



**U.S. FOOD & DRUG
ADMINISTRATION**

Front of Package Labeling Literature Review





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TABLE OF CONTENTS

BACKGROUND AND CONTENTS	4
LITERATURE REVIEW	4
General Findings	4
Introduction	4
Results of Key Systematic Reviews (2005 - 2016).....	5
Results of Key Systematic Reviews (2016 - 2018).....	6
Results of Key Systematic Reviews (2018 - 2021).....	10
Error! Bookmark not defined. Results of Key Systematic Reviews (2021 - 2022)	16
Appendix A: Front of Pack Nutrition Labeling Schemes and Symbols Available Online and in the Scientific Literature in 2018	23
Appendix B: Methods Report for Systematic Review of Literature on Front of Package Labeling Including Study Protocol	28
Introduction	28
Objective	28
Methods.....	28
Search Strategy	28
Mechanism Used to Manage the Review	36
Selection Process	36
Appendix C: Summary of Articles included in the FDA Healthy Symbol Literature Review	37
Appendix D: Citations for Studies in the Literature Review	58

BACKGROUND AND CONTENTS

FDA is prioritizing its nutrition initiatives to ensure people in the United States have greater access to healthier foods and nutrition information we can all use to identify healthier choices more easily. Increasing the availability of healthier foods could improve eating patterns and, as a result, improve everyone's health and wellness.

Claims and symbols can act as quick signals on the front of food packages to help consumers better understand nutrition information and select foods that are part of healthy eating patterns. Other aspects of food labels can provide consumers with further valuable information to help them to identify healthier foods.

To help consumers easily identify packaged foods that would meet an updated definition for the "healthy" claim, FDA is conducting consumer research to develop a "healthy" symbol that could appear on food packages.

FDA is also exploring the development of a nutrition labeling scheme referred to as front of package (FOP) labels displaying a summary of the product's healthfulness or nutrient content. To support these efforts, FDA conducted and updated reviews of the literature to summarize what is currently known and understood about FOP labeling.

Pages 4 to 10 of this report are the body of the review – the body encompasses 1) a summary of key systematic reviews on FOP symbols, 2) an updated review of the FOP scientific literature, and 3) summaries from guides on government implementation of FOP labels. The Appendices contain: A) a table of FOP labeling schemes and symbols available online and in the scientific literature in 2018; B) the methods report including the study protocol; C) a summary of each article in the updated review; D) citations for articles in the updated review.

LITERATURE REVIEW

General Findings

While the FOP scientific literature is nuanced, the following themes emerged:

- A FOP rating system or symbol can help consumers identify and select healthy foods.
- Consumers generally prefer simple labels (such as the ones using a summary system).
- While more recent studies have examined which type of labels (summary system or nutrient specific) work best, additional research is needed to understand whether consumers' use of these labels result in healthier diets and better health outcomes.
- Some manufacturers have reformulated products following the implementation of FOP nutrition symbols; some evidence suggests increased sales of products bearing a FOP symbol.
- Institutional endorsement of logos may be related to greater confidence in the label.

Introduction

Consumers can use the Nutrition Facts label (NFL) to learn about the product's nutrients and how a serving of that product fits into the context of their daily diet. In recent years, the market has seen a plethora of nutrition indicators on the front panel of the food label, highlighting nutrients that consumers might want to consume more of or those they might want to limit. These FOP nutrient

representations can most easily be grouped into two types: 1) Summary and 2) Nutrient-specific [Andrews et al. 2014] (See Appendix A, Table 1 for examples). Summary indicators are evaluative; that is, they provide an overall interpretive assessment of the healthfulness of a serving of the food, based on a proprietary algorithm. Nutrient-specific indicators, on the other hand, also called “reductive” indicators, are so called because they present a ‘reduced amount’ of the product’s nutrient content on the front of the package.

The scientific literature on FOP nutrition labeling has been the subject of several reviews and reports; we review and summarize them below, and then provide an update of the recent literature (2016 to 2019).

Results of Key Systematic Reviews (2005 to 2016)

A 2005 literature review on consumer understanding and use of nutrition labeling summarized more than 100 studies on NFL usage and FOP nutrition information [Cowburn and Stockley, 2005]. This review was one of the first to conclude that, although consumers report high usage of the NFL, actual usage is likely much lower. The studies reviewed showed that consumers could perform information retrieval tasks and simple calculations using the NFL but it was difficult for them to fully interpret nutrition information on the food label. The review concluded that interpretational aids could contribute to consumers making healthy point-of-purchase choices and moreover, that these aids could help consumers interpret the contribution of the food to the overall diet.

The first large systematic review of FOP nutrient indicators was conducted by the National Academies of Sciences, Engineering, and Medicine (NASEM, formerly the Institute of Medicine (IOM) IOMa, 2010). This report, requested by the U.S. Congress, evaluated the international landscape on FOP nutrition symbols generated by manufacturers, supermarkets, organizations, and governments. The report discusses three types of FOP symbols: 1) Nutrient-Specific Systems; 2) Summary Indicator Systems; and 3) Food Group Information Systems. The overall conclusion was that a FOP rating system or symbol could help consumers identify and select healthy foods, that calories and serving size would be helpful to include in the symbol, and that further testing of consumer use and understanding of “nutrient-specific information” or a “summary indicator” would be necessary. The NASEM report also concluded that a FOP symbol should be geared toward the general population.

The NASEM followed up the report with a Phase II report (IOMb, 2012), focused on consumers’ use of FOP symbols. The Phase II report concluded that, for a FOP symbol to encourage healthier food choices, a simple FOP summary symbol “...that serves as a signal or cue...” would be better than detailed information about nutrient content; the Phase II report recommended “...shifting from an informational approach to an interpretive one...,” and asserted that a successful symbol system would encourage product reformulation or development of products that meet the criteria.

Meanwhile, FDA commissioned a literature review to update the 2005 literature review discussed above. The 2011 FDA review (published by Hersey, et al. 2013) consisted solely of scientific studies on FOP and Shelf Label Nutrition Systems - to learn which types of FOP systems are most effective for influencing healthy food choices. Analysts searched 17 literature databases (e.g., PubMed, Web of

Science, ScienceDirect) using a targeted search algorithm. Thirty-eight out of 111 articles were retained for inclusion in the review. This literature review found that summary systems incorporating text and color worked better than those using only numeric information in attracting consumer attention and getting them to make healthier food choices - but that the nutrient-specific systems (the reductive indicators) worked better than the single summaries for providing consumers with details about what made the food healthy.

In 2016, FDA commissioned an update to the 2011 literature review discussed in the previous paragraph. This update captured the scientific literature on FOP from 2010 to August 2016 (RTI, 2016). Following the format of the previous literature reviews, the Addendum examined 79 articles and summarized them using the same categories identified in earlier reviews. Similar to previous reviews, the Addendum reported that 1) the literature suggests that graphic elements help consumers with food purchase decisions; 2) consumers – especially diverse subpopulations - prefer simple labels over those that have numerical information; 3) color coding with some text leads to better understanding of the nutrition information; 4) there is not enough evidence to indicate exactly which type of FOP label most influences consumers behavior; and 5) there is some evidence that FOP labels influence sales but no evidence on whether they lead to decreasing consumption of nutrients to limit or increasing consumption of nutrients to get enough of.

Results of Key Systematic Reviews (2016 to 2018)

The FDA updated the 2016 FOP literature review by reviewing the scientific literature on FOP from August 2016 to October 2018, using the same targeted database search algorithm and the analytical categories used in earlier reviews. Fifty-one scientific articles on FOP were analyzed for this FOP literature update. Table 1 below presents the highlights and conclusions of this literature review by analytical category.

Table 1. Highlights and Conclusions of updated FOP nutrition labeling literature by analytical category (August 2016 to October 2018)

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
Attention and Processing	<ul style="list-style-type: none"> Multiple FOP labeling systems were examined in the identified studies, including: Multiple Traffic Light, Guideline Daily Amounts, 5-Color Nutrition Label (a summary system proposed to France Health Minister, which later was updated to Nutri-Score), Guiding Stars, Health Star Rating, Health checks, NuVal, Logos, and warning signs. Studies have shown that FOPs, health claims, and warnings all drew consumers' attention. Whether consumers noticed FOPs and how much attention consumers attribute to FOPs varied by different factors (such as the type of FOP, the design of FOP, and the presence of educational effort). Furthermore, the interaction between FOPs and other marketing components on the package was emphasized.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<ul style="list-style-type: none"> One study (De la Cruz-Gongora et al. 2017) found that FOP symbols were perceived as easy to understand, highly acceptable, and useful for decision making, compared to Rating Stars, Guideline Daily Amounts, and Multiple Traffic Light. FOP labels are used differently depending on time pressure. One study (Reis et al. 2016) looked at how time-constraint plays a role in consumers' attention process and found that while time-constraint did not largely change the way consumers visually processed images of bottled products, it was linked to more fixating time on the information that differentiates among labels (FOP, nutrition claim, and processing claim). Another study (Sanjari et al. 2017) found that time pressure interacts on consumers' processing mode. <p>Conclusion: These studies extend the findings of the 2016 RTI Addendum which found that FOP labels catch consumers' attention; the newer studies highlighted interactions among a) FOPs, b) other marketing components on the package, and c) time pressure.</p>
Liking, Satisfaction, and Label Preference	<ul style="list-style-type: none"> Our review identified nine studies in this category, with three experimental studies, three cross-sectional surveys, two focus group studies, and one systematic review. These studies were conducted in different countries, including Australia, France, Uruguay, Germany, and Canada. Multiple FOP labeling systems were examined in the identified studies, including: Daily Intake Guide, Multiple Traffic Light, Health Star Rating, Nutri-Score (a summary FOP system proposed to the French Health Minister), SENS (a summary FOP system proposed by the French retailers), Modified Reference Intakes, and warnings. Results from these studies suggest that consumers think FOP labels are more useful than health claims or warnings, and they prefer simple to use and interpretive FOP labels (such as Health Star Rating and Nutri-Score) over others. <p>Conclusion: Consistent with 2016 RTI Addendum, results from these recent studies reveal that despite some varied preferences, consumers prefer simple labels, such as the ones using a summary system (e.g., SENS).</p>
Understanding	<ul style="list-style-type: none"> Our review identified 16 studies in this category, with 11 experimental studies, two quasi-experimental study, one focus group study, and one study using sales data and convenience sample survey. These studies were conducted in different countries, including US, France, Norway, Mexico, Australia, Germany, Brazil, Uruguay, and Canada. Multiple FOP labeling systems were examined in the identified studies, including: Single and Multiple Traffic Light, Keyhole, Guideline Daily Amounts, 5-Color Nutrition Label (a summary system proposed to France Health

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<p>Minister, which later was updated to Nutri-Score), Guiding Stars, Health Star Rating, binary check, NuVal, Facts Up Front, logos, and warnings.</p> <ul style="list-style-type: none"> Studies found that consumers' ability to understand different FOPs differed. In general, summary systems (Keyhole, binary check symbol, logos, and rating stars) were easier to understand compared to nutrient specific systems (such as Guideline Daily Amounts). However, one study (Cook et al., 2017) suggested that while a symbol-based (Stars) label helps consumers understand and choose a product in a comparative setting when they elaborate on the importance of nutrition information, the more complex label (Facts Up Front) helps consumers to interpret it when distracted. Consumers in general lack understanding of various FOPs. However, one study (Julia et al., 2016) showed that when the FOP label was presented with educational information, understanding was improved. <p>Conclusion: The updated literature review confirms the 2016 RTI findings. Studies indicate FOPs in general can help consumers to understand nutrition information, but to different extents and suggests that the more simplified FOPs are easier for consumers to understand.</p>
Effects on Use and Likely Purchase Behavior	<ul style="list-style-type: none"> Our review identified 23 studies in this category, with 19 experimental studies, two quasi-experimental study, one set of open interviews, and one study using sales data and convenience sample survey. These studies were conducted in the US, France, Australia, New Zealand, Uruguay, and Canada. The labels examined include the NuVal, 5-NCL, Keyhole Symbol, Traffic light, Daily Intake Guide, Health Star Rating, Guideline Daily Amounts, Guiding Stars, Facts-up-Front. Several studies showed that FOP labels led to selections of "mock" foods with better nutrition profiles. Several studies showed greater purchase intention for products with FOP symbols versus those without a symbol but one study on willingness to pay found no effects. Some studies found no purchase intention effects. FOP symbol rated third behind bottle design and general claims in purchase intention effects. In another study (Georgina, et al, 2017) Health Stars had significant effects (more stars versus fewer) for purchase intentions but the image of the product had a greater effect than the Health Stars. <p>Conclusion: Studies suggest that FOP nutrition symbols lead to mock 'purchase' of foods with better overall nutrition profiles, but results appear to be mixed on experimental and self-assessed purchase intentions; some studies showed significant FOP effects and others did not.</p>
Effects on Sales (Purchases)	<ul style="list-style-type: none"> Our review identified 10 studies in this category, with 4 experimental studies, one quasi-experimental study, three qualitative studies using interview methods, two product content analyses, and one study using sales data and a convenience sample survey.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
and Consumption	<ul style="list-style-type: none"> • These studies were conducted in the US, Turkey, New Zealand, Uruguay, and Canada • Lesser-known brands, versus brand leaders, showed positive sales effects when bearing FOP nutrition symbol. • A study on Guiding Stars™ show an increase in product sales for products bearing the symbol. • Several studies showed evidence of product reformulation toward removal of sat-fat, <i>trans</i>-fat, and sodium with FOP implementation. <p>Conclusion: The studies suggest that implementation of FOP Nutrition symbols has led to product reformulations and there is some evidence of increases in sales of products bearing a FOP symbol.</p>
Effects on Educational Differences	<ul style="list-style-type: none"> • Our review identified 10 studies that measured effects on education, with 4 experimental studies, 5 surveys, 1 set of focus groups, and 1 literature review. (1 study was multi-modal.) • These studies were conducted in France, Mexico, Canada, Uruguay, Germany, Australia, and the USA. • Summary systems (versus nutrient-descriptive systems) worked best for those with a less deliberative style of making food selections, i.e., those with high nutrition knowledge and those with low nutrition knowledge but high motivation. • There were very small differences in preference for certain labels by education; no difference in healthfulness of food choice; understanding, self-reported use, trust. <p>Conclusion: Although one study found differences in response to food labels by nutrition knowledge and motivation to eat healthfully, education-level was not revealed to be a significant factor in consumers' differentiating of FOP labels.</p>
Effects on Diverse Populations	<ul style="list-style-type: none"> • Our review identified 7 studies in this category, with 4 experimental studies, one set of focus groups and two surveys. • These studies were conducted in Uruguay, Mexico, France and Australia. • FOP effects seen for low-income children but not for middle and higher income. • For children in general (Uruguay), claims and FOP symbols led to increases in understanding of product healthfulness. <p>Conclusion: While results from the studies varied, they point toward positive comprehension effects of FOP nutrition information for low-income children.</p>
Evaluation of Government FOP Nutrition Symbols	<ul style="list-style-type: none"> • One study (Acton, et al., 2018) revealed that when a government attribution was present on a health warning label, it increased the believability of the label and the possible influence on likelihood of purchase. • Another study (De la Cruz-Gongora et al., 2017) found that while symbol schemes in general were perceived as easy to understand, highly acceptable, and useful for decision-making, institutional endorsement of logos was related to greater confidence in the label.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	Conclusion: These studies highlighted the potential benefits of having a government-created symbol.

In January 2019, the World Cancer Research Fund released a report entitled “Building momentum: lessons on implementing a robust front-of-pack food label” that focuses on instructions for government implementation of FOP nutrition labels. Authors conducted a literature review on challenges to international, government implemented nutrition labels and interviewed 23 international policymakers, academics, advocates. With a focus on interpretive FOP labels –which they prefer over nutrient-specific systems - the report contains recommendations for the development, design, implementation, defense, monitoring and evaluation of the FOP. The report recommends governments institute mandatory FOP labels to overcome limited industry uptake but acknowledged that voluntary labels will also help to achieve public health goals by adhering to a process starting with clear policy objectives, knowledge of the legal context, cultivating partners and stakeholders, implementing well-designed public education, and evaluating the labels’ effectiveness post implementation. The report cited challenges to government FOP label implementation - specifically tactics to delay, divide, deflect, and deny.

Additionally, in 2019 the World Health Organization (WHO) released a manual entitled, “WHO guiding principles and framework manual for front-of-pack labelling for promoting healthy diets”. The document is meant to support countries in the development, implementation, and monitoring and evaluation of an appropriate FOP system to help improve dietary patterns and reduce the burden of diet-related noncommunicable diseases. The five overarching guiding principles for FOP that form the basis of the manual are as follows:

- Principle 1: The FOP system should be aligned with national public health and nutrition policies and food regulations, as well as with relevant WHO guidance and Codex guidelines.
- Principle 2: A single system should be developed to improve the impact of the FOP system.
- Principle 3: Mandatory nutrient declarations on food packages are a prerequisite for FOP systems.
- Principle 4: A monitoring and review process should be developed as part of the overall FOP system for continuing improvements or adjustments, as required.
- Principle 5: The aims, scope, and principles of the FOP system should be transparent and easily accessible

Results of Key Systematic Reviews (2018 - 2021)

Mirroring methods discussed in the previous section, FDA further reviewed the literature, beginning where the last review, conducted August 2016 - October 2018, was completed. The review in this section covers the scientific literature on FOP from November 2018 to August 2021, using the same targeted database search algorithm and the analytical categories used in earlier reviews. We analyzed one hundred and eight additional scientific articles on FOP for this update. Table 2 below presents the highlights and conclusions of this review by analytical category.

Table 2. Highlights and Conclusions of updated FOP nutrition labeling literature by analytical category (November 2018 – August 2021)

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
Attention and Processing	<ul style="list-style-type: none"> • Our review identified six studies in this category, including one experimental study, four surveys, and one narrative review. • These six studies were conducted in Brazil, Italy, and Uruguay. Three studies examined each country respectively, while three others examined FOP systems across all three countries. • Multiple FOP labeling systems were examined in the identified studies, including Multiple Traffic Light, Nutri-Score, Guidelines Daily Amounts, Facts-up-front, Health Logos, and Warning Labels • The studies highlighted interactions among: a) FOP labeling systems, b) nutrition information panels on the back or side of packages, c) color and shape, and d) processing time. • Warning Labels were found to be efficient in attracting consumers' attention and required less time to process than other FOP schemes (Totoro, 2018). One study (Deliza, 2019) found that, although warning signs (also called Warning Labels) are generally attended to by consumers, the familiarity of signs matters. Graphic warning signs that are commonly used to convey a 'warning message' outperformed other graphic warning signs in terms of their ability to facilitate the interpretation of nutrition information. Furthermore, black warning signs required significantly less time to be detected, compared to red signs, on color food labels. • Studies indicate that FOP labels help shoppers to distinguish between healthy and less healthy foods. One review (Temple, 2020) found the designs that appear to be most successful in this regard are Multiple Traffic Light symbols, Warning Labels, and Nutri-Score. Additionally, studies confirm the advantages of Warning Labels, Multiple Traffic Light symbols and Nutri-Score, compared to the GDA, to facilitate the identification of products with high nutrient levels. <p>Conclusion: These studies extend the findings of the 2016 RTI Addendum, which found that FOP labels catch consumers' attention. Additionally, one of the studies (Deliza, 2019) suggests that over time, as consumers become more familiar with FOP labels, they will become even more useful.</p>

<p>Liking, Satisfaction, and Label Preference</p>	<ul style="list-style-type: none"> • Our review identified 12 studies in this category, including three experimental studies, eight cross-sectional surveys, and one focus group study. • These studies were conducted in eight different countries: Australia, Brazil, Canada, Colombia, Portugal, Spain, the UK, and Uruguay. Two of the studies evaluated multiple countries. • Multiple FOP labeling systems were examined in the identified studies, including Multiple Traffic Light, Health Star Rating, Nutri-Score, Guidelines Daily Amounts, Warning Labels, Modified Reference Intakes, and logos. • Few studies have been conducted to compare participants' preferences for one type of FOP label over others. One study (Ares, 2020) found consumers have positive attitudes toward nutritional warnings. They were regarded as easy to understand and identify, compared to summary labels (i.e., Multiple Traffic Light symbols or Health Star Rating). • Another study (Talati, 2018) that compared five summary labels across 12 countries suggested that participants preferred the Multiple Traffic Light symbols over other summary labels. Additionally, no meaningful differences were observed between country and FOP type, indicating that culture was not a strong predictor of general perceptions. • However, another study (Dana, 2019) found different forms of FOPs featuring varying degrees of information about energy and specific nutrients were likely to be preferred and used by different market segments. For example, those who are more concerned about their health are more likely to use a FOP label. • Furthermore, an additional study (Pettigrew, 2021) found that participants preferred color versions of summary FOP labels over monochrome versions and those that included nutrient-specific information. <p>Conclusion: Results from these recent studies reveal that additional research should be conducted to determine which type of FOP is preferred by most U.S. consumers. However, based on these findings, it appears consumers prefer simple, color labels, such as the ones using a summary system (i.e., Multiple Traffic Light symbols).</p>
<p>Understanding</p>	<ul style="list-style-type: none"> • Our review identified 26 studies in this category, including eight experimental studies, 14 surveys, one focus group study, two systematic reviews, and one narrative review. • These studies were conducted in Belgium, Brazil, Bulgaria, Italy, Mexico, Netherlands, Spain, Switzerland, Thailand, Uruguay, and the United States. Three of the studies assessed findings across several countries. • Multiple FOP systems were examined in the identified studies, including Multiple Traffic Light symbols, Nutri-Score, Health Star Rating, Warning Labels, Reference Intake, and logos. • Studies found that, compared to purely informative systems (i.e., Guideline Daily Amounts), summary/interpretive label systems (i.e., Multiple Traffic Light symbols, Nutri-Score, and Health Star Rating) have the greatest potential to improve consumers' understanding of the total nutritional quality of foods. One study (Andreeva, 2021) found Nutri-Score is most effective at improving consumers' abilities to correctly classify food according to its nutritional quality. Additional studies have confirmed the effectiveness of Nutri-Score to

	<p>aid consumers in their ability to rank products according to nutritional quality (Egnell, 2019).</p> <ul style="list-style-type: none"> Studies found that Warning Labels, while less effective at aiding consumers' understanding of the total nutritional quality of a food, are significantly more effective at helping consumers identify products with excessive amounts of a particular nutrient (e.g., sugar, fat, saturated fat, and sodium). One study (Andrews, 2021) found Warning Labels were more effective for evaluating levels of negative nutrients and their associated disease risks compared to the Traffic Light Label (also called Multiple Traffic Light symbols) or no FOP label. <p>Conclusion: The updated literature review confirms the 2016 RTI findings. The adoption and implementation of a uniform FOP labeling system could be beneficial to consumers at the point of purchase, help consumers better understand nutrition information, and therefore could help consumers improve their diet quality leading to a reduction in the incidence of diet-related chronic diseases. The updated literature review also further supports the conclusions of FDA's previous updated literature review that the summary/interpretive systems are likely to be more effective than purely informative systems in helping consumers understand the total nutritional quality of foods.</p>
Effects on Use & Likely Purchase Behavior	<ul style="list-style-type: none"> Our review identified 20 studies in this category, including 10 experimental studies, six surveys, three systematic reviews, and one narrative review. These studies were conducted in Australia, Belgium, Canada, Chile, France, Israel, Morocco, Peru, Portugal, UK, Uruguay, and the United States. Four of these studies assessed findings across several countries. Multiple FOP labeling systems were examined in the identified studies, including Multiple Traffic Light symbols, Nutri-Score, Health Star Rating, Guidance Daily Amounts, Warning Labels, Reference Intake, and logos. These studies found that, compared to the control with no-interpretive-label, FOP labels were effective tools that helped consumers identify healthier food choices. The most effective labels were the Nutri-Score and the Multiple Traffic Light symbols, followed by the Warning Label, the Health Star Rating, and lastly the Reference Intakes (Talati, 2019). However, there was no robust evidence of superiority of a specific FOP scheme's effect, either on consumers' understanding of nutritional content or on food choices. <p>Conclusion: These recent studies suggest that FOP labels are effective at helping consumers identify products with higher nutritional quality and also may be effective at positively impacting consumers' intent to purchase healthful foods.</p>
Effects on Sales (Purchases) and Consumption	<ul style="list-style-type: none"> Our review identified 19 studies in this category, which included 13 experimental studies, three surveys, two systematic reviews and one narrative review. These studies were conducted in Brazil, Canada, Colombia, France, Singapore, Switzerland, the UK, and the United States. Two of the studies assessed findings across several countries. Multiple FOP labeling systems were examined in the identified studies, including Multiple Traffic Light symbols, Health Star Rating, Nutri-Score,

	<p>Warning Labels, SENS (<i>Système d'Etiquetage Nutritionnel Simplifié</i> [simplified nutrition labelling system]), Modified Reference Intakes, and symbols meant to indicate the product meets some “healthy” criteria.</p> <ul style="list-style-type: none"> • The use of online/simulated grocery store shelves and access to real-world sales data has enabled researchers to better understand the impact of FOP labels on product consumption. Overall, results show that the presence of FOP labels leads to product purchases. • However, not all FOP labels are equally effective. Warning labels, like “High-in” labels have been shown to be most effective at reducing the purchase of products that are high in negative nutrients. In contrast, summary labels, like the Nutri-Score, Multiple Traffic Light symbols, and Health Star Rating were found to be more effective with regard to overall healthy choices. • One study from the United Kingdom (Elshiewy, 2018) that examined real-world sales data of store-brand products that carried a voluntary Guidelines Daily Amount type scheme on the front of the food label found that the presence of the scheme resulted in greater sales of products that had fewer calories. Another study (Finkelstein, 2021) found Nutri-Score may be preferred if the goal is to improve overall diet quality, but Multiple Traffic Light symbols may perform better if the goal is to reduce total energy intake. • An economics study from France (Egnell, 2019), using data simulations, modeled the sales data of products carrying five different schemes (Nutri-Score, Health Star Rating, Multiple Traffic Lights, Reference intakes, and SENS to dietary intake data to estimate changes in chronic disease mortality by scheme. Results indicated that use of the Nutri-Score scheme led to the greatest estimated reduction in mortality (3.4%). <p>Conclusion: These findings suggest that FOPs can influence healthier food purchases in supermarkets and, with prolonged use, may lead to improved health outcomes.</p>
Effects on Educational Differences	<ul style="list-style-type: none"> • Our review identified two experimental studies that measured effects of FOPs on education and health literacy. The studies were conducted in Canada and the UK. • Multiple FOPs were examined, including Multiple Traffic Light symbols, Nutri-Score, Warning Label, Health Star Rating, and Nutrition Facts label. • These studies examined the impact of FOPs on participants’ ability to accurately identify the healthfulness of foods. • A study (Packer, 2021) that looked at Nutri-Score, Multiple Traffic Lights, Warning Schemes, and a “Positive Choice Tick” (i.e., a symbol indicating the food met some “healthy” criteria), found that, compared to a “no-symbol” food package, participants were able to correctly identify the three-category levels of healthfulness of the food. Further analysis indicated that more highly educated participants, versus those with lower education, identified healthfulness with more accuracy. However, regardless of education level, compared to a “no symbol” control, participants could use the schemes to accurately rank the foods’ healthfulness. • Another study (Vanderlee, 2021) that compared Multiple Traffic Lights, Health Star Rating, a Warning Label, and a “no symbol” control found that, to varying

	<p>degrees, all the schemes helped participants correctly identify the healthier and less healthy products compared to a “no symbol” product. However, there were notable differences between participants with lower health literacy and those with higher health literacy; both groups ranked the product correctly, compared to the “no symbol” condition but those with lower health literacy consistently ranked even the less healthy products as healthier.</p> <p>Conclusion: Both studies found that interpretive FOP schemes, versus a “no FOP” condition, helped all consumers, regardless of education or health literacy levels, to correctly assess a food’s healthfulness even if some differences between higher and lower education and health literacy were found.</p>
Effects on Diverse Populations (Income, Age, Race/Ethnicity, Minority)	<ul style="list-style-type: none"> • We identified 14 studies in this category, including eight experimental studies, two sets of focus groups, three surveys, and one systematic literature review. • These studies were conducted in Australia, Brazil, Chile, France, New Zealand, and Mexico. The systematic literature review included research from multiple countries. • These studies focused on a range within and between demographic categories and included low- and middle-income populations, parents, children and adolescents, college students, and individuals at risk for obesity and its associated diseases. • Multiple FOP schemes were evaluated in the studies, including Multiple Traffic Light symbols, Nutri-Score, Guiding Stars, Warning Labels, and Reference Intake Labels. • Studies found that, compared to no FOP label, all FOP schemes led to these populations selecting foods with a healthier nutrient profile, although between-scheme results were not consistent. • Nutri-Score appears to have potential to encourage the purchasing of products with higher nutritional quality among a variety of groups. One study (Egnell, 2019) found that students (ages 18-25) purchased more nutritious foods when foods had Nutri-Score labels compared to foods with either the Reference Intakes label or no label. In an additional study (Egnell, 2021), low-income participants purchased more nutritious foods when products had the Nutri-Score label compared to foods with the Reference Intakes label. <p>Conclusion: While results from the studies varied, they point toward positive effects of FOP labels on consumers’ ability to select healthier products among diverse populations.</p>
Evaluation of Government-Instituted FOP Nutrition Labeling Systems	<ul style="list-style-type: none"> • Our review identified six studies in this category, with one set of focus groups, three surveys, and one systematic review. • These studies were conducted in Australia, Denmark, Ecuador, France, and New Zealand. • These studies focused on a range of FOP schemes developed and instituted by the governments of the study countries. These FOP schemes included Nutritional Traffic Light (Ecuador), Nutri-Score (France), Health Star Rating (Australia and New Zealand), the Keyhole (Denmark), and the Whole Grain logo (Denmark).

	<ul style="list-style-type: none"> Multiple studies evaluated the course of performance of Australia/New Zealand’s Health Star Rating since its introduction in June 2014. Between 2015 and 2018, consumers’ overall awareness and trust in the Health Star Rating system has increased (e.g., prompted awareness increased from 33% in April 2015 to 84% in July 2018) (Jones, 2019). However, lower awareness is observed in consumers who are overweight, from rural areas, or consumers with lower incomes (Jones, 2019). Furthermore, it was found that better diet quality as defined by the Health Star Rating dietary index was associated with lower risk of all-cause and cardiovascular disease mortality among Australian adults, supporting continued use of the Health Star Rating (Pan, 2020). Findings from other studies include: (1) the use of the Danish FOP schemes (the Keyhole and the Whole Grain logo) was associated with better overall dietary quality, which was driven by lower intake of added sugar and higher intake of fiber (Rønnow, 2020); and (2) study participants in Ecuador showed a high level of knowledge of Nutritional Traffic Light but a low level of usage of this FOP scheme. <p>Conclusion: These studies highlighted the potential benefits of having a government-created and sponsored FOP labeling scheme for assisting consumer food choices.</p>
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Results of Key Systematic Reviews (2021 - 2022)

FDA further updated the 2018-2021 FOP literature review by reviewing the scientific literature on FOP from January 2021 to August 2022, using a slightly modified version of the targeted database search algorithm but the same analytical categories used in earlier reviews. Because of the proliferation in FOP schemes worldwide since the earlier iterations of this literature review, we included the names of the schemes to the targeted database search algorithms that were used in the 2016-2020 reviews (See highlighted text in Appendix B). We analyzed 77 scientific articles on FOP in the January 2021 to August 2022 FOP literature review update. Table 3 below presents the highlights and conclusions of this literature review by analytical category.

Table 3. Highlights and conclusions of updated FOP nutrition labeling literature by analytical category (January 2021 – August 2022)

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
Attention and Processing	<ul style="list-style-type: none"> Our review identified four experimental studies in this category. These studies were conducted in Chile, France, Portugal, and the United States. FOP labeling systems examined in the identified studies include Facts Up Front, Health Star Rating, Multiple Traffic Light, Nutri-Score, Reference Intakes, and Warning Labels.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<ul style="list-style-type: none"> • The studies highlighted interactions among types of FOP schemes, including black-and-white, and colored versions, and nutrition information panels on the back or side of packages. • Nearly all FOPs were found to capture attention and improve the ability of participants to estimate healthfulness of products compared to products with no labels. • Studies indicate that color FOPs are more effective than black-and-white labels in capturing attention, but that lack of knowledge about the FOP can undermine that effectiveness. One study that compared a 3-category Nutri-Score with a 5-category Nutri-score found that the 5-category scheme resulted in more accurate identification of healthful products, but study participants also spent more time processing the information in the 5-category scheme. <p>Conclusion: These studies extend previous findings, which found that FOP labels – particularly those utilizing color – catch consumers’ attention. Also, in keeping with the prior reviews, these studies suggest that familiarity with FOP labels will make them even more useful.</p>
Liking, Satisfaction, and Label Preference	<ul style="list-style-type: none"> • Our review identified seven studies in this category, with two experimental studies, three surveys, and two focus group studies. • These studies were conducted in Australia, Brazil, Chile, China, and India. Two of the studies assessed findings across several countries. • FOP labeling systems examined in the identified studies include Health Star Rating, Multiple Traffic Light, Nutri-Score, Reference Intakes, Warning Labels, and pictograms (e.g., teaspoons of sugar). • Although few studies compare participants’ preferences for one type of FOP scheme to another, one study (Bhattacharya, 2022) that compared five FOP schemes found Warning Labels to be the most preferred, followed by Multiple Traffic Lights. • In studies comparing different types of Warning Labels, one study (Khandpur, 2022) found triangular warning labels to be more useful than those displayed with a magnifying glass, while another (Mazzonetto, 2022) found that most participants preferred black rather than red warning labels regardless of shape. • Labels communicating teaspoons of sugar, whether in text or pictograms, were perceived as highly factual, relatable, and interpretable, and as having the most potential to influence attitudes and intentions (Miller, 2022b). • One study (Septia Irawan, 2022) analyzed Twitter posts concerning FOP labels, and found that the discussion was very limited; Nutri-Score was mentioned most often but with conflicting sentiments. Authors concluded that education programs are needed to educate consumers in order for FOP labels to be useful. • A study on stakeholder and consumer perspectives on FOP schemes (Xuejun, 2022) revealed the complexity of reaching consensus for FOP schemes, and that major barriers include agreement on FOP format and the limited knowledge of FOP labelling, pointing again to the need for educating consumers.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<p>Conclusion: These current findings reinforce the earlier finding that consumers prefer labels that convey a clear message. However, as with previous reviews, results from these recent studies reveal that the literature is not conclusive about consumer preferences on FOP schemes.</p>
<p>Understanding</p>	<ul style="list-style-type: none"> • Our review identified 16 studies in this category, with two experimental studies and 14 surveys. • These studies were conducted in Australia, Brazil, Canada, Chile, China, Ecuador, Greece, Mexico, Netherlands, Slovenia, South Africa, Spain, the United Kingdom, and the United States. Three studies assessed findings across several countries. • FOP systems examined in the identified studies include Health Star Rating, Multiple Traffic Light, Nutri-Score, Positive Choice tick, Reference Intakes, Warning Labels, health logos, and NutrInform Battery which has been proposed as an alternative to the EU's Nutri-Score scheme. • Studies continued to support the finding that summary/interpretive label systems (i.e., Multiple Traffic Lights, Nutri-Score and Health Star Rating) offer the greatest potential - compared to purely informative systems - to improve consumers' understanding of the nutritional quality of foods. Two studies (Packer, 2022; Fialon, 2021) found Nutri-Score performed best at helping consumers rank products according to nutritional quality. A newly introduced FOP, the NutrInform Battery, outperformed Nutri-Score in understanding and comprehensibility (Baccelloni, 2021), presumably because it provides information about nutrients per usual serving. • Additional studies confirm the finding that Warning Labels are more effective at helping consumers identify products with excessive amounts of a particular nutrient (i.e., sugar, fat, saturated fat, and sodium). • One Chilean study (Mediano Stoltze, 2021) examined consumer perception of the co-occurrence of Warning Labels and nutrient content marketing claims because in Chile the use of nutrient content marketing claims is not prohibited even when the food is required to carry a warning label (due to excessive nutrients to limit) and this could confuse consumers. The study found that Warning Labels can mitigate the "health halo" effect of nutrient content marketing claims on perceived healthfulness of the product. <p>Conclusion: The updated literature review confirms earlier findings and demonstrates that since most FOP labels help consumers understand nutrition quality of a food, the adoption and implementation of a uniform FOP labeling system could be beneficial to consumers.</p>
<p>Effects on Use & Likely Purchase Behavior</p>	<ul style="list-style-type: none"> • Our review identified 19 studies in this category, with nine experimental studies, six surveys, two systematic reviews, and two narrative reviews. • These studies were conducted in Australia, Belgium, Brazil, Canada, Columbia, Denmark, France, Germany, Israel, Italy, Mexico, Morocco, Netherlands, Peru, Poland, Portugal, Singapore, Spain, Switzerland, the United Kingdom, Uruguay,

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<p>and the United States. Four of these studies assessed findings across several countries.</p> <ul style="list-style-type: none"> • Multiple FOP labeling systems were examined in the identified studies, including Multiple Traffic Lights, NutrInform Battery, Nutri-Score, Health Star Rating, Guidance Daily Amounts, Warning Labels, Reference Intake, and logos. • Studies confirm earlier findings showing that compared to control with no interpretive label, FOPs are effective tools to help consumers identify healthier food choices. • Warning Labels are most effective in helping consumers to identify “high-in...” products, but Nutri-Score and NutrInform Battery were effective in helping to identify the healthiest and unhealthiest products. • However, robust evidence of superiority of a specific FOP scheme’s effect is still lacking. Studies show disagreement in the ability of a given FOP system to always improve consumers’ understanding of nutritional content or food choices. Several studies found no impact of FOP schemes on purchase intentions (Folkvord, 2021; Muzzioli, 2022; Leão, 2022; Medina-Molina, 2021), while one study (Richetin, 2022) found that the presence of an organic label drives the perception of healthiness, and inclusion of Multiple Traffic Lights did not change that impact. <p>Conclusion: These recent studies suggest that FOP schemes can be effective at helping consumers identify products with higher nutritional quality and can positively impact consumers’ intent to purchase healthful foods, with varying results.</p>
Effects on Sales (Purchases) and Consumption	<ul style="list-style-type: none"> • Our review identified 12 studies in this category, with 8 experimental studies, one survey, two systematic reviews, and one narrative review. • These studies were conducted in Australia, Canada, France, Korea, Singapore, Switzerland, the Netherlands, and the United States. Two of the studies assessed findings across several countries. • FOP labeling systems examined in the identified studies include Multiple Traffic Light, Health Star Rating, Nutri-Couleurs (France) Nutri-Repère (France), Nutri-Score, SENS (<i>Système d’Etiquetage Nutritionnel Simplifié</i> [simplified nutrition labelling system]), Warning Labels, Modified Reference Intakes, pictograms (e.g., sugar teaspoons), and nutrient content claims • Studies continue to make use of online/simulated grocery store shelves and access to real-world sales data, both of which enable researchers to better understand the impact of FOP labels on product purchase. Overall, there is a positive impact on consumers’ purchases as a result of the presence of FOP labels, with an increase in sales of products with healthier FOP scores and a decrease in sales of products displaying “high in” warning labels, particularly those indicating the product is high in sugar. However, a review examining studies of various FOP (Donini, 2022) found little evidence that clearly correlates FOP labels with health outcomes such as risk of obesity or other non-communicable diseases, primarily due to the lack of any long-term study periods.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<ul style="list-style-type: none"> • Not all FOP schemes appear to be equally effective. Warning Labels have shown to be most effective at reducing purchases of products high in a particular nutrient. Depending on the nuanced study specifics summary systems, such as Health Star Rating, Multiple Traffic Lights, and Nutri-Score vary in their ability to discourage purchases of products with high levels of nutrients of concern or in improving overall purchases of healthier products. • In one study (Dubois, 2021), sales data from 60 supermarkets showed that consumers who saw products labeled with Nutri-Score increased purchases of foods in the top third (i.e., healthiest) of the food category, but there was no change for purchases with medium, low, or unlabeled nutrient quality. The net result was a modest improvement in the overall nutritional quality of the purchased foods. Another study (Acton, 2021) found that Warning Labels and Multiple Traffic Light symbols were more effective at discouraging purchases of products high in nutrients to limit than positive Health Star Rating or Nutri-Score scores were at encouraging purchases of healthier products. And a third study (Kühne, 2022) found that although FOP labels boosted healthy food product sales, more products and calories were purchased, such that use of the FOP labels did not result in a reduction of calories purchased. • Results are somewhat clearer when assessing the impact of FOPs on reducing purchases of products high in added sugar. Studies from Australia (Miller, 2022a), the United States (Taillie, 2022) and a review that assessed findings across several countries (Scapin, 2021) reported that Warning Labels (both text and image-based) increased the likelihood that consumers would identify items high in added sugar. • One systematic review (Song, 2021) found that Nutri-Score and Warning Labels were effective in reducing purchases of less healthful products, while Multiple Traffic Light, nutrient warnings, and health warning labels were associated with the purchase of more healthful products. The Nutri-Score and Warning Labels were also associated with increased overall healthfulness of products across all purchases. Color-coded labels performed better at directing consumers toward more healthful products than black-and-white labels. <p>Conclusion: These findings suggest that simplified, summary, colorful FOP schemes can encourage healthier purchases in supermarkets but that more research is needed to demonstrate the ability of FOP schemes with regard to overall health and diet-related chronic disease outcomes.</p>
Effects on Educational Differences	<ul style="list-style-type: none"> • Our review identified two surveys that measured interactions among FOPs, education, and health literacy. • These studies were conducted in Canada and the United Kingdom. • The current studies examined the Multiple Traffic Lights and Nutri-Score label systems. • These studies examined the impact of education and health knowledge on the extent to which FOP labels affected participants' ability to accurately identify the healthfulness of foods.

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
	<ul style="list-style-type: none"> While face-to-face education significantly increased participants' understanding of the Multiple Traffic Lights system, and their knowledge, attitude, and perceptions toward assessing the healthfulness of products displaying these FOPs (Esfandiari, 2021), a study among medical professionals (Riccò, 2022) found that overall understanding was low, with less than half of the participants reporting any knowledge of Nutri-Score. <p>Conclusion: These studies highlight the importance of specific FOP labeling education in order to help consumers make informed, healthier choices.</p>
Effects on Diverse Populations	<ul style="list-style-type: none"> Our review identified 8 studies in this category, with one experimental study, one focus group, and six surveys. These studies were conducted in Australia, Belgium, Canada, Chile, China, France, India, Mexico, New Zealand, Poland, Taiwan, and the United States. These studies focused on a range of populations which included children, adolescents, parents, and students, and also reported results by gender. FOP schemes evaluated in the studies include Guideline Daily Amount, Health Star Rating (both simple and hybrid), Multi-Traffic Light, Nutri-Score, Guiding Stars, Warning Labels (both traditional and numeric), Reference Intake Labels, and health logos. Studies generally found that, among diverse populations, all FOP schemes led to participants making healthier decisions, although one focus group study reported that mothers expressed fatigue with Warning Labels four years after full implementation (Correa, 2022), and suggested the need to identify groups of consumers that could experience similar reactions over time and consider ways to address. Nutri-Score continued to show potential to encourage the purchasing of products with higher nutritional quality among different groups. A variety of age and gender groups reported knowledge and understanding of the Nutri-Score, and demonstrated improved ability to rank food items according to nutritional quality relative to the Reference Intake label (Andreeva, 2022; Ducrot, 2022). Additionally, Nutri-Score was found to be more effective in guiding students with lower health literacy, from non-university institutions, and with low self-estimated nutrition knowledge or low self-estimated diet quality to improve the nutritional quality of their food choices (Hoge, 2022). A study investigating gender differences (Meng, 2022) found men to be more responsive than women to color, while text information on the package affected women's but not men's perceptions of product healthfulness. <p>Conclusion: While results from the studies varied as in previous reviews, they continue to show generally positive effects of FOP labels on the ability of different populations to select healthier products. Of particular importance are findings on the influence of color and design in helping to inform purchasing decisions of these populations.</p>

ANALYTICAL CATEGORY	HIGHLIGHTS AND CONCLUSIONS
Evaluation of Government-Instituted FOP Nutrition Symbols	<ul style="list-style-type: none"> • Our review identified three studies in this category, with two narrative reviews and one report from a roundtable. • These studies were conducted in Israel, Italy, and the United Kingdom. • These studies focused on a range of FOP schemes developed and instituted by the governments of the study countries and provided summaries of government or expert positions on the current usage of FOP labels. • These FOP schemes included Health Star Rating, Healthy/Healthier choice, Heart/Health logos, Keyhole logo, Multiple Traffic Light, NutrInform Battery, Nutri-Score, Red and green FOP label, Reference Intakes, and Warning Labels. • Since it was introduced, Nutri-Score performance has been evaluated in multiple studies in France, where it was developed, as well as internationally. Nutri-Score has been found to be useful for consumers in determining the healthier choice products, although results are not always consistent. One study and position paper (Carruba, 2021) proposed that Nutri-Score is limited by providing an assessment of nutrient intake based on 100 grams of the product instead of a usual portion. This study suggested that the NutrInform Battery, which was developed in Italy and was intended to help consumers better understand how to improve their dietary choices, may perform better than Nutri-Score. An additional review (SINU Scientific, 2021) concurs, finding that the NutrInform Battery is more focused on helping consumers understand food choices that can lead to a reduction in obesity and non-communicable diseases. • Most FOP labels help consumers make informed choices but there is a lack of strong evidence indicating that one particular FOP is clearly superior to the others. The roundtable participants (Gibson-Moore, 2022) recommended using one consistent FOP scheme as an important consideration for ensuring that consumers notice the FOP label, become familiar with it, and develop confidence in its use. <p>Conclusion: These studies highlighted the potential benefits of having a government created and mandated FOP labeling system for assisting consumer food choices.</p>

Appendix A: Front of Pack Nutrition Labeling Schemes and Symbols Available Online and in the Scientific Literature in 2018.



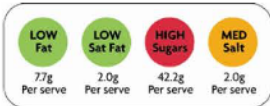
Appendix A.

TABLE 1. Overview of Existing Front-of-Package Programs

Nutrient-Specific Systems					
System Icon	Program Name	System Developer	Country	Criteria Publicly Available	Basis for Nutrient Criteria
	General Mills Nutrition Highlights	Food manufacturer	U.S.	Yes	FDA %DV's
	General Mills Goodness Corner	Food manufacturer	U.S.	Yes	FDA regulations for nutrient content claims
	Harris Teeter Wellness Keys	Retailer	U.S.	Yes	FDA regulations for nutrient content claims
	Kellogg's Nutrition at a Glance	Food manufacturer	U.S.	Yes	FDA %DV's presented as %GDAs
	Wegmans Wellness Keys	Retailer	U.S.	Yes	FDA regulations for nutrient content claims
	Health Star and Traffic-light System	Government agency	Australia and New Zealand	Yes	Australian Dietary Guidelines

Appendix A.

TABLE 1. Overview of Existing Front-of-Package Programs

Nutrient-Specific Systems															
System Icon	Program Name	System Developer	Country	Criteria Publicly Available	Basis for Nutrient Criteria										
	Nutriscore	Government agency	France	Yes	Santé publique France										
	Healthier Choice Symbol	Government agency	Singapore	Yes	Nutritional standards set by Health Promotion Board										
<p>Each grilled burger (94g) contains</p> <table><tr><td>Energy 924 kJ 220 kcal</td><td>Fat 13g</td><td>Saturated 5.9g</td><td>Sugars 0.8g</td><td>Salt 0.7g</td></tr><tr><td>11%</td><td>19%</td><td>30%</td><td><1%</td><td>12%</td></tr></table> <p>of an adult's reference intake</p> <p>Typical values (as sold) per 100g: Energy 966 kJ / 230 kcal</p>	Energy 924 kJ 220 kcal	Fat 13g	Saturated 5.9g	Sugars 0.8g	Salt 0.7g	11%	19%	30%	<1%	12%	Multiple 'Traffic Lights	Government agency	United Kingdom	Yes	UK's Dietary Reference Values
Energy 924 kJ 220 kcal	Fat 13g	Saturated 5.9g	Sugars 0.8g	Salt 0.7g											
11%	19%	30%	<1%	12%											
	UK Traffic Light	Government agency	United Kingdom	Yes	Regulation No. 1924/2006 for green/amber boundaries; COMA and SACN advice for amber/red boundaries										

Appendix A.

TABLE 1. Overview of Existing Front-of-Package Programs

Summary Indicator Systems					
System Icon	Program Name	System Developer	Country	Criteria Publicly Available	Basis for Nutrient Criteria
	American Heart Association Heart Check	Nonprofit organization	U.S.	Yes	FDA %DVs, implied nutrient content claims, coronary heart disease health claims
	Giant Food Healthy Ideas	Retailer	U.S.	Yes	Dietary Guidelines for Americans 2005, FDA regulation for "healthy"
	Guiding Stars	Retailer	U.S.	No	Proprietary algorithm based upon FDA, USDA, HHS, IOM, and WHO recommendations
	Kraft Sensible Solution	Food manufacturer	U.S.	Yes	<i>Dietary Guidelines for Americans</i> and authoritative statements from NAS and FDA
--Not able to locate graphic--	Nutrient Rich Foods Index	Non-industry experts	U.S.	Yes	FDA %DVs
	NuVal	Non-industry experts	U.S.	No	Proprietary algorithm based upon Dietary Guidelines for Americans and DRIs, as well as established data in scientific literature



Appendix A.

TABLE 1. Overview of Existing Front-of-Package Programs

Summary Indicator Systems					
System Icon	Program Name	System Developer	Country	Criteria Publicly Available	Basis for Nutrient Criteria
	PepsiCo Smart Spot	Food manufacturer	U.S.	Yes	Authoritative statements from FDA and NAS
	Smart Choices	Industry and non-industry consortium	U.S.	Yes	<i>Dietary Guidelines for Americans</i> and authoritative statements from NAS and FDA
	Canada's Health Check	Nonprofit organization	Canada	Yes	Canada's Food Guide
	Choices (EU)	Non-industry experts	European Union	Yes	FWHO guidelines for saturated and trans fats, sodium, sugars; dietary guidelines
	Sweden National Food Administration Keyhole	Government agency	Sweden	Yes	National Food Administration Regulation LIVSFS 2005:9
	Tick Programme	Industry and non-industry working group	Australia/New Zealand	Yes	Working-group determined values

Appendix A.

TABLE 1. Overview of Existing Front-of-Package Programs

Food Group Information Systems					
System Icon	Program Name	System Developer	Country	Criteria Publicly Available	Basis for Nutrient Criteria
	ConAgra Start Making Choices	Food manufacturer	U.S.	Yes	USDA's MyPyramid
	Whole Grain Council Whole Grain Stamp	Industry and non-industry consortium	U.S.	Yes	USDA's MyPyramid

Appendix B: Methods Report for Systematic Review of Literature on FOP Labeling Including Study Protocol

Introduction

FDA updated the 2016 FOP literature review by reviewing the scientific literature on FOP labeling in four stages. The Phase I literature search covered August 2016 to the end of March 2018. The Phase II search covered the literature from April 2018 to October 2018. The Phase III search covered literature from November 2018 to August 2021. The Phase IV search covered literature from January 2021 to August 2022, in order to capture literature published in early 2021 that may not have been included in databases at the time of the Phase III search. The first three stages used the same targeted database search algorithm and the analytical categories used in the earlier literature reviews for which this project is a follow-on. For the Phase IV search, the database search algorithm was expanded to include the names of the FOP labeling systems identified in the previous three stages.

Objective

Conduct a systematic review of the literature on front of package nutrition labeling/systems/frameworks/symbols/icons since August 2021, using the same search algorithm that had been used for the Hersey, et al (2013), RTI Addendum (2016), and FDA (2021) reviews.

Methods

Articles in English meeting the search criteria and time frame constraints (January 2021 to present for the Phase IV search) were eligible for inclusion in the literature search.

Search Strategy

We searched the following databases: PubMed, Web of Science, ScienceDirect, *under which the following databases are subsumed*: CHINAHL, Business Source Corporate, PsycINFO, AGRICOLA, Food Science and Technology Abstracts, New York Academy of Medicine Grey Literature Report, NTIS, AgEcon, and CAB Abstracts. The databases Web of Science, CAB Abstracts and New York Academy of Medicine Grey Literature Report, none of which had results in the Phase II or III searches, were not searched in Phase IV.

The following are the search terms used for each database identified above, with the additional terms used in Phase IV indicated by bold type, as well as the number of results returned by database. The first number on the “Results” line is from the Phase I search; the second number, the one in parentheses, is the number returned for the Phase II search; the third number, the one in brackets, is the number returned for the Phase III search, and the fourth number, the one in curly brackets, is the number returned for the Phase IV search. The total number of articles returned in Phases I, II, III and IV searches include many duplicates that were identified and deleted before researchers began the review.

PubMed

Results = 66 (18) [148] {152}

((("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers)) AND ("2021"[Date - Publication] : "3000"[Date - Publication])) OR ((**"Health Star"** OR **"Traffic Light"** OR **"Reference Intakes"** OR **"Warning symbol"** OR **"Heart-check"** OR **"Healthier Choice Symbol"** OR **"Nutri-Score"** OR **"Nutri score"** OR **Nutri-Score** OR **NuVal**) AND label* AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND ("2021"[Date - Publication] : "3000"[Date - Publication])))

Web of Science

Results = 22 (0) [0]

(TS=("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND TS=(consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers))

Science Direct

Results = 0 (advanced search) (3) [39] {45}

Title-Abstr-Key ("front of pack* nutrition label*" OR "FOP label*" OR "front of package label*" OR "shelf labeling" OR "shelf nutrition label*") AND Title-Abstr-Key (consumer* OR effective OR design* OR nutrition OR producer* OR retailer*) date: 2016-2018

Phase IV search information: Science Direct limits the number of Boolean operators that can be used in any one field at a time to no more than 8. Science Direct also does not support truncation. As a result, searches were conducted as follows:

- Title, abstract, keywords: ("front of pack nutrition label" OR "front of package nutrition label" OR "front of pack nutrition labeling" OR "front of package nutrition labeling" OR "front of pack label" OR "front of pack labeling" OR "front of package label" OR "front of package labeling" OR "FOP label") Year: 2021-2022
- Title, abstract, keywords: ("front of pack nutrition labels" OR "front of package nutrition labels" OR "front of pack labels" OR "front of package labels" OR "FOP labels" OR "FOP labeling") Year: 2021-2022

- Title, abstract, keywords: ("shelf label" OR "shelf labels" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels" OR "shelf nutrition labeling") AND (nutrition OR design OR effective) Year: 2021-2022
- Title, abstract, keywords: ("shelf label" OR "shelf labels" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels" OR "shelf nutrition labeling") AND (consumer OR retailer OR producer) Year: 2021-2022
- Title, abstract, keywords: ("Health Star" OR "Traffic Light" OR "Reference Intakes" OR "Warning symbol" OR "Heart-Check" OR "Healthier Choice Symbol") AND (label OR labels OR labeling) Year: 2021-2022
- Title, abstract, keywords: ("Nutri-Score" OR "Nutri score" OR Nutri-Score OR NuVal) AND (label OR labels OR labeling) Year: 2021-2022

Food Science and Technology Abstracts

Results = 13 (2) [0] {99}

((("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR shelf-labeling OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers)) OR (("Health Star" OR "Traffic Light*" OR "Reference Intakes" OR "Warning symbol" OR "Heart-check" OR "Healthier Choice Symbol" OR "Nutri-Score" OR "Nutri score" OR Nutri-Score OR NuVal) AND label* AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers))) AND (pd(20210101-20221231))

CINAHL

Results = 15 (1) [0] {96}

((("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels")) AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND (Limiters - Published Date: 20210101-20221231; English Language)) OR (("Health Star" OR "Traffic Light*" OR "Reference Intakes" OR "Warning symbol" OR "Heart-check" OR "Healthier Choice Symbol" OR "Nutri-Score" OR "Nutri score" OR Nutri-Score OR NuVal) AND label* AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR

"consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND (Limiters - Published Date: 20210101-20221231; English Language))

PsycInfo

Results = 7 (0) [0] {21}

(noft(("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers))) OR (noft(("Health Star" OR "Traffic Light*" OR "Reference Intakes" OR "Warning symbol" OR "Heart-check" OR "Healthier Choice Symbol" OR "Nutri-Score" OR "Nutri score" OR Nutri-Score OR NuVal) AND label* AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers))) AND pd(2021-2022)

Business Source Complete

Results = 8 (2) [0] {32}

((("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND (Limiters - Published Date: 20210101-20221231; English language)) OR ((("Health Star" OR "Traffic Light*" OR "Reference Intakes" OR "Warning symbol" OR "Heart-check" OR "Healthier Choice Symbol" OR "Nutri-Score" OR "Nutri score" OR Nutri-Score OR NuVal) AND label* AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND (Limiters - Published Date: 20210101-20221231; English Language)))

AGRICOLA (Dialog Proquest)

Results = 5 (1) [0] {71}

((ab,ti(("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR

"consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers)) AND (Limited by: Date: From 2021 to August 2022; Language:English)) OR (ab,ti(("Health Star" OR "Traffic Light*" OR "Reference Intakes" OR "Warning symbol" OR "Heart-check" OR "Healthier Choice Symbol" OR "Nutri-Score" OR "Nutri score" OR Nutri-Score OR NuVal) AND label* AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND (Limited by: Date: From 2021 to August 2022; Language:English))) AND (all(label*))

Cab Abstracts (via ProQuest Dialog)

Results = 14 (0) [0]

("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR "shelf-labeling" OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR consumers OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers)

AgEcon

Results = 18 (0) [0] {3}

Search filter = any field / (date added/modified 01/04/2016 to 31/12/2018)

Results total = 51 (0) removal of duplicates = 33; [1]

front of pack* nutrition label* = 15 (1=2016); [1]

FOP label* = 6 (none 2016-) [0]

front of package label* = 8 (none 2016-) [1, duplicate]

shelf labeling = 8 (only 1=2017) [0]

shelf nutrition label* = 14 (1=2016; 3=2017) [0]

- ("front of package nutrition label" OR "front of package nutrition labels" OR "front of pack nutrition label" OR "front of pack nutrition labels" OR "FOP label" OR "FOP labels" OR "front of package label" OR "front of package labels" OR shelf-labeling OR "shelf labeling" OR "shelf nutrition label" OR "shelf nutrition labels") AND (consumer OR "consumer behavior" OR "consumer behaviors" OR "consumer preference" OR "consumer preferences" OR "consumer satisfaction" OR "consumer response" OR "consumer responses" OR effective OR design OR designs OR nutrition OR producer OR producers OR retailer OR retailers) AND year:2021->2022
- "Health Star" AND year:2021->2022
- "Traffic Light*" AND year:2021->2022
- "Reference Intakes" AND year:2021->2022
- "Warning symbol" AND year:2021->2022
- "Heart-check" AND year:2021->2022

- "Healthier Choice Symbol" AND year:2021->2022
- "Nutri-Score" AND year:2021->2022
- "Nutri score" AND year:2021->2022
- Nutri-Score AND year:2021->2022
- NuVal AND year:2021->2022

NTIS

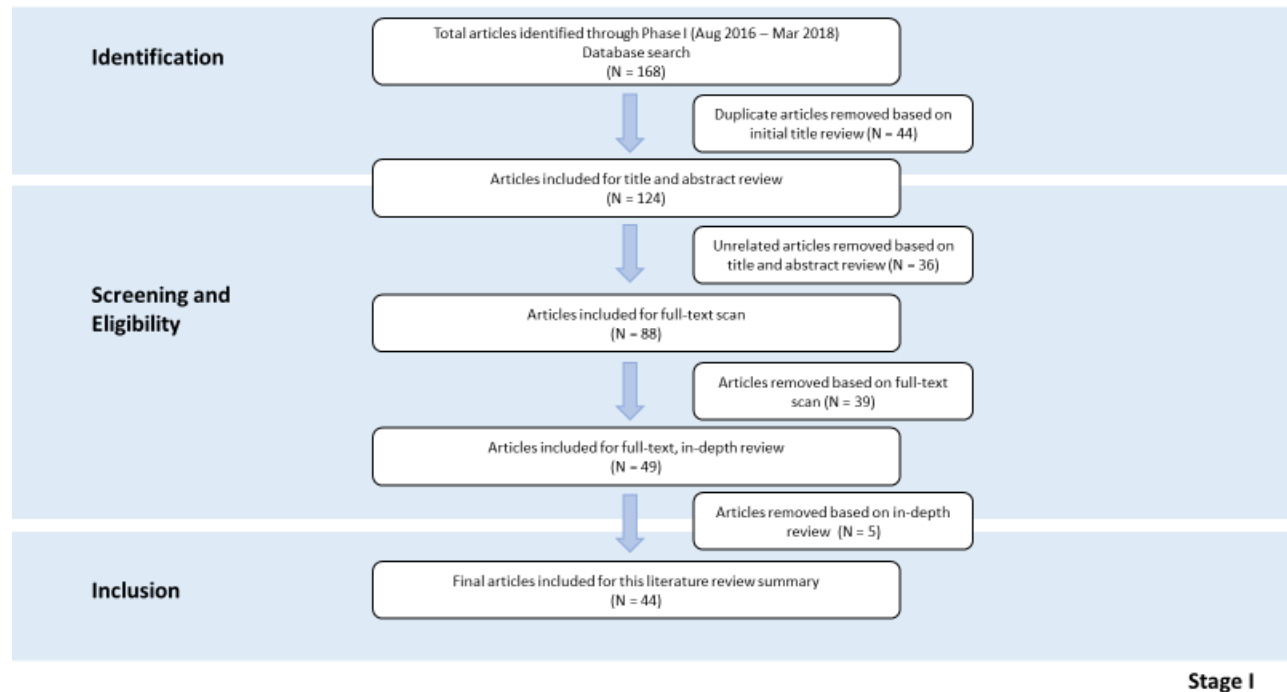
Results = {0}

No search terms provided for Phase I, II or III. For Phase IV, each labeling term listed below was searched individually. The consumer terms were not used, so as not to limit the search results.

- "front of package nutrition label"
- "front of package nutrition labels"
- "front of pack nutrition label"
- "front of pack nutrition labels"
- "FOP label"
- "FOP labels"
- "front of package label"
- "front of package labels"
- shelf-labeling
- "shelf labeling"
- "shelf nutrition label"
- "shelf nutrition labels"
- "Health Star"
- "Traffic Light*"
- "Reference Intakes"
- "Warning symbol"
- "Heart-check"
- "Healthier Choice Symbol"
- "Nutri-Score"
- "Nutri score"
- Nutri-Score
- NuVal

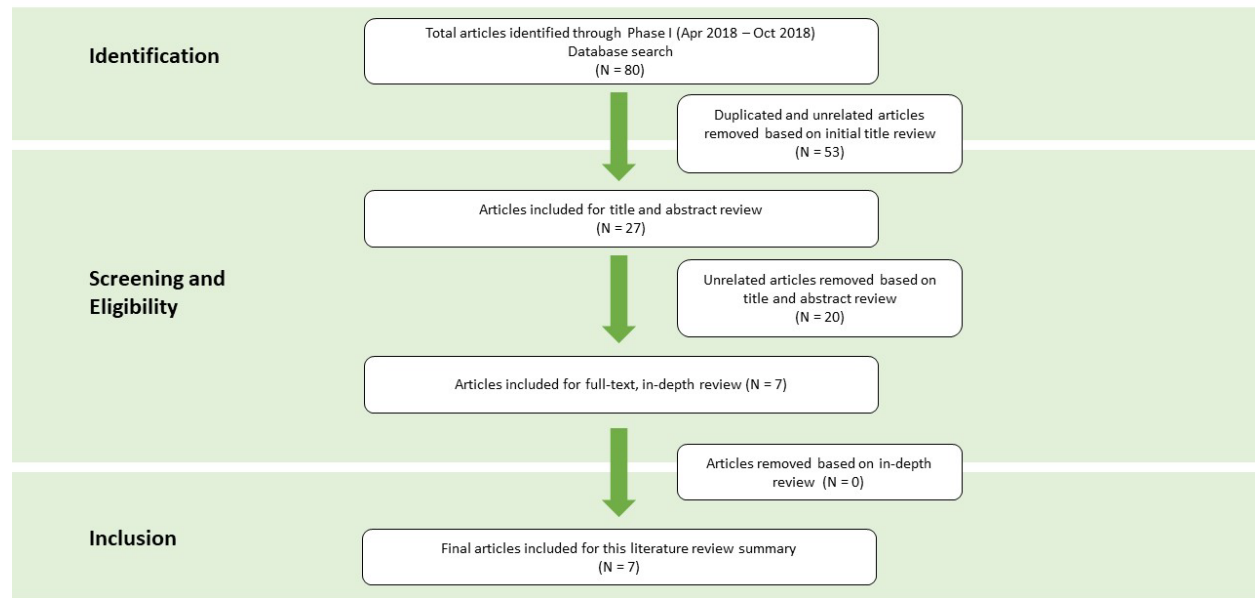
Phase I (Search period: August 2016 – March 2018)

Overall, 168 articles were identified in the literature search; 44 duplicates were removed; 36 articles were removed because they were not related to the research topic; 39 additional articles were removed because, 1) upon closer examination they were not related to the research topic, 2) they were already reported in one of the previous literature reviews, or 3) they were duplicates of articles in the review; five articles were removed at the final stage, after the in-depth review because they were determined by both researchers that they were not relevant to the research topic. 44 articles from this stage of search were included in this literature review summary.



Phase II (Search period: April 2018 – October 2018)

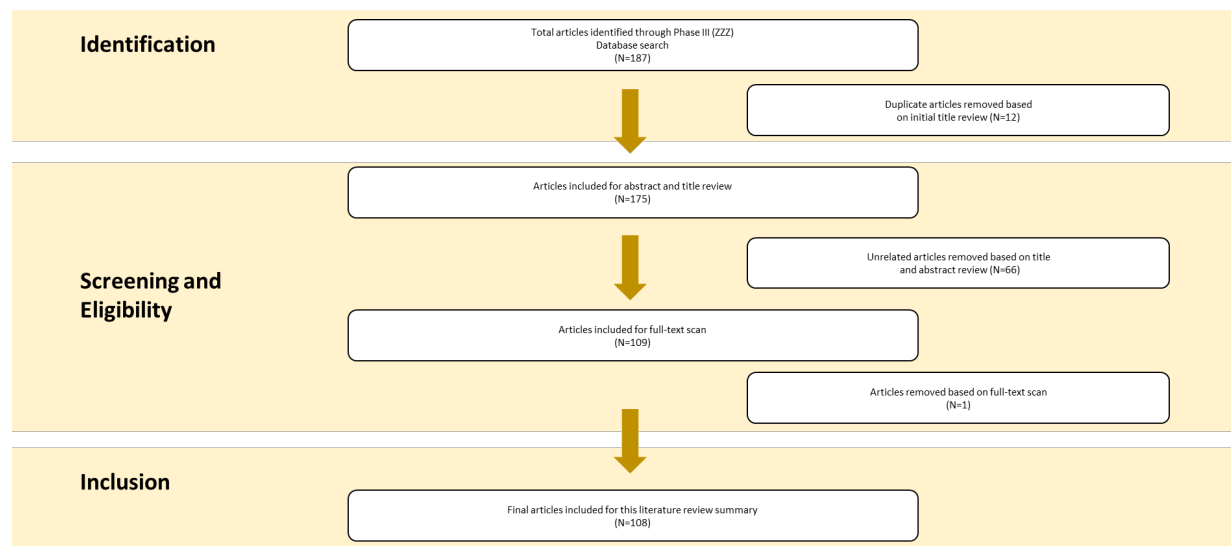
Overall, 80 articles were identified in the literature search; 53 duplicates were removed; 20 articles were further removed because they were not related to the research topic. Seven articles from this stage of search were included in this literature review summary.



Stage II

Phase III (Search period: November 2018 to August 2021)

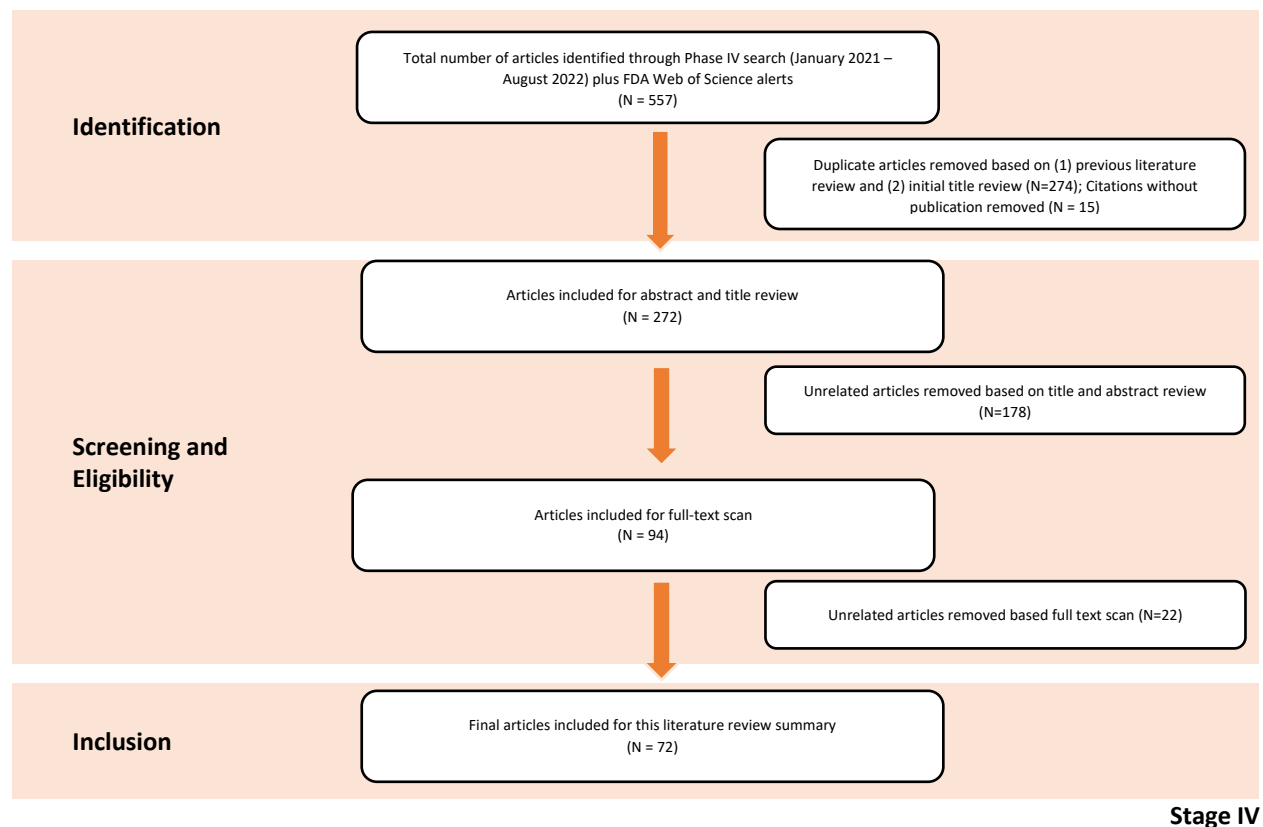
Overall, 187 articles were identified in the literature search; 12 duplicates were removed; 66 articles were further removed because they were not related to the research topic. One article was removed because it was not published in English. One hundred and eight articles from this stage of search were included in this literature review summary.



Stage III

Phase IV (Search period: January 2021 to August 2022)

Overall, 517 articles were identified in the literature search, to which 40 articles were added from FDA's Web of Science updates, resulting in 557 articles. Of those, 46 articles included in Phase III were removed as well as 224 duplicates and 15 citations for which no publication existed; 200 articles were further removed because they were not related to the research topic (178 removed based on title and abstract review; 22 removed following full text review). Seventy-two articles from this stage of search were included in this literature review summary.



Mechanism Used to Manage the Review


Search results were downloaded to- and delivered in- EndNote (20.4.1, Bld 16297), a reference management software program supported by FDA's reference library.

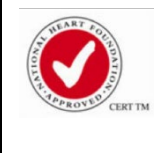
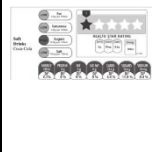
Selection Process


Researchers imported basic information for each of the 94 identified articles identified in Phase IV into Excel, into a file that listed author, year, title, study type, method, sample size, type of FOP, FOP image, country, highlight of findings, and whether the study included "education" as a variable. The articles were divided evenly among five researchers who read them and sorted them into the summary categories that had been used by the prior studies: Attention and processing; Liking, satisfaction, and label preference; Understanding, Effects on use and likely purchase; Effects on sales (purchases and






consumption); Effects on Diverse Populations; and Evaluation of Government FOP Nutrition Symbols. At the request of the HSIT, we added a category for Effects on Educational Differences. Researchers also wrote a summary of each article's findings. These summaries were used to develop overall conclusions by category. The Phase IV reviews were completed by one researcher, who sorted the articles into the same categories used in Phase III and summarized the articles' findings.





Appendix C: Summary of Articles Included in FDA Healthy Symbol Literature Review (2016 to 2022)

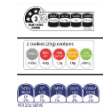


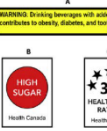
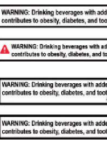
Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Akgüngör, et al.	The impact of nutrition labels on food sales: an iNutri-Score experiment in a Turkish supermarket	2016	Quantitative 1. iNutri-Score experiment 2. Stickers of nutrition info were put on the front of selected wafer packages, including numeric nutrition info + health tick 3. Sales of wafers were monitored before, during, and after the experiment	1. Nutrient specific 2. Health tick/check		Turkey	1. The presence of the FOP label itself increased consumer demand for the follower brand (but not for the leader brands). The impact of the FOP on sales differs across brands for foods in the same category. 2. The presence of a health tick on the FOP did not affect sales of more healthful foods.
Epstein, et al.	Effects of nutrient profiling and price changes based on NuVal® scores on food purchasing in an online experimental supermarket	2016	Quantitative 1. Online virtual supermarket 2. 2 x 2 factorial design - Nutrient profiling using NuVal - Taxes/subsidies based on nutrient profiling - 781 women	NuVal	N/A	US	1. Providing nutrient profiling scores (NuVal) improved overall diet quality of foods purchased. 2. Price changes were associated with an increase in protein purchased, an increase in energy cost, and reduced carbohydrate and protein costs. 3. Price changes and nutrient profiling combined were not associated with unique benefits beyond price changes or nutrient profiling alone.
Julia, et al.	Impact of the front-of-pack 5-colour nutrition label (5-CNL) on the nutritional quality of purchases: an experimental study	2016	Quantitative 1. LabStores: shopper laboratory stores, similar to regular stores except no other customers 2. General purchase instruction, assessment of shopping cart, customers didn't need to pay 3. Three experimental conditions: - Control - 5-CNL alone - 5-CNL + consumer information (on use and understanding of the label) 4. Outcome: nutritional quality of items purchased, awareness and understanding of the label 901 participants.	5-Color Nutrition Label (5-CNL)		France	1. Sales/purchase: the nutritional quality of items purchased - sweet biscuits: label + communication group picked higher nutritional quality products than other groups - no other difference observed for other food categories 2. Attention (recall of 5-CNL): higher in the label + communication group 3. Self-reported understanding: label + communication > label only > control
Wang, et al.	Snacks with nutrition labels: tastiness perception, healthiness perception, and willingness to pay by Norwegian adolescents	2016	Quantitative 1. Experiment: 3 tasks (compare healthfulness, provide prices, use of %DV to identify healthier products), 3 conditions - on the front of packages - Plain label (not nutrition info) - Plain label + Keyhole - Plain label + %DV nutrition facts 2. Survey n=566 adolescents	1. Keyhole symbol 2. % DV		Norway	1. The Keyhole symbol increased health perception without influencing taste perception or willingness to pay. 2. When asked to make a purchase from among the different products: 47.2% of the participants chose a snack product with Keyhole symbol, 25.8% chose one with the %DV, 27% chose plain-label snacks. 3. Norwegian adolescents had limited abilities to understand and use the %DVinfo.
Reis, et al.	Does a time constraint modify results from rating-based conjoint analysis? Case study with orange/pomegranate juice bottles	2016	Quantitative 1. 2 x 2 x 2 x 2 full factorial experimental design: bottle design, FOP label, nutrition claim, processing claim 2. Used eye-tracking technique 3. Examined participants' purchase intention - with time-constraint - without time-constraint n=100 fruit juice consumers	Traffic light		Uruguay	1. Attention (eye-tracking): when there's a time-constraint, there's a decrease in the percentage of consumers who fixated their gaze on nutrition claim and FOP. But in general, time-constraint didn't largely change the way consumers visually processed bottle images. 2. Attention (eye-tracking): when there's a time-constraint and evaluating time fixating on areas of interests in relation to the whole bottle, consumers spent more time on the information that differentiated among labels (nutrition claim, processing claim, and FOP). 3. Purchase intention: Bottle design seemed to matter the most, followed by processing claim, and FOP. 4. Purchase intention: higher purchase intention with time-constraint.
Talati, et al.	Do Health Claims and Front-of-Pack Labels Lead to a Positivity Bias in Unhealthy Foods?	2016	Quantitative 1. Experimental design + online survey with a web panel provider + mock packs 2. 4 x 4 x 4 design: - food type (cookies, corn flakes, pizza, yoghurt) - health claim (none, nutrient content, general level, higher level) - FOP (none, Daily Intake Guide/DIG, Multiple Traffic Light/MTL, Health Star Rating/HSR) 3. To assess whether a positivity bias would occur in unhealthy variations of four products that feature different health claims and FOPs. 4. Perceived healthiness, global evaluations (taste, etc.), and willingness to buy were measured. n=1,984 participants (adults + children over 10 yrs.)	1. Daily Intake Guide (DIG) 2. Multiple Traffic Light (MTL) 3. Health Star Rating (HSR)		Australia	1. Health claims did not produce a positivity bias. 2. FOP did elicit positivity bias: (1) DIG > MTL, led to positive global evaluations compared to control, but not on perceived healthiness or willingness to buy (2) HSR did not result in judgements that were sig. different from the control group.




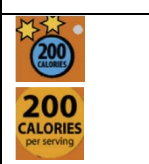
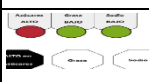

Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Talati, et al.	The combined effect of front-of-pack nutrition labels and health claims on consumers' evaluation of food products	2016	Qualitative 1. Focus groups 2. To explore participants' reactions when presented with both a FOP (Daily Intake Guide/DIG, Multiple Traffic Light/MTL, Health Star Rating/HSR) and a health claim (nutrient content, general-level-, or high-level), particularly how participants process discrepant information n=85 participants (adults + children over 10 yrs)	1. Daily Intake Guide (DIG) 2. Multiple Traffic Light (MTL) 3. Health Star Rating (HSR)		Australia	1. Results indicate that consumers generally find FOPs more useful than health claims. 2. Trust and ease of interpretation were most important for FOPs, which were more likely than health claims to meet criteria and be considered during product evaluation (especially the HSR and MTL).
Thomson, et al.	Tick front-of-pack label has a positive nutritional impact on foods sold in New Zealand	2016	Quantitative 1. Analyses of newly licensed Tick products (nutrient content + sales data) -45 newly licensed products 2. Interviews of four manufacturers of these products - 4 manufacturers	Tick (voluntary)		New Zealand	1. Eligible products (31% of all Tick products in these categories) removed 4.1 million megajoules of energy, 156 tonnes of saturated fat, 15.4 tonnes of trans-fat and 4 tonnes of sodium from food products sold in New Zealand over three years. 2. On average, Tick products were 14-76% lower in energy, saturated fat, trans-fat and sodium than non-Tick products. 3. Tick was used as part of manufacturers' marketing strategy, as it was perceived as a credible, well-recognized logo for New Zealand consumers.
Yang, et al.	Analysis of Front-of-Pack labelling systems on packaged non-alcoholic beverages for Australian consumer guidance	2016	Quantitative. To apply three FOP systems: TLS, %DI, and HSR to a selection of representative non-alcoholic beverages to assess these systems in terms of their potential comprehensiveness, consistency and utility.	1. % Daily Intake (%DI) 2. Multiple Traffic Light (MTL) 3. Health Star Rating (HSR)		Australia	1. The HSR system was concluded to be more suitable to label beverages based on better utility, applicability and ease of identifying healthier beverage choices; however, this system would benefit from further refinement. 2. In the HSR system, regular soft drinks scored one star and diet soft drinks scored two stars. For TLS, total fat for all beverages was low (green) except for dairy beverages which showed medium (amber).
Arrua, et al.	Impact of front-of-pack nutrition information and label design on children's choice of two snack foods: Comparison of warnings and the traffic-light system	2017	Quantitative. 1. The aim was to evaluate the relative influence of two FOP nutrition labelling schemes, the traffic light system and Chilean warning system on 2 popular snack foods 2. The children were asked to complete a choice-conjoint task with wafer cookies and orange juice labels, varying in label design and the inclusion of FOP nutrition information. 3. Half of the children completed the task with labels featuring the traffic-light system (n=217) and the other half with labels featuring the Chilean warning system (n=225) n= 442 children	1. Traffic Light 2. Chilean warning system		Uruguay	1. Children's choices of wafer cookies and juice labels was significantly influenced by both label design and FOP nutritional labels. 2. The relative impact of FOP nutritional labelling on children's choices was higher for the warning system compared to the traffic-light system
Arrua, et al.	Warnings as a directive front-of-pack nutrition labelling scheme: comparison with the Guideline Daily Amount and traffic-light systems	2017	Quantitative. 1. Warnings were compared to Guideline Daily Amounts (GDA) symbol and traffic lights in terms of goal-oriented attention, influence on perceived healthfulness and ability to differentiate b/w products 2. Goal-directed attention to FOP labels was evaluated using a visual search task in which participants were presented with labels on a computer screen and were asked to indicate whether labels with high sodium content were present or absent. 3. A survey with 387 participants was also carried out, in which the influence of FOP labels on perceived healthfulness and ability to identify the healthful alternative were evaluated. n=387	1. Warnings 2. Traffic Light 3. Guideline Daily Amounts (GDA)		Uruguay	1. Warnings improved consumers' ability to correctly identify a product with high content of a key nutrient within a set of labels compared with GDA and received the highest goal-directed attention 2. Products with high energy, saturated fat, sugar and/or sodium content that featured warnings were perceived as less healthful than those featuring GDA or traffic light 3. Warnings and the traffic-light system performed equally well in the identification of the most healthful product
Arrua, et al.	Influence of Label Design on Children's Perception of 2 Snack Foods	2017	Quantitative. 1. Labels of 2 snack products (yogurt & sponge cake) were assessed 2. Labels of each product were designed using 3 2-level variables: cartoon character (present vs absent), nutrition claim (present vs absent), and front-of-package nutritional information (Guideline Daily Amount system vs traffic light system). 3. The children examined 8 labels - 4 for each product after a Williams Latin Square Experimental Design 221 children from 3 SES levels (low, middle, high)	1. Traffic Light 2. Guideline Daily Amounts (GDA)		Uruguay	1. Low-income children showed a more positive attitude toward the products than did middle- and high-income children. Traffic light had no impact on children's liking of product. 2. The inclusion of a cartoon character in sponge cake labels significantly affected hedonic expectations regardless of income. 3. Middle- and high-income children tended to use the term "funny" more frequently and the term "boring" less frequently to describe labels that included the cartoon character, compared with those that did not.


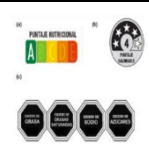





Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Brown, et al.	The influence of front-of-pack nutrition information on consumers' portion size perceptions	2017	Quantitative. 1. Participants (university students) were randomly assigned to one of 3 experimental groups: Group 1 viewed a kJ/100 g label, Group 2 viewed a HSR label and Group 3 received no information on nutrient composition (control). Genders were balanced between the experimental groups. 2. Participants were individually invited to serve themselves food portions they believed to be an adequate amount for someone their age and gender from a Fake Food Buffet (non-edible foods). n=117	1. HSR 2. Energy only label (KJ/100g)	None provided	Australia	1. Neither an energy only label (KJ/100g) or HSR influenced the self-serve portion size selection of foods and meal components from a fake food buffet. 2. It's possible that participants had pre-formed opinions on the (familiar) food products and did not consider the food labels when making their choices. Food labels may have a stronger influence when selecting from unfamiliar food items. 3. Authors acknowledge that influencing portion size selection of foods was not a direct aim of the HSR. 4. Consumer education is needed to improve understanding of front-of-pack labels to assist consumers in making appropriate portion size choices.
Cook and Kizilova	Direct and Indirect Processing Effects of Front-of-Package Labels	2017	Quantitative. Online study: comparative setting to measure differences in label formats between four cans of beef stew on a grocery shelf. 2 FOP Label Modality [evaluative (symbol-based) or objective (text-based)] × 3 Information Processing [immediate (control), elaboration, or distraction] n=311	1. Guiding stars [Evaluative] 2. Facts up front (GMA/FMI) [Objective]	None provided	US	1. Evaluative (stars) label helps consumers with diet-related diseases identify the healthiest product more often (50%) than when a decision is made immediately (versus 43%). 2. Under conditions of distraction, the majority (79%) of consumers are able to identify the healthiest product (out of four products) with the objective label. 3. No difference in identification under conditions of elaboration between consumers with and without diet-related diseases. 4. When consumers elaborate on the importance of nutrition information, a symbol-based (stars) label helps consumers choose a product in a comparative setting. When consumers are given the same amount of time to process product information, but are distracted, the subconscious can interpret the complex objective label with less effort, and perceptions of choice difficulty are improved.
De la Cruz-Gongora, et al.	Understanding and acceptability by Hispanic consumers of four front-of-pack food labels	2017	Qualitative. 1. Trained interviewers performed 18 focus groups with the participants 2. Participants were asked about their subjective understanding and acceptability of the FOP, displaying 16 generic breakfast cereal boxes designed for this study (four for each FOP), varying in their nutritional value. Afterwards, participants were asked to choose among the four cereal boxes the one to best communicate the product healthiness and their reasons for choice, proposals for improving the FOP, and desirable characteristics for new FOP. 3. Finally, a socio-demographic questionnaire was applied. Thematic analysis of the transcriptions of the focus groups was performed, using Atlas.tiV5 software. n=135 parents of 5th grade students	1. Logos, 2. Rating Stars, 3. Guideline Daily Allowances (GDA's) 4. Multiple Traffic Lights (MTL)		Mexico	1. Logos were perceived as easy to understand, highly acceptable, and useful for decision-making 2. institutional endorsement of Logos was related to greater confidence in the label 3. GDA's were hard to understand considering the nutritional knowledge and time needed for interpretation 4. Rating Stars were related to the quality in businesses rather than foods 5. MTL were viewed as indicating the high/low content of specific nutrients, but the meaning of the amber color was not fully understood 6. Participants highlighted the need for a simple FOP that allows easily identification of healthy products while considering food purchasing time limitations and interpretation of food portions.
Dukeshire and Nicks	Benchmarks and Blinders: How Canadian Women Utilize the Nutrition Facts Table	2017	Qualitative. Open-ended interviews on how females (45 min) use the NFT (Nutrition Fact Table) in their everyday shopping decisions and food consumption habits. Participants were provided with 2 cereal food packages with NFTs to assist in their responses. n=13	1. NFT 2. Health checks	N/A	Canada	1. Health claims and health checks drew attention to the product, but this elevated interest does not mean the product will then be purchased, as participants did not trust health claims and health checks enough to use them as a deciding factor in the purchase decision. People used the NFT to verify the nutritional content before deciding whether they would buy the product. 2. Consumers use the NFT primarily to avoid a particular nutrient related to a health condition.
Dunford, et al.	Color-Coded Front-of-Pack Nutrition Labels - An Option for US Packaged Foods?	2017	Quantitative. Categorized product labels n=175,198 products	Traffic Light	N/A	US	>40% of US packaged foods would receive the "red" light for sodium, total fat, and total sugars based on their algorithm for 'healthy'. >50% received a red light for total fat and sodium. Only 30% of products were considered "healthy" using the traffic light aggregate score method.
Dunford, et al.	A comparison of the Health Star Rating system when used for restaurant fast foods and packaged foods	2017	Quantitative. Nutrient content data for fast food menu items were collected from the websites of 13 large Australian fast-food chains. Scored 1529 fast food products and 3810 packaged food products for the "Health Star Rating." Statistics describing HSR values for fast foods were calculated and compared to results for comparable packaged foods. n=1529 fast food products and 3810 packaged food products	Health Star Rating (HSR)	N/A	Australia	1. The mean HSR for the fast foods was 2.5 and ranged from 0.5 to 5.0 and corresponding values for the comparator packaged foods were 2.6 and 0.5 to 5.0. 2. Support for the idea that HSR system could be expanded to Australian fast foods. There are likely to be significant benefits to the community from the use of a single standardized signposting system for healthiness across all fresh, packaged and restaurant foods.







Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Fernan, et al.	Health Halo Effects from Product Titles and Nutrient Content Claims in the Context of "Protein" Bars	2017	Quantitative. Between Subjects Experiment n=274	Traffic Light		USA	Product title (e.g., Protein Bar™) had a greater effect on measures of product healthfulness than did the traffic light symbol.
Georgina-Russell, et al.	The impact of front-of-pack marketing attributes versus nutrition and health information on parents' food choices	2017	Quantitative. Discrete choice experiment n=520 parents	Health Star Rating (HSR)		Australia	Parents preferred cereal with 5 stars and least preferred cereal with 2 stars, but the color of the cereal made the biggest impact on preference (because they really didn't like the colorful flakes!) "The present findings indicate that in order to shift parents' packaged food choices towards healthier alternatives, which is the aim of government-initiated FOP health and nutrition labeling systems, consideration needs to be given to not only the impact of such systems in isolation, but their effects when they co-occur with marketing attributes..."
Graham, et al.	Impact of explained v. unexplained front-of-package nutrition labels on parent and child food choices: a randomized trial	2017	Quantitative. Experimental study n=153 parent/child pairs	1. Traffic light 2. Facts-up-front	N/A	USA	Study found virtually no effect of either type of FOP label on selecting of more healthful product. Found some modest effects of in-aisle explanatory signage.
Hobin, et al.	Consumers' Response to an ONutri-Scorehalf Nutrition Labelling System in Supermarkets: Evidence to Inform Policy and Practice	2017	Quantitative. Quasi-experiment and "exit" survey 1. Experiment: n= 3supermarkets; 2. Survey: n=783 participants	Guiding Stars		Canada	Relative to control supermarkets, shoppers in intervention supermarkets made small but significant shifts toward purchasing foods with higher nutritional ratings; however, shifts varied in direction and magnitude across food categories. These shifts translated into foods being purchased with slightly less trans fat and sugar and more fiber and omega-3 fatty acids. We also found increases in the number of products per transaction, price per product purchased, and total revenues. Exit survey results show a modest proportion of consumers were aware of, understood, and trusted Guiding Stars in intervention supermarkets, and a small proportion of consumers reported using this system when making purchasing decisions. However, 47% of shoppers exposed to Guiding Stars were confused when asked to interpret the meaning of a 0-star product that does not display a rating on the shelf tag.
Julia, et al.	Perception of different formats of front-of-pack nutrition labels according to sociodemographic, lifestyle and dietary factors in a French population: cross-sectional study among the NutriNet-Sante cohort participants	2017	Quantitative. Cross sectional web-based survey n=21,702	1. Nutri-Score 2. SENS 3. Modified Reference Intakes 4. Multiple Traffic Lights		France	1. Nutri-Score received the most important number of favorable responses on positive perception. 2. The Nutri-Score appears to have a wide reach in the population and to appeal to subjects with lower adherence to nutritional recommendations.
Machin, et al.	Consumer Perception of the Healthfulness of Ultra-processed Products Featuring Different Front-of-Pack Nutrition Labeling Schemes	2017	Quantitative. 1. Participants were shown the labels of each product and asked to rate their perceived healthfulness and the frequency with which each product should be consumed 2. Results were analyzed using analysis of variance for statistical significance (P < .05) n=300	1. Guideline Daily Amounts 2. Traffic Light System 3. Monochromatic traffic light system		Uruguay	1. Low-income participants perceived ultra-processed products to be significantly (P < .05) more healthful than did middle- and high-income participants. 2. The lowest perceived healthfulness scores for low-income participants were obtained for products featuring the colored and monochromatic traffic light system whereas no significant differences (P > .05) among schemes were found for middle- and high-income participants.





Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Mhurchu, et al.	Effects of a Voluntary Front-of-Pack Nutrition Labelling System on Packaged Food Reformulation: The Health Star Rating System in New Zealand	2017	Quantitative. Observational study of the composition of packaged foods before and after the introduction of the HSR system in New Zealand. Homescan® data were obtained for 1. 2014 (n = 1726 households and 4.65 million products); 2. 2015 (n = 1827 households, 4.89 million products); and 3. 2016 (n = 1839 households, 4.89 million products).	Health Star Rating		New Zealand	Two years following adoption of the voluntary front-of-pack Health Star Rating System in New Zealand, approximately 5% of packaged food and non-alcoholic beverage products displayed HSR star graphic labels. Food groups with the highest rates of uptake of HSR labels were cereals, convenience foods, packaged fruit and vegetables, sauces and spreads, and 'other' products (predominantly breakfast beverages). The majority of products displaying HSR labels had star ratings greater than 3.0, and the median rating was 4.0. Products displaying HSR star graphic labels had significantly lower mean saturated fat, total sugar and sodium contents, and higher fibre content, compared to non-HSR products. Approximately eight in 10 products (83%) displaying HSR graphics had been reformulated to some extent, and small but significant favourable changes were observed in mean energy, sodium and fibre contents, compared with product composition prior to adoption of HSR.
Neal, et al.	Effects of Different Types of Front-of-Pack Labelling Information on the Healthiness of Food Purchases-A Randomised Controlled Trial	2017	Quantitative. In store experimental study comparing four FOP labeling schemes and the Nutrition Information Panel (NIP) using a Smartphone app in the store. The main outcome was the mean nutrient profile score for all food and beverages purchased over the four-week intervention period. n=1,578 participants	1. Health Star Rating 2. Multiple Traffic Light 3. Daily Intake Guide 4. Recommendation/Warning 5. Nutrition Information Panel		Australia	These data provide endorsement of the Australian Government's decision to adopt the HSR as their recommended front-of-pack labelling system. The HSR was as good as any other label that was tested in terms of the healthiness of purchased foods, while being superior to others in several aspects of consumer preference. It was also a front runner in terms of its utility across groups with a range of different levels of nutritional knowledge. This is an important attribute given the greater burden of diet-related ill health amongst less educated sectors of the population and the known difficulties that some groups have in understating nutrition information.
Ning, et al.	Dietary sodium reduction in New Zealand: influence of the Tick label	2017	Quantitative. Product examination (n=56) and semi-structured interviews (n=5)	Tick	N/A	New Zealand	Evidence of product reformulation (sodium-reduction) in "Tick-approved" products.
Pettigrew, et al.	The types and aspects of front-of-pack food labelling schemes preferred by adults and children	2017	Quantitative. 1. cross-sectional online survey of 2058 Australian consumers (1558 adults and 500 children) assessed preferences b/w a daily intake FOP, a traffic light FOP, and the Health Star Rating FOP. N=2058 (included adults & children)	1. Daily Intake 2. Traffic Light 3. Health Star Rating (HSR)		Australia	1. the Health Star Rating was the most preferred FOP (44%) and the daily intake guide was the least preferred (20%). 2. ease of use, interpretive content, and salience usually explained a respondent's preference 3. Findings support a simple to use, interpretive, star-based food label
Raine, et al.	Policy recommendations for front-of-package, shelf, and menu labelling in Canada: Moving towards consensus	2017	Consensus Conference (Global Recommendations)	N/A	N/A	Canada	Experts and professionals in Nutrition recommend standardizing FOP with an interpretive logo that distills meaning and utilizes a graduated scale to represent nutritional guidance.
Roseman, et al.	Attitude and Behavior Factors Associated with Front-of-Package Label Use with Label Users Making Accurate Product Nutrition Assessments	2017	Quantitative. 1. A between-subjects experimental design was employed 2. Participants were randomly assigned to one of four label conditions: Facts Up Front, Facts Up Front Extended, a binary symbol, and no-label control 3. Participants in one of four label condition groups viewed three product categories (cereal, dairy, and snacks) with corresponding questions 4. Used an online survey n=161	1. Facts Up Front 2. Facts Up Front Extended 3. a binary symbol 4. a no-label control		United States	1. Participants selected the more nutrient-dense product in the snack food category when it contained an FOP label 2. Subjective health and nutrition knowledge and frequency of selecting food for healthful reasons were associated with FOP label use (P<0.01 and P<0.05, respectively). 3. Both Facts Up Front (reductive) and binary (evaluative) FOP labels appear effective for nutrition assessment of snack products compared with no label




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Sanjari, et al.	Dual-process theory and consumer response to front-of-package nutrition label formats	2017	Quantitative. Systematic literature review n=59 published papers	N/A	N/A	Germany	1. Which type of format is effective across different shopping situations? Consumers' processing mode (system 1 - quick/automatic VS. system 2 - slow/deliberate) varies both within and between people and impacts effectiveness of a variety of FOP labels. Consumer's preferences vary. 2. Highly knowledgeable consumers care more about nutrients to limit. Those with low levels of knowledge but high motivation use similar heuristics but focus on different nutrients. High and low knowledge level consumers do not differ in their ability to make a healthy choice when using the nutrition label formats. Moderate level of knowledge use the slow/deliberate processing because they are not relying on a heuristic.
Sanjari, et al.	Choosing Fast and Slow: Processing Mode and Consumer Response to FOP Nutrition Label Formats	2017	Quantitative. Online experimental study: 2 (label format) X 2 (motivation: targeted, nontargeted). Mock pizza products. N=155 (Americans)	1. GDA 2. Traffic light	N/A	Germany	FOP labels are used differently depending on nutrition knowledge and time pressure. One Study found that processing mode mediates the impact of FOP label usage on making healthy choices. Intuitive versus deliberate mode... 2nd study found that time pressure and nutrition knowledge interact on processing mode. *This is a conference proceeding
Talati, et al.	The impact of interpretive and reductive front-of-pack labels on food choice and willingness to pay	2017	Quantitative. Discrete choice experiment; willingness to pay n=2069	1. Daily intake Guide 2. Multiple Traffic Light 3. Health Star		Australia	Interpretive FOPs with a summary indicator are more effective than reductive FOPs in facilitating healthier choices.
Talati, et al.	Consumers' responses to health claims in the context of other on-pack nutrition information: a systematic review	2017	Quantitative. Meta-analyses n=24	Traffic lights		Australia	Meta analyses was not symbol focused, but they found that traffic light symbols worked better than the NFL for helping participants correctly identify healthy and unhealthy products.
Yoo, et al.	Children and adolescents' attitudes towards sugar reduction in dairy products	2017	Quantitative. Cross-sectional survey - convenience sample (although the article says experimental design) n=646	Variety of traffic light symbols		Uruguay	Compared the effects of a sugar claim modulated by the presence of a traffic light symbol. Both 'claim types' increased understanding of product healthfulness but the traffic lights did not affect liking of the product.
Acton and Hammond	The impact of price and nutrition labelling on sugary drink purchases: Results from an experimental marketplace study	2018	Quantitative. 1. To examine the effect of FOP and sugary drink taxation on consumer beverage purchases 2. Experimental design: 4 x 5 within-between group design: - FOP: no label; star rating; high sugar symbol; health warning - price/tax conditions: 0%, 10%, 20%, 30%, and a variable tax proportional to free sugar level n=675	1. Health warning 2. High sugar 3. Health Star Rating (HSR)		Canada	1. The overall effect of labelling was not statistically sig. However, there was a trend for the 'high sugar' label to reduce the likelihood of selecting a sugary drink and encouraging participants to select drinks with less free sugar. 2. Results from the HSR are mixed: no impact on purchase of a sugary drink, a modest reduction in the grams of free sugar purchased, and an increase in the calories purchased. 3. As price increased, participants were significantly less likely to select a sugary drink, and selected drinks with fewer calories and less free sugar.
Acton, et al.	Consumer perceptions of specific design characteristics for front-of-package nutrition labels	2018	Quantitative. 1. To investigate consumer perceptions of several FOP label (health warning of sugar-sweetened beverages) design characteristics, including potential differences among sociodemographic sub-groups. 2. Experimental design: five primary design characteristics (border, background presence, background color, 'caution' symbol, and government attribution). 3. Outcomes: noticeability, readability, believability, likelihood of changing purchase choice.	Health warning		Canada	1. FOP labels with a border, solid background and contrasting colors increased noticeability. 2. Both a 'caution' symbol and a government attribution increased the believability of the labels and the perceived likelihood of influencing beverage choice.






Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Carter and Gonzalez-Vallejo	Nutrient-specific system versus full fact panel: Testing the benefits of nutrient-specific front-of-package labels in a student sample	2018	Quantitative. 1. To evaluate and assess nutrition judgement accuracy by comparing nutrition judgements to a nutrition expert criterion (NuVal) in three package conditions: - no nutritional information highlighted - nutrients highly related to nutritional quality highlighted using a FOP label - nutrients unrelated to nutritional quality highlighted using a FOP label 2. Experimental design: online via Qualtrics (69%) and in the lab (31%) 3. Lens model judgment analysis methodology n=297	Nutrition Keys Label (based on the General Mills nutrient-specific FOP label) - (DV%?)		US	Labels that included FOP information that was relevant to the overall nutritional quality of the product did not result in greater nutritional accuracy compared to an FOP with irrelevant information, or no FOP label at all. Author's discussion: "the practical utility of nutrient-specific labels for improving nutritional judgment is likely negligible".
Finkelstein, et al.	Identifying the effect of shelf nutrition labels on consumer purchases: results of a natural experiment and consumer survey	2018	Quantitative. Sales data evaluation and online convenience sample survey n=665	NuVal	N/A		Researchers evaluated the change in sales when NuVal changed its algorithm for scoring the nutritional quality of foods. When scores decreased, sales also decreased, but they couldn't control for anything except price -which had not changed. 44% noticed the NuVal label & 32% knew what the scores were about and the meaning of the scores. A very small fraction reported using the scores to influence purchases.
Gorski-Findling, et al.	Comparing five front-of-pack nutrition labels' influence on consumers' perceptions and purchase intentions	2018	Quantitative. Experimental Study n=1247	1. Single Traffic light 2. Multiple traffic light 3. Facts up front 4. NuVal 5. 0-3 star ranking		USA	DV= purchase intent, accuracy of interpretation. All labels improved nutrition accuracy better than no label. NuVal and MTL led to most accurate estimates of sat fat, sugar, and sodium. Single TL worked best when comparing similar products. None of the labels shifted purchase intentions.
Lima, et al.	How do front of pack nutrition labels affect healthfulness perception of foods targeted at children? Insights from Brazilian children and parents	2018	Quantitative. Web based controlled experimental study comparing three different FOP nutrition labeling schemes. 1. 316 children aged 6 -12 years 2. 278 parents of children aged 6-12	1. GDA 2. Traffic light 3. Warning system		Brazil	For parents, products with the warning system were rated significantly less healthful than those containing the GDA, whereas the TLS did not significantly differ from the other two systems. Age and socio-economic status influenced the effect of FOP labels on children's perceived healthfulness. Only 9-12 years old children from middle/high socio-economic status were influenced by FOP labels: the warning system and TLS reduced healthfulness perception of frosted corn flakes compared to the GDA system.
Lundeberg, et al.	Comparison of two front-of-package nutrition labeling schemes, and their explanation, on consumers' perception of product healthfulness and food choice	2018	Quantitative. Experimental study n=306	1. Traffic lights 2. Star-based		USA	Star system outperformed traffic light on healthfulness ratings; for both more and less healthful products. Purchase intent was not affected by type of system; participants said they would purchase the healthiest food regardless of system. Information explaining the system, versus the control condition of no explanation, made a difference for products in the mid-range of healthfulness (versus high and low) but there was no difference within the explanation types (gain, loss, loss+ gain).
Machin, et al.	Traffic Light System Can Increase Healthfulness Perception: Implications for Policy Making	2018	Quantitative. Experimental study n=1228	1. Multiple Traffic Light 2. Warning system		Uruguay	Warning system results similar to simplified traffic light system. For traffic lights, where at least two nutrients were "low in" (green) the product was perceived as healthier even in the presence of a "high in" (red) nutrient.
Tortora, et al.	Influence of time orientation on food choice: Case study with cookie labels	2018	Quantitative. 1. A choice conjoint task was designed using labels differing in type of cookie (chocolate chips vs. granola), FOP nutrition information (nutritional warnings vs. Facts Up Front system) and nutritional claim (no claim vs. "0% cholesterol. 0% trans fat") 2. 155 participants evaluated 8 pairs of cookie labels and selected the one they would buy if they were in the supermarket n=155	1. Facts Up Front 2. Claims		Uruguay	1. Participants with greater consideration of future consequences preferred the granola cookies, associated with health, while those who prioritized immediate consequences preferred chocolate chip cookies 2. nutritional warnings discouraged choice regardless of participants' time orientation






Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Acton, Vanderlee, & Hammond	Influence of front-of-package nutrition labels on beverage healthiness perceptions: Results from a randomized experiment	2018	Quantitative. 1. Experimental + Survey 2. Experiment: Participants were asked to rate the healthiness of soda, unflavored milk, and chocolate milk displaying one of four FOP conditions (no label + the other three listed on the right) 3. Survey: after the experiment component, participants were asked about their preference between summary indicator versus nutrient-specific FOP 675 participants	1. Numeric Rating 2. Health Star Rating (HSR) 3. Simplified traffic light (STL)		Canada	1. Consumers in the HSR and STL conditions were more likely to correctly perceive a chocolate milk beverage as 'moderately healthy'. 2. The largest proportion of participants (45%) indicated they would like to see both an overall health rating and nutrient-specific info. 3. Results suggest that the influence of FOP labels may vary based on the nutritional quality of food products and may have the greatest influence on consumer perceptions of 'nutritionally ambiguous' foods. 3. Consumers indicated almost unanimous support for implementing FOP nutrition labeling systems.
Ares, Varela, Machin, et al	Comparative performance of three interpretative front-of-pack nutrition labelling schemes: Insights for policy making	2018	Quantitative. 1. Visual search task - 112 participants 2. Online survey - 892 participants	1. Nutri-Score 2. Health start rating (HSR) 3. Nutritional warning		Uruguay	1. Effectiveness of capturing attention and affecting perception and purchase intention: Nutri-Score and warning did better than HSR. 2. Warning label had more effects on the perception (and intention) of unhealthy products
Billlich, Blake, Backholer, et al	The effect of sugar-sweetened beverage front-of-pack labels on drink selection, health knowledge and awareness: An online randomised controlled trial	2018	Quantitative. 1. Experimental - Online (controlled choice experiment) 2. Consumers' intended choice of Sugar Sweetened Beverages (SSBs) 994 young adults	1. Graphic warning 2. Text warning 3. Sugar information (# of tps of added sugar) 4. Health Start Rating (HSR)		Australia	1. All FOP groups had significantly less selection of SSB. 1. Results of this study could be a good argument against choosing warning label because even warning label has the greatest effect on reducing intended choice of unhealthy drinks, HSR is the only one encouraging healthy choices. 2. Results also suggest graphic design might be more effective than text format (effect: graphic warning > text warning) 2. The magnitude of effect was greatest for the graphic warning label. 3. Only the HSR label significantly increased selection of the HSR drinks.
Egnell, Ducrot, Touvier, et al	Objective understanding of Nutri-Score Front-Of-Package nutrition label according to individual characteristics of subjects: Comparisons with other format labels	2018	Quantitative. Experimental - Online 3,751 (started w/ 4,328)	Nutri-Score, MTL, Sens		France	Compared France's Nutri-Score label with MTL, and a modified reference intake graphic. Compared to no label, all FOP's were significantly associated with an increase in the ability to classify the product, but Nutri-Score outperformed the others on although results varied widely between logos.
Egnell, Kesse-Guyot, et al	Impact of Front-of-Pack Nutrition Labels on Portion Size Selection: An Experimental Study in a French Cohort	2018	Quantitative. Experimental - Online n= 25,772	Nutri-Score, MTL, Evolved Nutrition Label		France	Study focused mainly on testing the effect of the ENL (a modified MTL developed by industry) compared to other FOP's on portion size. Compared to no label, the Nutri-Score resulted in lower portion sizes, followed by the MTL. The ENL (an adaption of the MTL) only lowered portion sizes for cheese but increased it for spreads.
Hamlin and McNeill	The Impact of the Australasian 'Health Star Rating', Front-of-Pack Nutritional Label, on Consumer Choice: A Longitudinal Study	2018	Quantitative. Field experiment - two supermarket exits 1,000 in one location and 1,600 in the other.	Australia's HSR		New Zealand	Tested effects of HSR on consumers stated preference for mock breakfast cereals vs. control (no HSR). Neither hypotheses supported; HSR did not affect consumer choice and more stars did not consistently affect choice. (Critique: DV too broad, no covariates and sample too narrowly drawn).
Talati, Pettigrew, Kelly, Ball, Et al	Can front-of-pack labels influence portion size judgements for unhealthy foods?	2018	Quantitative. Experimental - Online N=1505	Daily Intake Guide; Multiple Traffic Light; Health Star Rating		Australia	Compared FOP effect on portion size; included a no-FOP control; used unhealthy pizza, cookies, yoghurts, and cornflakes. HSR and MTL resulted in small but significant reduction in portion size for some of the products; Pizza and cornflakes for HSR; Cornflakes for MTL. Concluded that the more interpretive labels (HSR & MTL) worked better than less interpretive (DIG) for reducing portion sizes.

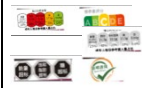

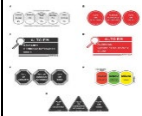
Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Acton, et al.	Exploring the main and moderating effects of individual-level characteristics on consumer responses to sugar taxes and front-of-pack nutrition labels in an experimental marketplace	2021	Quantitative 1. Explored the impact of sugar taxes and FOPs on the protein, calcium, and fiber density of snack food purchases - Experimental study (n = 3584) aged 13+, 3 × 8 between-within group experiment. - Participants received \$5 and viewed images of 20 snack food products available for purchase - Participants were randomized to one of five FOP conditions 2. Objective: examine impact of FOPs on purchase of products that had conflicting ratings across the FOP systems	1. Warning label (WL) 2. Multiple Traffic Light (MTL) 3. Health Star Rating (HSR) 4. Nutrition grade		Canada	1. FOP systems differ in the extent to which they promote or dissuade purchases 2. "High in" and Traffic Light more effectively discourage purchases than the positive ratings encourage them
Baccelloni et al.	Effects on Consumers' Subjective Understanding and Liking of Front-of-Pack Nutrition Labels: A Study on Slovenian and Dutch Consumers	2021	Quantitative 1. Aims to assess the clear comprehension by consumers of the information provided by the NutriInform Battery FOP scheme - participants (n=200) in a real-life setting, with products representative of the most widely consumed food categories, using a between-Nutri-Score subject design. - A questionnaire to evaluate the subjective understanding and liking of a FOP. - Subjective understanding was based on several sub-dimensions: comprehensibility design, help-to-shop and complexity. - The participants' subjective understanding and liking of the different labels were assessed in two periods: at the beginning of the test, right after the product delivery, and at the end of the test-period.	1. NutriInform Battery 2. Nutri-Score		Slovenia and the Netherlands	1. NutriInform Battery registered a better performance than Nutri-Score in all 3 sub-dimensions of subjective understanding, comprehensibility, help-to-shop, and complexity in both countries. 2. NutriInform Battery outperformed Nutri-Score in Slovenia for liking, but no difference between the two seen in the Netherlands.
Bandeira, et al.	Performance and perception on front-of-package nutritional labeling models in Brazil	2021	Quantitative 1. Online questionnaire, 2,400 participants, to evaluate understanding, perception of healthiness, purchase intention and perception of 5 FOPs applied to 9 products	1. Octagon 2. Triangle 3. Circle 4. Magnifier 5. Traffic light		Brazil	1. All FOPs increased understanding of the nutritional content, reduced perception of healthiness and purchase intentions compared to control. 2. Understanding of nutritional content: Warning models significantly better compared to traffic light; magnifier similar to all 4 other models. 3. Perception of healthiness and purchase intentions: Warning models significantly better than magnifier or traffic light. 4. Consumers favorable to presence of FOPs, perceived as reliable.
Bossuyt, et al.	Nutri-Score and Nutrition Facts Panel through the Eyes of the Consumer: Correct Healthfulness Estimations Depend on Transparent Labels, Fixation Duration, and Product Equivocality	2021	Quantitative 1. 398 participants assessed the healthfulness of 20 products; eye-tracking data collected to determine effect of FOP Nutri-Score vs. Nutrition Facts Panel 2. 3 RQs: assess (combined) impact of Nutri-Score and NFP; is the impact the same for all products; how does visual attention affect the results	1. Nutri-Score		Belgium	1. Nutri-Score positively affects accuracy in healthfulness estimation; NFP had no effect or a negative effect 2. Nutri-Score had a bigger effect in healthfulness estimation for equivocal products 3. Eye-tracking data confirmed the findings, showed that 'cognitive overload' occurs with too much information on the label
Carruba, et al.	Front-of-pack (FOP) labelling systems to improve the quality of nutrition information to prevent obesity: NutriInform Battery vs Nutri-Score	2021	Qualitative Review of literature on Nutri-Score, critique used to endorse NutriInform Battery	1. NutriInform Battery 2. Nutri-Score		Italy	1. Nutri-Score limited by providing assessment based on 100 g instead of a usual portion. 2. Countered all criticisms of Nutri-Score with evidence that NutriInform Battery is an improvement
Constantin, et al.	A human rights-based approach to non-communicable diseases: mandating front-of-package warning labels	2021	Qualitative 1. Review usefulness of FOPs and the need to mandate them to improve health and decrease incidence of non-communicable disease -- Narrative review	Various	No image available	Americas	1. FOP warning labels with excessive critical nutrients are the most effective FOP system 2. Mandated FOPs are required to offset opposition from the food and beverage industry and enable public health improvements
Dubois, et al.	Effects of front-of-pack labels on the nutritional quality of supermarket food purchases: Evidence from a large-scale randomized controlled trial	2021	Quantitative 1. Labeled 1266 food products in four categories in 60 supermarkets, analyzed nutritional quality of 1,668,301 purchases using FSA nutrient profile scores by FOP system	1. SENS 2. Nutri-Score 3. Nutri Repere 4. Nutri Couleurs		France	1. Only modest effects on nutritional quality of foods purchased in the four categories: Nutri-Score was most effective FOP, but only effect was to increase purchases of foods in the top third of their category by 14%; no effect on purchases of foods with medium, low, or unlabeled quality. 2. Nutri-Score was the most effective, followed by Nutri-Couleurs, with SENS and Nutri-Repère significantly behind



Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Esfandiari, et al.	Effect of Face-to-Face Education on Knowledge, Attitudes, and Practices Toward "Traffic Light" Food Labeling in Isfahan Society, Iran	2021	Quantitative 1. 673 participants completed intro questionnaire in-person at grocery store, then received face-to-face explanation for the TL using instructional pamphlets 2. The same participants completed the same questionnaire at home, in-person to evaluate whether TL education results in healthier food choices based on knowledge, attitudes, and practices; practices were evaluated by self-reported purchases	Traffic Light (TL)		Iran	1. Education significantly increased scores for knowledge, attitudes, and practices 2. Education is required to make TL and food labeling information effective
Fialon, et al.	Is FOP Nutrition Label Nutri-Score Well Understood by Consumers When Comparing the Nutritional Quality of Added Fats, and Does It Negatively Impact the Image of Olive Oil?	2021	Quantitative 1. Online survey of 486 adults; answered question about perception and understanding of Nutri-Score; then asked about usefulness of Nutri-Score to differentiate the nutrition quality of 8 fats (oils and butter), specify which had the best nutritional quality, and which they would buy more frequently. 2. Asked if Nutri-Score would impact future purchases of olive oil.	Nutri-Score		Spain	80% felt Nutri-Score was useful 89% identified olive oil as one of the added fats with best nutritional quality 86% stated they would buy olive oil most frequently; 71% stated they would keep consuming olive oil despite being reminded that the Nutri-Score grade was C
Folkvord, et al.	The effect of the Nutri-Score label on consumer's attitudes, taste perception and purchase intention: An experimental pilot study	2021	Quantitative and Qualitative 1. Quantitative: 196 participants answered questions about their attitude, taste perception, and purchase intention of 3 snacks, both with and without Nutri-Score labels 2. Qualitative: participants replying "yes" they saw an additional label on the package answered question describing the additional label.	Nutri-Score		The Netherlands	Nutri-Score label had no effect on consumers' attitudes, taste perception, and purchase intention.
Goiana-da-Silva, et al.	Nutri-Score: The Most Efficient Front-of-Pack Nutrition Label to Inform Portuguese Consumers on the Nutritional Quality of Foods and Help Them Identify Healthier Options in Purchasing Situations	2021	Quantitative 1. Quantitative: 1059 participants rated healthfulness of food products both with and without labels, and answered questions related to ease of understanding, label visibility, appreciation and trust	1. Health Star Rating (HSR) 2. Multiple Traffic Light (MTL) 3. Nutri-Score 4. Reference Intakes label (RI) 5. Warning symbol (black octagon)		Portugal	1. All 5 FOPs led to better ranking of healthfulness compared to no label 2. Nutri-Score had highest improvement on correctly ranking products, was the most efficient in improving food choice, was effective for all three food categories, and also most likely to be remembered by participants, less confusing and faster to understand; RIs provided more information and were more trusted compared to Nutri-Score
Hock, et al.	Experimental study of front-of-package nutrition labels' efficacy on perceived healthfulness of sugar-sweetened beverages among youth in six countries	2021	Quantitative 1. 11,108 children (age 10-17) completed online survey asking them to rate the healthfulness of beverages	1. Health Star Rating (HSR) 2. High in Octagon 3. Traffic Light 4. Nutri-Score 5. Guideline Daily Amount (GDA)		Australia, Canada, Chile, Mexico, UK and US	1. All 5 FOPs effective in reducing the perceived healthfulness of sugar-sweetened beverages 2. "High in" Octagon had greatest impact on perceived healthfulness
International Food Information Council	IFIC Survey: Knowledge, Understanding and Use of Front-of-Pack Labeling in Food and Beverage Decisions Insights from Shoppers in the U.S.	2021	Quantitative 1. Online survey of 1,002 participants ages 18 to 80 yo, part of a consumer panel. 2. Results weighted to reflect US population	Not specified	No image available	U.S.	1. Half find FOP impactful, but nutrition facts panel and list of ingredients were slightly higher ranked 2. People <50 yo, those with higher incomes, and parents with children under 18 more likely to consider FOPs impactful 3. Nutrition Facts highlights most helpful when shopping 4. Just over half say they are likely to review FOPs when purchasing a new product
Kontopoulou, et al.	Online Consumer Survey Comparing Different Front-of-Pack Labels in Greece	2021	Quantitative 1278 participants, online survey; they ranked three products according to their nutritional quality, first without FOPs and then with FOPs.	1. Multiple Traffic Lights (MTL) 2. Health Star Rating (HSR) 3. Guideline Daily Amounts (GDA) 4. Warning Symbols 5. Nutri-Score		Greece	Nutri-Score label presented greater improvements when compared to the GDA label






Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Marette, Stéphan	Ecological and/or Nutritional Scores for Food Traffic-Lights: Results of an Online Survey Conducted on Pizza in France	2021	Quantitative 1. 1200 participants asked about purchase intents before and after seeing nutritional and/or ecological scores, as well as a global score synthesizing both nutritional and ecology	1. Red label 2. Green label	No image available	France	1. Scores and labels significantly affect purchase intentions 2. Dominant effect is reduction in purchase intent related to the red color, although green or yellow colors change to a lesser extent 3. Red nutritional score leads to more significant decreases than ecological or global score. 4. Negative effect of a red score is not outweighed by the positive impact of the green for another score.
Mauri et al.	The effect of front-of-package nutrition labels on the choice of low sugar products	2021	Quantitative 1. 199 participants completed an online survey where they selected one of two products, labeled with different FOPs and sugar levels 2. 272 participants completed an online survey where they selected from three versions of three products, and then indicated whether they would have used additional nutrition information	1. Traffic light 2. Sugar teaspoons	No image available	U.K.	1. Sugar teaspoons more effective than traffic light in signaling sugar level and helping consumers make healthier choices. 2. More relevant in foods with simpler ingredient composition.
Mediano Stoltze, et al.	Impact of warning labels on reducing health halo effects of nutrient content claims on breakfast cereal packages: A mixed-measures experiment	2021	Quantitative 1. 497 participants used an online questionnaire to view and rate cereal packages with warning labels with and without nutrition claims	1. Warning labels 2. Nutrient content claims		Chile	1. No significant interaction between WL and NC claims 2. WL significantly reduced perception regardless of NC claims; warnings can mitigate the influence of NC claims on perceptions of healthiness
Medina-Molina	Analysis of the moderating effect of front-of-pack labelling on the relation between brand attitude and purchasing intention	2021	Quantitative 1. Participants viewed 5 products either with Nutri-Score FOPs or without; products with Nutri-Score had grades of A through E; questionnaire assessed participant's attitude toward the brand and intent to purchase the products	1. Nutri-Score		Spain	1. FOP does not modify the relation between brand attitude and purchase intent, though some variation by gender.
Roudsari; Pouri Hosseini; Bonab; Zahedi-rad; Nasrabadi; Zargaraan	Consumers' perception of nutritional facts table and nutritional traffic light in food products' labelling: A qualitative study	2021	Qualitative 1. Interviewed 40 participants to determine knowledge, concept and views of Nutrition Facts Table and Traffic Light Labels	1. Traffic Light Label		Iran	1. Large number of participants not aware of NFT or TLL 2. Several reasons for lack of attention to the labels: lack of knowledge about NFT and TLL concepts and defects in appearance and details written in the labels, lack of education about labels, position of labels, lack of time to use labels during shopping
Scapin, et al.	Influence of sugar label formats on consumer understanding and amount of sugar in food choices: a systematic review and meta-analyses	2021	Quantitative 1. Literature review and meta-analysis of randomized controlled trials and quasi-experimental studies investigating the influence of sugar label formats on consumers' understanding of sugar information or on amount of sugar in consumers' food choices 2. Analyzed 23 studies	1. Traffic light label (TLL) 2. Warning sign 3. Health warning message 4. Guideline Daily amount (GDA) 5. Sugar teaspoons 6. Alternative Nutrition Facts Panel (NFP) 7. Health Star Rating (HSR)	No image available	International	1. Label formats using "high in sugar" interpretative texts (traffic light labels and warning signs) were most effective in increasing consumers' understanding of the sugar content in packaged foods. 2. Health warning messages, graphic depictions of sugar content in teaspoons most effective in influencing choices






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Shahrabani, et al.	The impact of Israel's Front-of-Package labeling reform on consumers' behavior and intentions to change dietary habits	2021	Quantitative 1. 507 participants completed a survey asking about frequency of using FOPs, intention to change purchasing/consumption habits in the coming year	1. Red/green labels	No image available	Israel	1. More than half reported using the FOPs to some extent - One third always or often use the red/green FOPs and avoid buying products with red labels - Slightly less than half rarely or never use the FOPs - Half reported changing buying habits to healthier products following the reform (to add FOPs), though nearly all others said they had not changed habits 2. Nearly three quarters reported willingness to change to healthier products in coming year
Sinu Scientific; Sinu Scientific	Front-of-pack" nutrition labeling"	2021	Qualitative 1. Review of FOP nutrition labeling, focus on Nutri-Score and NutriInform Battery	1. Nutri-Score (NS) 2. NutriInform Battery (NB)	No image available	International	1. NB is more focused toward the primary goal of FOPs, which is to fight malnutrition by excess as a contributor to obesity and non-transmissible disease 2. NS algorithm is too obscure for consumer to understand; is non-educational, requiring the consumer to simply accept the score without understanding how to improve it
Song, et al.	Impact of color-coded and warning nutrition labelling schemes: A systematic review and network meta-analysis	2021	Quantitative 1. Literature review and meta-analysis of randomized controlled trials and quasi-experimental studies on the impact of FOPs on changing consumers' purchasing behavior 2. Analyzed 134 studies in 120 articles	Various	No image available	International	1. Traffic light labelling systems, nutrient warning, and health warning labels associated with selecting more healthful products 2. Nutri-Score and warning labels effective in reducing selection of less healthful products and with increased overall healthfulness 3. Traffic light, Nutri-Score, and nutrient warning labels associated with reduced energy, sodium, fat, and total sat fat purchases 4. Color-coded labels performed better toward purchasing more healthful products; warning labels better at discouraging unhealthy purchases.
Thomas; Seenivasan; Wang	A nudge toward healthier food choices: the influence of health star ratings on consumers' choices of packaged foods	2021	Quantitative 1. tested perception of healthiness of products with negatively correlated nutrients, and whether Health Star Rating could help participants select the healthier option	1. Health Star Rating (HSR)		Australia	1. HSR increased the choice of the healthier option when nutrients were negatively correlated 2. Consumers rely on a dominant nutrient when choosing food products, which leads to less healthy choices when nutrients are negatively correlated 3. HSR increase healthiness of consumer food purchases
Zafar, et al.	Readable Labels and Moderating Effect of Individual Personality Traits Effect on Consumer Healthy Packaged Food Selection Intention	2021	Qualitative and Quantitative To examine factors affecting consumer intention to select healthy packaged food. 713 participants completed a questionnaire asking about purchase intentions for products with traffic lights label, health statements, efficacy and intention for selecting healthy food items 32 qualitative interviews assessing attitudes toward labels, effect of personality traits on intentions	1. Traffic lights 2. Health Statements	No image available	Pakistan	FOPs had insignificant effect on purchase intentions without label reading attitude; results highlight the need for consumer education regarding nutrients.
Acton, et al.	Comparing the Effects of Four Front-of-Package Nutrition Labels on Consumer Purchases of Five Common Beverages and Snack Foods: Results from a Randomized Trial	2022	Quantitative 1. Explored the impact of sugar taxes and FOPs on the protein, calcium, and fiber density of snack food purchases - Experimental study (n = 3584) aged 13+, 3 x 8 between-within group experiment. - Participants received \$5 and viewed images of 20 snack food products available for purchase - Participants were randomized to one of five FOP conditions 2. Objective: identify whether key socio-demographic and behavioral characteristics moderated the effects of sugar taxes and FOP nutrition labels	1. Warning label (WL) 2. Multiple Traffic Light (MTL) 3. Health Star Rating (HSR) 4. Nutrition grade	   	Canada	1. Participants seeing HSR more likely to purchase 100% fruit juice (compared to MTL) and cheese snacks (compared to no label and WL) 2. WL resulted in fewer purchases of chocolate milk than no label 3. WL better at discouraging consumption of products with high levels of nutrients of concern; HSR less likely to discourage, and no better at encouraging purchases of protein, calcium or fiber from snack foods compared to nutrient-specific labels
Adasme-Berrios, et al.	Effect of Warning Labels on Consumer Motivation and Intention to Avoid Consuming Processed Foods	2022	Quantitative 1. Explore relationship between FOP nutrition warnings and nutritional knowledge, consumer motivation, and intent to avoid consuming processed foods. 2. 807 participants who purchased processed foods with warning labels completed a questionnaire asking about food behaviors, nutritional knowledge, and how they choose foods.	1. Stop sign	No image available	Chile	1. Nutrition warnings effective to help mitigate eating motivations and to boost intention to avoid processed food




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Agarwal, et al.	The effect of energy and fat content labeling on food consumption pattern: a systematic review and meta-analysis	2022	Qualitative 1. Synthesized findings from 6 studies published between 2014 and 2019 (413 abstracts reviewed to identify 10 for further review; meta-analysis carried out on 6) 2. Examine the effect of energy and fat content labeling on food consumption patterns	Various	No image available	International	1. Although the 6 studies claimed that labeling did not reduce the consumption of energy or fat, meta-analysis showed that fat and energy labeling had a statistically significant effect on consumption 2. No difference with respect to types of labels, but energy content labels more effective than fat content labels
Ahn and Lee	Effect of NUTRI-SCORE labeling on sales of food items in stores at sports and noNutri-Scoreports facilities	2022	Quantitative 1. Analyze impact of NUTRI-SCORE labels on sales at sports and noNutri-Scoreports facilities 2. Collected baseline sales data for 2 years at 2 stores, followed by post-intervention sales data for 5 weeks after adding NUTRI-SCORE labels	1. Nutri-Score		Korea	1. In sports facilities, sales were higher for relatively healthy foods compared to less healthy. 2. In noNutri-Scoreports facilities, sales for grade A items decreased while sales of grade B and E items increased. 3. Differences between the two facilities likely due to differences in cognitive consumption patterns between consumers at sports and noNutri-Scoreports facilities.
Andreeva, et al.	Polish Consumers' Understanding of Different Front-of-Package Food Labels: A Randomized Experiment	2022	Quantitative 1. Compare five FOPs among Polish participants of varying age groups in terms of perception and understanding of the labels and food choices - 1159 consumers asked to select one product from among a set of three foods with different nutritional profiles, and then rank the products within the sets according to their nutritional quality. - These tasks were performed with no label and then with one of the five FOPs on the package, depending on the randomization arm. Finally, participants were questioned on their perceptions regarding the label to which they were exposed.	1. Health Star Rating (HSR) 2. Multiple Traffic Light (MTL) 3. Nutri-Score 4. Reference Intakes (RI) 5. Warning symbols		Poland	1. Relative to RI's, Nutri-Score showed significant improvement in objective understanding of FOP. 2. Significant variability in the objective understanding of FOP with age group; Nutri-Score emerged as the only label capable of improving the objective understanding of FOP relative to RI in youngest age group (18-30 yo); no significant associations for oldest age group.
Bhattacharya	Consumers' Perception About Front of Package Food Labels (FOP) in India: A Survey of 14 States	2022	Quantitative 1. 2024 participants completed questionnaire asking about attitudes toward FOPs 2. Reported their perception and preference for different FOP designs	1. Warning Labels (WL) 2. Multiple Traffic Lights (MTL) 3. Health Star Rating (HSR) 4. Reference Intake (RI) 5. Nutri-Score	No image available	India	1. Majority of participants consumed packaged foods and were aware of the food package labeling; most (89%) considered the labels helpful. 2. WL were most preferred labels, followed by MTL, difference was significant; applied to all food products. 3. Majority reported FOPs would be useful 4. Significant difference in perception by gender, education, and employment status Note: conclusion in the abstract does not align with conclusions in the article.
Bhawra, et al.	Correlates of Self-Reported and Functional Understanding of Nutrition Labels across 5 Countries in the 2018 International Food Policy Study	2022	Quantitative 1. Online survey of adults in 5 countries (3900-5100 per country) assessing association between label understanding and consumer dietary behaviors, functional nutrition knowledge and sociodemographic characteristics	1. Health Star Rating (HSR) 2. Multiple Traffic Light (MTL) 3. Guideline Daily Amounts (GDA) 4. Nutrition Facts table (Nft)		Australia, Canada, Mexico, UK and US	1. FOP understanding significantly higher for interpretive label systems (HSR, Traffic lights) compare with Guideline Daily Amounts 2. Interpretive FOPs (HSR, MTL) easier to understand than those requiring numeracy skills (NFTs, GDAs).
Cabrera, et al.	Traffic-light nutrition labeling use and demand among Ecuadorean children	2022	Quantitative 1. Survey of 1179 children (12-18 yo) assessing understanding of the Traffic Light label 2. Choice experiment, students chose yogurt and soft drinks	1. Traffic light		Ecuador	1. Survey results: 42% of all participants answered all 4 correctly, 22% got between 2 and 3, and 36% got 0 to 1. 2. Choice experiment: Participants preferred products with labels indicating healthier alternatives and are willing to pay premium prices for these products.
Contreras-Manzano, et al.	Objective understanding of front of pack warning labels among Mexican children of public elementary schools. A randomized experiment	2022	Quantitative 410 children ages 6-13; examined use of warning labels and nutrition facts panel and ability of children to select healthiest and least healthy choices; also determine length of time to make selections	1. Traditional warning labels 2. Numeric warning labels		Mexico	1. Warning labels led to children identifying healthiest or least healthy items most correctly and in the least amount of time 2. Traditional warning labels more effective than numeric warning labels (these display a single warning sign with a number indicating the number of warnings for the food item; used on foods in small packages) 3. Presence of a cartoon character on the package reduced the ability of children to select healthy or unhealthy foods correctly.



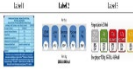




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Cordero-Ahiman, et al.	Responsible Marketing in the Traffic Light Labeling of Food Products in Ecuador: Perceptions of Cuenca Consumers	2022	Quantitative 1. 384 participants completed a survey asking about knowledge and use of traffic light nutrition labels 2. Examined variables that were associated with people being more likely to use traffic light nutrition labels -evaluating traffic light labels as part of responsible marketing research	1. Traffic light nutrition labels	No image available	Ecuador	1. Education, knowledge of labeling, and knowledge of marketing were associated with understanding of traffic light nutrition labels. 2. Use of the traffic light nutrition labels associated with income level, knowledge of the traffic light labels, illnesses, confidence in the traffic light label, influence of COVID-19 on eating habits, and knowledge of marketing.
Correa et al.	Why Don't You [Government] Help Us Make Healthier Foods More Affordable Instead of Bombarding Us with Labels? Maternal Knowledge, Perceptions, and Practices after Full Implementation of the Chilean Food Labelling Law	2022	Qualitative 1. Examined mothers' understanding, perceptions, and behaviors associated with the FOP warning label regulation four years after its implementation, using a qualitative approach -- Nine focus groups of mothers (n= 69) of children 2-14 years old, stratified by SES and children's age	1. Warning label (WL)	No image available	Chile	1. Mothers' reported fatigue with FOPs. 2. Suggest (a) need to identify groups more likely to get desensitized, (b) develop ad hoc strategies, (c) reinforce targeted messages. 3. Schools are important routes for promoting healthier diets and awareness of FOPs.
Cui, et al.	Types and Aspects of Front-of-Package Labeling Preferred by Parents: Insights for Policy Making in China	2022	Quantitative 1. Questionnaire (2,407 participants) collecting data on parents' preference for 5 different FOPs, the importance of nutrients to include on FOPs, packages food that most needs to have FOPs	1. Multiple Traffic Light (MTL) 2. Nutri-Score 3. Warning label (WL) 4. Health logos 5. Guideline Daily Amount (GDA)		China	1. MTL preferred, followed by warning labels 2. Most needed nutrients: sugar, salt, total fat 3. Top three foods needing label: "baked food", "milk and dairy products", "sugar-sweetened beverages"
Dang and Nichols	Consumer response to positive nutrients on the facts up front (FUF) label: A comparison between healthy and unhealthy foods and the role of nutrition motivation	2022	Quantitative 3 studies testing 3 hypotheses Study 1: 208 participants viewed product images and answered questions about perceived healthiness, purchase interest, nutrition motivation Study 2: 425 participants followed same procedures as study 1, but then saw a second similar product without nutrition label, asked about perceived healthiness and purchase interest for the 2nd product Study 3: eye tracking data collected while 56 students viewed two versions of a product label, one with only negative nutrients, one with positive nutrient	1. FactsUpFront (FUF)		U.S.	1. Positive nutrient label causes unhealthy food to be perceived as healthier; healthy food is unaffected. 2. Spillover effect can occur where a similar unhealthy food without a FUF label is perceived as healthier after person is exposed to a product with a positive nutrition fact on the FUF label. 3. Eye tracking showed no difference in attention to positive nutrients over negative nutrients.
de Alcantara, et al.	How Do Nutritional Warnings Work on Commercial Products? Results From a Hypothetical Choice Experiment	2022	Quantitative 1. Online randomized controlled trial; 1,932 participants selected food products in eight sets of three commercial products with 7 different labels	1. Guideline Daily Amount (GDA) 2. Traffic Light 3. 5 variations of warning labels: -black magnifier -red magnifier -black octagon -black triangle -red circle		Brazil	1. Nutritional warnings and the TLS significantly increased likelihood of selecting none of the products instead of the least healthful product; increased likelihood of selecting a healthier product compared to the GDA. 2. No effect on purchases of snack foods, authors suggest this is due to participants already expecting snack foods to be less healthy 3. Only slight advantage with black octagon, black triangle and red circle compared with the red magnifier.
Donini, et al.	Efficacy of front-of-pack nutrition labels in improving health status	2022	Qualitative 1. Narrative review of studies demonstrating the ability of FOPs to improve health status, with emphasis on concern about focusing on single nutrients/goods rather than eating patterns to prevent obesity and non-communicable disease	1. Non-directive labels (e.g., Reference Intakes [RI], NutriInform Battery) 2. Semi-directive labels (e.g., the English traffic light or Multiple Traffic Light [MTL], Warning Signs such as the octagon	No image available	Italy	1. Few studies conducted in real world settings on FOPs on purchase attitudes 2. Evidence showing that reducing intake of a certain nutrient/food has a positive effect on health status is weak; only limited evidence that clearly correlates FOPs with health outcomes, and most are retrospective microsimulations



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				"stop" or the words "rich in"). 3. Directive labels (e.g., Swedish Keyhole, Nutri-Score)			
Ducrot, et al.	Nutri-Score: Awareness, Perception and Self-Reported Impact on Food Choices among French Adolescents	2022	Quantitative 1. 1201 adolescents completed a web-based survey assessing Nutri-Score awareness, perception and self-reported impact on food choices 2. Also identified determinants associated with higher awareness and impact on food choices	1. Nutri-Score		France	1. Almost all knew Nutri-Score and considered it easy to understand and easy to identify; 54% reported that it impacted their food choices 2. Girls more likely to be aware than boys; 15-17 yos more likely to be aware than 11-14 yos 3. Use of Nutri-Score by parents was the most determinant criterion
Fondevila-Gascón, et al.	Ultra-Processed Foods in University Students: Implementing Nutri-Score to Make Healthy Choices	2022	Quantitative: 1. 161 university students completed a survey to evaluate the Nutri-Score label as an aid in choosing healthier products	Nutri-Score		Spain	1. One third of students did not know what Nutri-Score label indicates. 2. Majority (89%) of students felt Nutri-Score is helpful for better product choice
Gibson-Moore	Evolution not revolution – what might the future hold for front-of-pack nutrition labelling in the UK?: A British Nutrition Foundation roundtable	2022	Qualitative Report from British Nutrition Foundation roundtable discussion on FOPs to gather views and evidence on multiple traffic light and other FOPs in respect of their impact on consumer and industry behavior	1. Reference Intakes (RI) 2. NutrInform Battery 3. Multiple Traffic Light (MTL) 4. Stop sign warnings 5. Keyhole logo 6. Heart/Health logos 7. Healthy/Healthier choice 8. Nutri-Score 9. Health Star Rating (HSR)		U.K.	1. Labels use colors, shapes, and nutrition information to help consumers make informed choices, but no strong evidence to say that any one is more effective than another, particularly in the UK. 2. Using just one consistent form of FOP is key in consumers noticing the information, becoming familiar with it and gaining confidence in its use. 3. Roundtable participants recommend: - ongoing and timely reviews of the underlying basis of any FOPNL. - FOPNL should never be considered as a magic bullet for improving public health and encouraging healthier food choices - needs wider approach than just focus on single nutrients - may not need all evidence that the FOPNLs are effective, need to act to educate consumers about the nutritional value of foods/beverages so they can make informed choices.
Hoge, et al.	Health Literacy and Its Associations with Understanding and Perception of Front-of-Package Nutrition Labels among Higher Education Students	2022	Quantitative 1. Online survey of 2295 students (universities, colleges, arts colleges, social advancement education institutions) relating to objective understanding and perception to assigned FOP and level of health literacy	1. Nutri-Score 2. Reference Intakes (RI) 3. Multiple Traffic Light (MTL)	No image available	Belgium	1. Nutri-Score most effective in guiding students among disadvantaged students (those with inadequate health literacy, from non-university institutions, with low self-estimated nutrition knowledge or low self-estimated diet quality) 2. Students with inadequate health literacy preferred Nutri-Score, those with problematic health literacy preferred the MTL, and those with sufficient health literacy preferred the RI or no label.
Jáuregui, et al.	Impact of front-of-pack labels on the perceived healthfulness of a sweetened fruit drink: a randomized experiment in five countries	2022	Quantitative 1. Online survey: 22,140 participants randomly assigned to view one of 6 images with different FOPs and then rated healthfulness of sweetened fruit drinks	1. Guideline Daily Amounts (GDA) 2. Multiple Traffic Lights (MTL) 3. Health Star Rating (HSR) 4. 'High-in' Warning Labels (HWL) 5. Health Warning Labels (HWL)		Australia, Canada, Mexico, UK and US	1. HWL most effective in decreasing perceived healthfulness of a sweetened fruit drink across all countries and demographic characteristics

Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Khandpur, et al.	A comparative assessment of two different front-of-package nutrition label designs: A randomized experiment in Brazil	2022	Quantitative 1. 1384 participants viewed images of snacks with either a triangular warning label or a magnifying glass, answered questions about usefulness, understanding, and purchase intentions.	1. Warning label (WL) - Triangular - Magnifying glass		Brazil	1. Usefulness: TL found to be significantly more useful 2. Understanding nutrient content: no significant difference; but participants thought the TL would be easier for the general Brazilian population to understand 3. Understanding product healthfulness: participants in TL significantly better at identifying healthier of two products Participants in TL arm significantly more worried if children in their family consumed products with this label, and were marginally more likely to continue to purchase a frequently bought product even if it carried a TL 4. 73% of participants from TL arm selected same label over the ML, but 79% of the ML arm preferred the TL
Kühne, et al.	Labels Affect Food Choices, but in What Ways?	2022	Quantitative 1. 354 participants viewed product offerings at online store, then selected products they needed for a weekend with 6 people 2. Participants randomly assigned to one of 5 label conditions (4 FOPs and control = no label)	1. 2 summary label conditions (Nutri-Score and Healthy Food Label (HFL)) 2. 2 nutrient (sugar)-specific label conditions (manga and comic)		Switzerland	1. Labels boosted healthy food product sales, however, more products and more calories purchased in the label conditions than in the control; use of the labels did not lead to reduction in calorie intake. 2. Effects were smaller and not as clear as estimated in the past.
Leão, et al.	Impact of front-of-pack labels in chocolate bars and soft drinks on consumer perceptions: A cross-sectional study using free word association	2022	Qualitative 1. Participants completed a questionnaire asking about their purchase habits and then entered a word describing their response to a FOP on either a chocolate bar or soda. 2. Word obtained in the word association test were categorized by three researchers, revised until a consensus was reached, categories mentioned by at least 5% of the 551 participants were analyzed.	1. Traffic light (TL) 2. Warning labels (WL)	No image available	Brazil	1. FOPs did not impact the purchasing intention when compared with packaging only having the nutritional table 2. FOPs cause participants to reflect on the information; WL more effective than TL.
Mazzonetto, et al.	Front-of-pack nutrition labels: perceptions and preferences of Brazilian adult consumers	2022	Qualitative 1. Four FOPs displayed on packaged bread; thematic analysis used to identify key topics addressed by participants 2. 6 focus groups with 33 participants	1. Traffic light 2. Warning labels: - Black octagon - Black triangle - Red ellipse		Brazil	1. General: difficult to read the NFP because of low readability; did not pay attention to nutrition info except to identify items related to dietary restrictions 2. Label design: most preferred black warning labels and statements from Ministry of Health 3. Traffic light provides more info but is difficult to interpret 4. Warning labels had greatest influence on purchase decisions, but participants did not know how to interpret lack of warning labels on products
Mazzù, et al.	Introducing the Front-Of-Pack Acceptance Model: the role of usefulness and ease of use in European consumers' acceptance of Front-Of-Pack Labels	2022	Quantitative 1. Tested a model developed to assess understanding and usefulness of FOPs in decision-making 2. Preliminary plus 2 main studies assessed ease and usefulness of FOPs. Shoppers made selections and then completed questionnaires about their purchases. In preliminary studies, students were instructed about the labels, over several sessions, and then tasked with select foods from 5 categories. In Study 1, respondents assessed the items from the preliminary phase according to Nutri-Score and MTL. In Study 2, tested the acceptance of NutriInform Batter, a Nutrient-specific numerical label, the MTL, a nutrient-specific color-coded label, and Nutri-Score.	1. Nutri-Score 2. Multiple Traffic Light 3. NutriInform Battery	No image available	Italy, France, UK	1. Labelling systems support buying decisions and contribute to the definition of healthier choices when they are perceived as useful and easy to use. 2. Both interpretative and summary labels are effective, though the magnitude of the effects for the two categories and for countries with different degree of adoption of FOP in their respective market vary.
Mazzù, et al.	The role of trust and algorithms in consumers' front-of-pack labels acceptance: a cross-country investigation	2022	Quantitative 3 studies: all three studies collected data from primary grocery shoppers selected from a web panel. All 3 studies asked shoppers to review products with various FOPs, assessed trust in the FOPs affecting behavioral intention; work done to strengthen the Front-of-Pack Acceptance Model	1. Nutrient-specific labels - Numerical labels - Color-coded labels 2. Summary labels - Endorsement logos - Graded indicators		Italy, France, UK	1. Trust in FOPs has a positive effect on behavioral intention 2. Relative performance of different labels on the Front-of-Pack Acceptance Model is due to trust differences 3. Nutri-Score is less effective than the NutriInform Battery on attitude, behavioral intention, and trust.
Mazzù, et al.	Uncovering the Effect of European Policy-Making Initiatives in Addressing Nutrition-Related Issues: A Systematic Literature Review and Bibliometric Analysis on Front-of-Pack Labels	2022	Quantitative 1. Bibliometric and co-citation analyses and systematic literature review of 170 papers and 49 articles recent publications (219 articles total), analyzed over 3 time periods.	1. Nutrient-specific labels - Numerical labels - Color-coded labels 2. Summary labels - Endorsement logos - Graded indicators		Europe	1. Regulations evolved over the 33 years covered by the review, with the most recent goal of finding a harmonized and universal system to adapt in all EU countries; must avoid two risks identified in literature: - FOP system may be fully supported by converging evidence derived from multiple constructs - intention to purchase healthier products improved with FOP but little real world proof

Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
							- must not overlook valid and worthwhile alternatives that may not have as many citations or as large a network of authors 3. The right choice of FOP would be beneficial for consumers and industry, but knowledge gaps remain.
Meng et al.	Traffic light signals and healthy food choice: Investigating gender differences	2022	Quantitative Study 1: Participants viewed two different versions of cracker packages bordered with green, red or black border for a standard package and a manipulated one with higher sodium and less fiber content, then answered questions about the healthiness of the product and about the nutrition label and whether it helped them to determine the healthiness and was understandable Study 2: Participants viewed two versions of potato chip packages where the nutrient of interest (sodium was bordered with the color. Participants reported whether or not they would buy the product and responded to questions from the Analism-Holism Scale.	1. Red, green or black border on either nutrition facts label or the nutrient of concern		U.S.	1. All participants rated the unmanipulated cracker as more healthy, but there was a higher perceived healthiness for the green label, lower for the red label, compared to the black label. Men were more responsive to the color than women. The text information on the package affected women's but not men's perceived healthiness. The NFP had no differences based on gender, though men referred to this less often than women. 2. No main effect of gender on purchase intentions, but participants reported higher purchase intentions when the sodium label was in green than black or red. Among men, difference across three colors was significant, but not among women. Conclusion is that traffic light signals are more useful for men than women.
Miller, et al.	"You can't just eat 16 teaspoons of sugar so why would you drink 16 teaspoons' worth of sugar?": a qualitative study of young adults' reactions to sugary drink warning labels	2022	Qualitative 1. 16 focus groups with 105 young adults (18-24 yo); labels shown during group discussion, themes identified related to participants' perceptions	1. Warning labels (WL): - Health effects - Nutrient content - Exercise 2. Pictograms of sugar content		Australia	1. Labels communicating the number of teaspoons of sugar in a drink (either text or pictogram) were perceived as highly factual, relatable and interpretable, having the greatest potential to impact consumption attitudes and intentions.
Miller, et al.	Warning labels and interpretive nutrition labels: Impact on substitution between sugar and artificially sweetened beverages, juice and water in a real-world selection task	2022	Quantitative 1. University students (n=511) accessed an on-campus laptop to select one of 10 beverages; task repeated with the addition of a warning label in round 2, and again after the addition of a HSR label in round 3.	Five warning labels, with and without Health Star Rating (HSR)		Australia	1. Both males and females, addition of warning labels caused significant decrease in SSB selection and significant increase in artificially sweetened beverages (ASB) compared to control (no label) 2. 100% fruit juice selection decreased for females with addition of warning label, but increased following addition of 4-star HSR label 3. Important to have warning label thresholds and HSR algorithms aligned to present consistent messaging.
Mora-Plazas, et al.	Impact of nutrient warning labels on choice of ultra-processed food and drinks high in sugar, sodium, and saturated fat in Colombia: A randomized controlled trial	2022	Quantitative 1. Participants (8,061) viewed 2 fruit drinks with different FOPs, one high in sugar and one not, and selected 2. Viewed 4 products high in sugar, sodium, and/or sat fat and selected the label which would most discourage them from consuming the products	1. Warning label 2. Guideline daily amount (GDA) 3. Nutri-Score		Colombia	1. WL performed better on most outcomes, though GDA better in helping identify high-sugar drinks. 2. WL best helped identify high-sodium and high-sat fat products, and most discouraged participants from wanting to consume "high in" products.
Muzzioli, et al.	Are Front-of-Pack Labels a Health Policy Tool?	2022	Qualitative 1. Narrative review of literature to clarify the goals and objectives that could and could not be achieved by FOPs 2. Establish whether a model can be effective in (1) modifying purchase behavior, (2) guiding dietary patterns toward a healthy and sustainable diet, (3) reformulating food products by the food industry	1. Non-directive labels (e.g., Reference Intakes [RI], NutriInform Battery). 2. Semi-directive labels (e.g., the English traffic light or Multiple Traffic Light [MTL], Warning Signs such as the octagon "stop" or the words "rich in").		Italy	1. Changing purchasing behavior: evidence is limited 2. Directing dietary patterns: non-directive FOPs strongly informative and helpful, but directive ones were weak 3. Reformulating foods: research inconclusive; data still pending

Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
				3. Directive labels (e.g., Swedish Keyhole, Nutri-Score)			
Oswald, et al.	Effect of front-of-package labels on consumer product evaluation and preferences	2022	Qualitative and Quantitative 1. Participants chose from 3 food items in simulated shopping scenario, with goal to shop as usual (control), pick the healthiest food, or the lowest sodium food. 2. Participants were shown the NFP label with no other packaging, told it was for donuts, with or without a color or B&W label next to the NFP. 3. Participants completed questionnaire indicating purchase intentions, criteria used to make selections, health literacy, preferences toward FOP, how well they understood the label and NFP	1. FactsUpFront (FUF) - one version in B&W - one version color-coded where nutrients were classified as red, yellow or green (based on U.K. criteria)		U.S.	1. Color coded FOPs more effective than B&W 2. Participants viewed the NFP label for info on calories, fat and sodium more often than the FOPs 3. Overall, FOPs used to reference nutrients but did not affect choice, product evaluation or nutrition knowledge.
Packer, et al.	Secondary Outcomes of a Front-of-Pack-Labeling Randomized Controlled Experiment in a Representative British Sample: Understanding, Ranking Speed and Perceptions	2022	Qualitative and Quantitative 1. 4530 Participants randomized to one of 5 experimental groups, viewed 3 product labels; assessed ability to rank healthiest products, time to complete the rankings, and a descriptive analysis of the perceptions.	1. Nutri-Score (NS) 2. Multiple Traffic Lights (MTL) 3. Warning Label (WL) 4. Positive Choice tick (PC)	No image available	U.K.	1. Probability of correctly ranking healthiest product significantly greater for all FOPs compared to control, with NS consistently performing best 2. Time was fastest for NS, PC, and control. 3. FOPs were perceived favorably, especially NS and MTL.
Pettigrew, et al.	An 18-country analysis of the effectiveness of five front-of-pack nutrition labels	2022	Quantitative 1. 18,393 participants viewed products with and without FOPs; asked which they would buy and to rank the product's nutritional quality. 2. 12 choice sets presented to participants: one for understanding, one each for each of 3 product categories, both with and without FOPs	1. Health Star Rating (HSR) 2. Multiple Traffic Lights (MTL) 3. Nutri-Score 4. Reference Intakes 5. Warning Label		Argentina, Australia, Belgium, Bulgaria, Canada, Denmark, France, Germany, Italy, Mexico, Netherlands, Poland, Portugal, Singapore, Spain, Switzerland, UK, USA	1. Largest improvements in ability to identify healthiest product AND unhealthiest product seen for NS, followed by MTL 2. NS and MTL associated with largest improvement in choice of healthiest and non-choice of the unhealthiest options 3. Most effective FOPs featured color-coded spectrum designs
Riccò, et al.	Understanding of the Nutri-Score front-of-pack label by Italian Medical Professionals and its effect on food choices: a web-based study on knowledge, attitudes and practices	2022	Quantitative 1. 153 medical professionals completed a questionnaire assessing knowledge of Nutri-Score, overall understanding of its conceptual issues, usefulness of FOPs, and acceptance as a guide for nutritional choices.	1. Nutri-Score (NS)		Italy	1. 43% report any knowledge of NS, overall understanding of its conceptual issues was low (51%) 2. Only half acknowledge some usefulness of FOPs, acceptance as a guide for choice was low (37%) 3. Overall: NS is a useful instrument but the actual understanding of its rationale by MPs was insufficient.
Richetin; V. Caputo; Demartini; Conner; Perugini	Organic food labels bias food healthiness perceptions: Estimating healthiness equivalence using a Discrete Choice Experiment	2022	Quantitative 1. 415 participants chose the healthiest product between two products plus an opt-out alternative, either with a FOP TLS or none 2. Products were labeled with the following attributes: organic (present/absent), fat content (low/medium/high), sugar content (low/medium/high), and price (4 levels)	1. Traffic Light system (TLS)	No image available	Italy	1. Organic label drives the healthiness perception of the food, regardless of the other FOP information 2. Including a TLS did not attenuate the organic label's impact

Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Sagaceta-Mejia, et al.	Understanding of front of package nutrition labels: Guideline Daily Amount (GDA) and warning labels in Mexicans with non-communicable diseases	2022	Quantitative 1. 14,880 participants (stratified by number of known non-communicable diseases) classified products as healthy or unhealthy; products displayed either the Guideline Daily Amount or Warning Label as FOPs	1. Guideline Daily Amount (GDA) 2. Warning Label (WL)		Mexico	1. Odds of correct classification of products using WL were 2 times greater compared to GDA image 2. Proportion of people with NCDs correctly classifying products decreased according to the number of diseases the participant had
Septia Irawan, et al.	Analysis of Content, Social Networks, and Sentiment of Front-of-Pack Nutrition Labeling in the European Union on Twitter	2022	Qualitative 1. Analyzed Twitter posts (tweets) concerning FOPs for content, sentiment, and mapping network characteristics.	Various	No image available	Europe	1. Discussion on Twitter limited - only a very limited group of people 2. Education programs needed to inform consumers 3. General topics perceived negatively, more positive sentiments toward food industry, negative sentiments toward political conflicts 4. Nutri-Score mentioned most often, with conflicting sentiments
Silva et al.	Comparison of two front-of-pack nutrition labels for Brazilian consumers using a smartphone app in a real-world grocery store: A pilot randomized controlled study	2022	Quantitative 1. 230 participants randomized to one of three study arms (Mexican FOP, Brazilian FOP, control), scanned product barcode and viewed the FOP for the product on a smartphone app 2. Answered questions indicating decision to buy or not buy a product, perceived healthiness of the product, facilitation of quick purchase decision, and identification of excess nutrients	1. Mexican FOP 2. Brazilian FOP		Brazil	1. Mexican FOP better at facilitating decision on when to buy or not to buy and in helping to quickly decide, and in identifying products high in added sugars. 2. Brazilian FOP better at helping participants identify products high in saturated fats 3. Both systems helped participants identify critical nutrients in excess or not in the dairy products tested
Silva et al.	Perception of Portuguese Consumers Regarding Food Labeling	2022	Quantitative 1. 467 participants completed a survey assessing perception and literacy regarding food labeling	1. Nutrition Facts Panel (not FOP) 2. Guideline Daily Amount 3. Traffic Light		Portugal	1. 84% of participants read the food label, but only 47% regularly read it; 20% of the participants understand all the information on the label 2. FOP systems: Traffic Light was preferred format; most consumers understood the information transmitted in the FOP system; 85% would change their eating behavior to decrease intake of products classified as nutritionally unbalanced according to the FOP system
Taillie; Higgins; Lazard; Miles; Blitstein; Hall	Do sugar warning labels influence parents' selection of a labeled snack for their children? A randomized trial in a virtual convenience store	2022	Quantitative 1. participants selected virtual products for their child, both with a text warning label, an image warning label, or no label with sugar content info	1. Black box with text warning 2. Red box with image and text warning		U.S.	1. Both warning labels decreased likelihood that participants would select the snack compared to control 2. Both labels resulted in greater attention, anticipated social interactions, negative affect, cognitive elaboration, perceived effectiveness, and lower perceptions of healthfulness, appeal, and intentions to purchase or consume the product 3. No differences between text and pictorial sugar warning labels
Todd, et al.	Healthy or Not Healthy? A Mixed-Methods Approach to Evaluate Front-of-Pack Nutrition Labels as a Tool to Guide Consumers	2022	Qualitative and Quantitative 1. In depth interviews with 49 participants asked about challenges faced when using food labeling and ways in which labeling could be improved 2. 1261 participants used an online survey to assess 2 FOPs relative to no label and rate a cereal product	1. Health Star Rating 2. Guideline Daily Amount 3. Warning labels 4. Endorsement logos		South Africa	1. Interview results: "make it clearer", "make it simpler", "make it smarter" 2. Labels will not replace education about nutrient 3. In helping consumers identify less healthy products, Health warnings and low health star ratings were most effective.
van den Akker; Bartolet; Brouwer; Luijpers; Nap; Havermans	The impact of the Nutri-Score on food choice: A choice experiment in a Dutch supermarket	2022	Quantitative 1. 300 participants randomly assigned to one of three conditions (Nutri-Score, Multiple Traffic Light, no label), presented with 6 cereals and asked to choose. 2. Shown a product with relatively good label score and had to select their desired serving size	1. Nutri-Score 2. Multiple Traffic Light 3. no label		The Netherlands	1. NS promotes the choice of the healthiest cereal; dieting and health conscious shopping did not moderate this effect 2. Labels did not affect serving size selection
Wang, et al.	Effects of food nutrition labels on the health awareness of school-age children	2022	Quantitative 1. 343 children rated products with various FOPs for healthiness and visibility of the label	1. Guideline Daily Amount (GDA) 2. Apple label 3. Traffic light system (TLS) 4. Warning label		Taiwan	1. 3 FOPs (GDA, Apple, TLS) helped children determine healthier snack choices 2. Black warning label does not result in healthier choices 3. Children who buy often buy snacks do not notice the nutrition labels 4. Rural children less likely to pay attention to nutrition labels on packaging

Author	Title	Year	Method	FOP	FOP Image	Country	Highlights of Findings
Werle; Pruski Yamim; O. Trendel; Roche; Nadaud	When Detailed Information Works Better: Comparison of Three- and Five-Color/Letter Front-of-Package Nutrition Labels	2022	Quantitative 1. Assess influence of 3-color vs. 5-color FOPs in selection of products with higher nutritional quality - obtained sales data from 2 vending machines over 3 weeks; week 1, no label, week 2 5-color label, week 3 3-color label; purchasers were asked to complete questionnaire about reasons for purchase 2. Monitored eye-tracking as participants chose products in experimental supermarket 3. Participants asked to identify as fast as possible, the healthier option among pairs of products with the 3-color or 5-color label 4. Participants asked to evaluate one product - either the healthiest or unhealthiest - of a set of products	1. 5-color FOP 2. 3-color FOP	 	France	1. Participants select products with better nutritional quality when 5-color label used, not 3-color; participants cite health reasons more frequently when 5-color label used 2. Percentage of healthier products chosen higher with the 5-color label but not the 3-color; 5-color label more effective in decreasing the share of unhealthy products chosen and increasing share of healthy items, consumers selected products with lower energy density and higher nutritional quality; consumers in the 5-color condition spent more time looking at the label than those in the 3-color 3. Both 5- and 3-color label show shorter reaction time to select healthier product, with fewer errors; 5-color seems to result in fewer errors compared to 3-color 4. Participants reported easier to discriminate healthiness with the 5-color label compared to control or 3-color label; 5-color label also enhances purchase intentions
Xuejun, et al.	Key Stakeholder Perspectives on Introducing a Front-of-Pack Labelling Scheme on Packaged Foods in China: A Qualitative Study	2022	Qualitative 1. In depth interviews with 30 participants (stakeholders and consumers) using tailored guides to obtain views on barriers and facilitators to developing FOP policy	Various	No image available	China	1. The major barriers were the absence of national contextual analysis, perceived complexity of the process of policy development, disagreement on a preferred FOP format, cost for the food industry, low priority compared to food safety policies, lack of existing regulatory framework or authorized nutrient profiling system, limited knowledge of FOP, and the lack of planning and engagement with stakeholders. 2. Facilitators included existing prerequisites, experiences and lessons from the pilot, policy coherence with Healthy China 2030, and support from external agents (e.g., WHO).

Appendix D: Citations for all References

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