label did not result in lower purchase intentions for products with a high sugar content. However, consumers showed higher purchase intentions for products with the traffic light FOP nutrition label showing low sugar content than those without it.

Most studies report findings consistent with the present research, suggesting lower purchase intention in the presence of FOP nutrition labels. However, some studies have not observed

this pattern, which may be related to differences in participants' health concerns, the type of product evaluated, and the FOP nutrition label model examined.

In general, the presence of FOP nutrition labels on the packaging increased the applicability of negative terms, such as "it seems to have a terrible flavor," "I disliked it," "sadness," "disgust," and "concern"; and reduced the applicability of positive terms, such as "I liked it," "desire," "well-being," "happiness," "curiosity," "pleasure," and "it makes me want to eat it" (Table 2). The magnifying glass FOP nutritional label had the most negative impact on consumers' perceptions of the product; not coincidentally, it also may have led to the greatest reduction in purchase intention.

The RATA test is seldom used to assess perceptions, feelings, and emotions regarding packaging with FOP nutrition labels. However, studies have shown that more transparent nutritional information (e.g., product kilocalories, walking duration needed to burn the kcal in the product, the term "light," and reduced sodium) on food packaging reduces the applicability of positive terms and increases the applicability of negative terms for products with high levels of saturated fat, sugars, and sodium (Schouteten et al. 2015; Oliveira et al. 2020).

Compared to traditional packaging without FOP nutrition labels, such labels allowed consumers to more easily identify less healthy products and make healthier choices. The magnifying glass FOP nutrition label was the most efficient for this purpose. Then, packaging featuring the magnifying glass FOP nutrition label was perceived by consumers as less healthy and was the one with the lowest percentage of choice for purchase. In contrast, packaging displaying nutritional claims indicating percentage reductions in specific constituents was perceived as healthier and was associated with a higher purchase intention.

The traffic light FOP nutrition label reporting both high and medium constituent content had an intermediate performance compared to packaging with a magnifying glass FOP nutrition label and nutritional claims. These results demonstrate, once again, that nutritional labeling with more direct language (such as the magnifying glass and nutritional claims) can be better understood by consumers and tends to have a more significant effect.

Regardless of the model adopted, the effectiveness of FOP nutritional labeling depends on carefully crafted regulation. For the application of the magnifying glass FOP model, Legislation considers only the nutrient content of the product in its ready-to-eat form (Brazil 2020a, 2020b). As a result, products with high levels of added sugar, saturated fat, and sodium that require dilution in water during preparation are exempt from FOP labeling. This is the case of instant noodles, the focus of this study, which contain 7.20 g of saturated fat and 1408 mg of sodium per 85 g serving. According to the manufacturer's instructions, 450 mL of water should be added during preparation, diluting the nutrients and removing the requirement for the magnifying glass FOP label.

However, many consumers do not follow the manufacturer's preparation guidelines, often using smaller volumes of water.

Additionally, it is common for consumers to eat one or more units of the product per meal, regardless of dilution. As a result, consumers may be ingesting high amounts of saturated fat and sodium without being aware of it or, even more concerning, may increase their consumption of such products due to perceiving the absence of FOP labeling as an indication of healthfulness.

This study showed that the presence of the magnifying glass FOP label on instant noodle packaging facilitates the identification of the product as less healthy and reduces consumers' purchase intentions. Considering that the purpose of FOP labeling is to alert consumers and enable healthier food choices, the findings indicate that improvements to Brazilian legislation are necessary to achieve these goals more effectively.

Furthermore, the results of the present study suggest that if food industries intend to avoid having their sales affected by the implementation of the Magnifying Glass FOP nutrition label, they need to reformulate their products with high levels of added sugars, saturated fats, and sodium. From a market perspective, offering products with improved nutritional profiles may help limit potential losses in market share. However, reductions in added sugars, saturated fats, and sodium should be approached carefully and not implemented arbitrarily.

Although packaging with reduced content claims obtained a higher percentage of purchasing choices (53.2% of participants), 7.7% of participants reported that they would buy the product with packaging containing the magnifying glass FOP nutrition label stating that instant noodles have high levels of saturated fat and sodium. Although almost all participants reported that they were aware that high consumption of saturated fat (95%) and sodium (93%) could lead to diseases, only a little more than half reported taking concrete action to reduce their saturated fat content (52%) and sodium (56%) in the foods they consume. These results suggest that, for part of the population, greater access to nutritional information alone may not be sufficient to change food choices. Although FOP nutrition labels provide a simple and standardized indication of high levels of specific nutrients, other factors also appear to influence food choices.

In recent years, the consumption of instant noodles in Brazil has increased. Reasons for this trend include their practicality, high palatability, and low price. In 2020, almost 3.1 billion people worldwide could not afford a healthy diet (World Health Organization [WHO] 2022). On the other hand, recent research indicates consumer interest in products with reduced saturated fat and sodium as long as there are no changes in the sensory characteristics of the food (Sant'Anna et al. 2023; Steele et al. 2022).

Therefore, as long as saturated fat, sugars, and sodium are reduced carefully, implementing the FOP nutrition labeling can enable a greater supply and consumption of healthier foods. This will help reduce the population's consumption of added sugars, saturated fat, and sodium and, in the long term, minimize the incidence of cardiovascular diseases, diabetes, and obesity, among others (Zlatevska et al. 2024).

There is still a lack of evidence of the long-term benefits of FOP nutrition labeling and the actual consumer purchasing process.

However, this should not be seen as evidence of a lack of effectiveness (Storcksdieck et al. 2020). This question is essential for future research and studies that capture consumers' behavioral responses and possible impacts on long-term product purchases (Khandpur et al. 2018). Thus, exploratory studies such as the present work can help identify potential consumer reactions to new labeling strategies. However, insights from consumer psychology, based on frameworks such as the Elaboration Likelihood Model, the Health Belief Model, and the Theory of Planned Behavior, could further enhance understanding of how advertising messages influence consumers' decision-making processes. These theoretical approaches provide a valuable basis for examining the impact of advertising content on consumer behavior, as well as the relationship between purchase intention and actual purchasing behavior (Singh et al. 2025; Pan 2024).

Another limitation of this study is the use of snowball sampling, which, due to its non-probabilistic nature, is subject to selection bias and homophily, thereby restricting sample representativeness and the generalizability of the findings. Future studies should adopt probabilistic sampling or stratified sampling strategies to enhance representativeness and enable more robust inferences across different demographic groups. Nevertheless, the sample profile in the present study, predominantly composed of young consumers, is consistent with the typical consumer base of instant noodles. Therefore, although the results should be interpreted with caution, the sample is appropriate for the target population of the product evaluated, reinforcing the relevance of the findings. In addition, this study was conducted using a real, commercially available product marketed in Brazil and other countries, and involved real consumers, providing a more realistic indication of consumer behavior than studies based on non-commercial or fictitious food products.

5 | Conclusion

The magnifying glass and traffic light FOP nutrition label, warning consumers about high levels of saturated fat and sodium in instant noodles packaging were not associated with marked changes in perceived healthiness but were associated with lower purchase intention. Thus, the results suggest that a more practical FOP model and its implementation on product labels could influence consumer perceptions and desires.

The presence of FOP nutrition labels also appeared to negatively influence consumers' perceptions and emotional responses, facilitating the identification of products perceived as less healthy and supporting healthier choice patterns. Furthermore, the magnifying glass FOP nutrition label showed a stronger association with consumer awareness of products perceived as more harmful to health and with lower purchase intention than the traffic light label. These findings suggest that differences in label design may play a role in how nutritional warnings are processed by consumers.

Finally, the results indicate that further improvement of Brazilian FOP labeling legislation may enhance the effectiveness of the magnifying glass label in achieving its intended public health objectives. Furthermore, new, more in-depth studies evaluating consumer psychology are recommended.

Author Contributions

Danielle Esthefane Sousa Lima: formal analysis, methodology, investigation, writing – original draft preparation. **Mariana Rocha Manzo Henriques:** methodology, investigation. **Mariana Grancieri:** data curation, investigation, writing – original draft, writing – review and editing. **Lara Lima Cornejo:** conceptualization, methodology. **Ingrid Carvalho Moreira:** investigation. **Suzana Maria Della Lucia:** supervision, writing – review and editing preparation. **Tarcísio Lima Filho:** conceptualization, formal analysis, methodology, writing – review and editing preparation, visualization preparation, project administration.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Table S1:** List of terms and phrases applied in Rate-all-that-apply (RATA). **Table S2:** Sociodemographic and behavioral profile of consumers. **Table S3:** Percentage of people who would buy each product.