

Review

Effects of Digitalized Front-of-Package Food Labels on Healthy Food-Related Behavior: A Systematic Review

Nikola Ljusic ^{1,*}, Asle Fagerstrøm ¹, Sanchit Pawar ¹ and Erik Arntzen ²¹ School of Economics, Innovation, and Technology, Kristiania University College, 0152 Oslo, Norway² Department of Behavioural Sciences, Oslo Metropolitan University, 0176 Oslo, Norway

* Correspondence: nikola.ljusic@kristiania.no

Abstract: Front-of-package (FOP) food labels may impact healthy food-related behavior. However, such labels may be presented using new technology and they may impact behavior differently than physical labels. This systematic review investigated the effects of physical and digitalized labels on healthy food-related behavior. This review used four search engines to collect articles that investigated the effects of food labels on the purchase, consumption, hypothetical choice, and self-reports of healthy foods. General findings, types of labels, or whether the articles used physical versus digitalized static, interactive, or technology-enabled labels were synthesized. The dependent variables were categorized according to whether they were under full, partial, or no control of the independent variables. The risk of bias was measured by the RoB 2 tool and adapted Joanna Briggs Institute Checklist. The search strategy identified 285 records and 30 articles were included. While digitalized static and physical labels did not differ in their effects on healthy food-related behavior, technology-enabled labels were more predictive of healthy food-related behavior than interactive labels.

Keywords: food labeling; consumer behavior; healthy foods; physical labels; digitalized labels; technology



Citation: Ljusic, N.; Fagerstrøm, A.; Pawar, S.; Arntzen, E. Effects of Digitalized Front-of-Package Food Labels on Healthy Food-Related Behavior: A Systematic Review. *Behav. Sci.* **2022**, *12*, 363. <https://doi.org/10.3390/bs12100363>

Academic Editor: Lauren Dundes

Received: 24 July 2022

Accepted: 22 September 2022

Published: 27 September 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Consumption of unhealthy foods is a major societal problem despite numerous efforts by different institutions and organizations. Obesity has approximately doubled worldwide since the 1980s [1]. Research shows a connection between the consumption of unhealthy foods and an increased risk of heart disease [2]. In addition, it is even associated with an increased risk of suicide attempts [3]. Furthermore, it is also an economical burden for society. A high body mass index is estimated to cost USD 990 billion per year globally for healthcare services [4]. Using mandatory nutritional labels on food products is only one of many proposed interventions. It may have ameliorated the rising epidemic of obesity. However, this may not be the case for all subgroups of consumers, such as individuals who are already obese [5]. As a result, the World Health Organization [6] suggests that the food industry should promote healthier diets by providing simple and clear food labels. This can be achieved by presenting simplified front-of-package (FOP) food products. Several types of FOP food labels exist, as shown in Figure 1. However, research shows that the effects of these FOP food labels on healthy food-related behavior are inconsistent and vary in relation to which type of behavior is measured [7–12].

Technology may be used to present digitalized FOP food labels in novel ways, and such labels may be more effective than physical labels. Digitalized FOP food labels may be static, interactive, and technology-enabled. Interactive technology may provide detailed product information to consumers, and technology-enabled retailing may provide personalized products for each consumer, dynamic presentations of products that may be changed based on previous purchase history, and provide real-time information where such offers are given immediately [13,14]. These characteristics may be used for digitalized FOP food labels.

For instance, Shin et al. [15] presented digitalized FOP food labels in order to study their effect on healthy food purchases. The label presented an overall healthiness score based on foods in the virtual basket of each consumer in an online grocery store experiment. They found that such digitalized FOP food labels increased healthy food purchases. Physical FOP food labels are static labels that are presented on the physical package, menu boards, or shelf tags near the products in physical stores. Digitalized FOP food labels are presented mostly in online grocery stores by a medium or device. In this situation, digitalized FOP food labels are presented together with images of the food product and may be in the form of static, interactive, or technology-enabled. Digitalized static FOP food labels are similar to physical FOP labels as they also present a static image of the food label but differ as they are presented through a medium. Interactive FOP food labels provide additional options to access more information regarding the health aspects of the food product or the label. Technology-enabled FOP food labels provide personalized, dynamic, and real-time information. Specifically, such labels can provide personalized information based on each consumer, dynamical information based on their specific actions with the medium, and real-time information to the consumers. Hence, physical, digitalized static, interactive, and technology-enabled FOP food labels may present different information to consumers, as shown in Figure 2, and these may influence healthy food-related behavior in different ways.



Figure 1. The figure shows examples of different types of front-of-package food labels. From top left to right, a single summary label (Nordic Keyhole), graded summary label (French Nutri-score), and combined label (Australian Health Star Ratings) are shown. A percentage-based nutrient-specific label (British Guideline Daily Amounts), single nutrient-specific label, and graded nutrient-specific label (British Traffic Lights) are shown from bottom left to right.

Healthy food-related behavior may be measured in several ways and FOP food labels may impact these behaviors differently. Healthy food-related behaviors can be categorized into purchase, consumption, hypothetical choice, and self-reports regarding healthy foods. Purchase may be measured by actual money spent on foods, consumption in terms of the number of calories consumed, and hypothetical choices may be measured by a relative selection of a product given a set of several products without actually owning or consuming the item in the presence of a question. Self-reports are verbal estimations of participants' own behavior toward a given product in the context of other questions and may be used to study consumer behavior in general (see [16] for different measurements of consumer behavior related to FOP food labels). FOP food labels may affect one or several of these measurements. For example, the purchase of foods may be influenced by FOP food labels, although with either small or inconclusive results [7], consumption may be influenced by different FOP food label types [10], hypothetical choices may also be impacted by these FOP food labels [17], and self-reports such as participants ratings of healthfulness [18],

taste [19], trustworthiness, intent to purchase [20], affect and familiarity [21] related to healthy foods may also be influenced by FOP food labels.

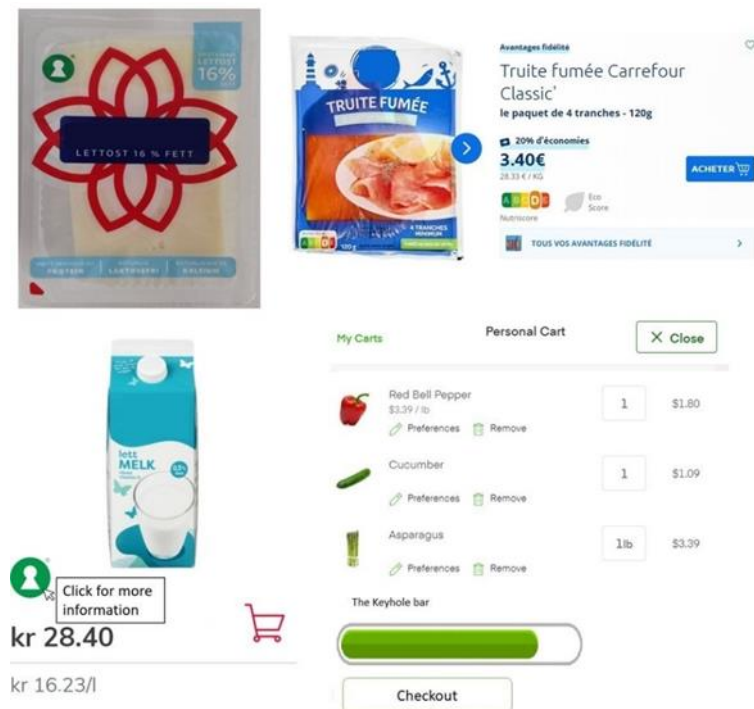


Figure 2. The figure shows hypothetical examples of physical (upper left), digitalized static (upper right), digitalized interactive (lower left), and digitalized technology-enabled (lower right) front-of-package food labels.

Although there exists extensive research on related topics, few literature reviews exist on the effects of digitalized FOP food labels on healthy food-related behavior. For instance, there exists research on health-related information delivered by technology in physical stores [22] and the effects of health labels and ingredient labels on consumption and self-reports [23]. Furthermore, Granheim et al. [24] did a systematic scoping review regarding the digital food environment and identified some articles which have examined the impact of healthy food labels on healthy food-related behavior in an online grocery setting without comparing their effects to physical FOP food labels. Similarly, Pitts et al. conducted a review on the promises and pitfalls of online grocery shopping related to healthy food purchase [25]. However, to the best of our knowledge, no systematic literature review has examined the effects of physical and digitalized FOP food labels regarding different types of labels and their effect on healthy food-related behavior. Knowledge of such effects on healthy food-related behavior has both academic and social importance. First, such research provides an understanding of how technology in this setting influences human behavior, health-related behavior, and consumer behavior. Second, such knowledge may aid in reducing obesity, economic costs, and human suffering worldwide. Finally, knowledge regarding digitalized FOP food labels may give brand owners and retailers a competitive advantage [26]. Specifically, digitalized interactive and technology-enabled FOP food labels may provide more accurate descriptions regarding products and present personalized, dynamic, and real-time information on health scores to consumers. This may increase the value of healthy foods while at the same time benefiting brand owners and retailers by increasing the number of healthy food purchases, attracting new customers, and increasing positive word-of-mouth [27]. This paper aims to fill that knowledge gap by presenting a classification system of physical and digitalized FOP food labels and investigating how such labels impact consumer behavior through a systematic review. The objective of this paper is to investigate how physical, digitalized static, digitalized interactive, and digitalized

technology-enabled FOP food labels impact purchase, consumption, hypothetical choice, and self-reports regarding healthy foods.

The rest of the paper is structured in the following manner. First, previous research regarding the classification of FOP food labels and studies that have investigated physical labels, and digitalized static, interactive, and technology-enabled labels is presented. This is followed by providing the methods used in this review. The result of the review is then presented. Discussion of the results in light of previous research is then provided. At last, further research directions are suggested.

2. Literature Review

FOP food labels can be classified as summary labels, nutrient-specific labels, or combinations of both [9] as shown in Figure 1, and their effects may be moderated by other variables. Summary labels present an overall health evaluation of a food product and may be presented as single or graded summary labels. Single summary labels are binary and their presence on a food product indicates that the product is considered healthy; an example is the Nordic Keyhole [28]. However, graded summary labels present a score between a minimum and a maximum value as a higher score corresponds to a higher degree of the healthiness of a product, such as the French Nutri-Score [29]. In contrast, nutrient-specific labels present some key nutrients on the front of the package and specify the degree of the healthiness of specific nutrient contents. Nutrient-specific labels can be presented in terms of percentage-based, single, and graded nutrient-specific labels. Percentage-based nutrient-specific labels show a percentage that is based on specific nutrient content or recommended daily intake based on an average adult. Single nutrient-specific labels are binary and show an excess of a given nutrient. Graded nutrient-specific labels show the nutritional content such as “low”, “medium”, or “high” amounts. Guideline daily amounts [30] warning labels [31], and traffic lights [30] are examples of nutrient-specific labels. Some FOP food labels use combinations of summary and nutrient-specific label elements such as the Australian Health Star Rating system [32]. In addition, several other independent variables that influence the effectiveness of these labels have been investigated, such as color-based labels [8,12], time-pressure conditions, nutritional knowledge about labels [11], textual claims [33], and self-control [34], among others. In short, FOP food labels can be categorized in summary, nutrient-specific, and combined labels with several different subcategories and other variables in combination with labels have been investigated.

Physical FOP food labels and their effects on healthy food-related behavior have been examined by other researchers. Roberto et al. [19] allocated participants randomly in a campus store context to no FOP food label, combined FOP food label, and combined FOP food label with additional per serving information conditions. These labels were presented for a cereal and the study measured participants' self-reports regarding estimations of calories, total sugars, vitamins, healthfulness, intent to purchase cereals, total grams poured, and total grams consumed. Participants allocated to the combined FOP food label per serving condition had higher self-reports regarding estimations of calories. In contrast, other healthy food-related behavior measurements did not differ between the conditions, indicating no effect. Similarly, Julia et al. [35] allocated participants in a controlled lab store context to no FOP food label, graded summary FOP food label, and graded summary FOP food label with information regarding the criteria of the labels, and these were presented for different food products. The study measured the mean nutritional qualities of the food items participants had selected in their shopping carts and used self-reports regarding the recall of the labels, healthfulness, and understanding. The results show that there were few differences between healthy food-related behavior as a function of these FOP food labels on hypothetical choice, but that they impacted self-reports regarding recall and understanding. Koenigstrofer et al. [34] conducted two studies regarding the effects of nutrient-specific FOP food labels on healthy food-related behavior. In the first study, participants in a controlled laboratory store context were allocated to no FOP food label. Participants in the nutrient-specific FOP food label conditions were instructed to shop for four items. The

process measured participants' purchases and self-reports regarding self-control and used professional dieticians to classify which foods were considered healthy. The second study extended the previous study by using a standardized healthiness of food product scale instead of ratings of dieticians. The results of both studies show that participants who had lower self-reports regarding self-control were correlated with a larger decrease in unhealthy food purchases when the label was present, while participants with higher self-reports regarding self-control were correlated with smaller effects when the label was present. Hence, in regard to the effects of physical FOP food labels, one article found differences regarding purchases when self-reports regarding self-control were high [34] one article did not find different effects on hypothetical choices [35], one article did not find differences in self-reports [19], and one article found different effects regarding self-reports [35].

Digitalized static FOP food labels and their effects on healthy food-related behavior may differ from physical FOP food labels. For instance, digitalized static FOP food labels may be presented at several locations in the online grocery retail setting, such as on the first webpage in context with other products or on the second webpage when the product is presented alone and together with the nutritional information labels of that product. Digitalized static FOP food labels may be enlarged and may take up more space with the food product image than physical labels. In addition, there is a longer delay between the purchase and consumption of food products in the presence of digitalized FOP food labels compared to physical FOP food labels. Talati et al. [17] conducted a large-scale online experiment with participants across 12 countries to study the effects of combined, graded nutrient-specific, percentage-based nutrient-specific, graded summary, single nutrient-specific, and no FOP food labels on hypothetical choice. Participants were exposed to food products with no FOP food label, were instructed to select which one out of three products they would like to purchase, and were again presented with the same products in combination with one type of FOP food label. Their results show that the hypothetical choice regarding healthy foods was improved from most to least by graded summary, graded nutrient-specific, single nutrient-specific, combined, and percentage-based nutrient-specific FOP food labels. Similarly, Raats et al. [36] conducted an online experiment with participants from 6 different countries and investigated the effects of percentage-based nutrient-specific labels based on "per 100g" and "typical portion size" in combination with different food products on self-reports regarding the healthfulness of products by categorizing products on a scale from most to least healthy. Their results show that these labels produced different results. For instance, products in combination with labels based on "per 100g" were rated less healthy than "typical portion size" labels. At last, Khandpur et al. [37] investigated the effects of single nutrient-specific and graded nutrient-specific labels on hypothetical choices and self-reports regarding the intention to purchase, nutritional accuracy, and ratings of the healthfulness of food products. Their results show that participants exposed to single nutrient-specific labels had a higher hypothetical choice and self-reports regarding nutritional accuracy, and lower self-reports regarding healthfulness than graded nutrient-specific FOP food labels. Hence, in regard to the effects of digitalized static FOP food labels, two article found differences in hypothetical choice [17,37], and three articles found differences in self-reports regarding the healthfulness of products [36,37].

Digitalized interactive FOP food labels and their effects on healthy food-related behavior have been investigated, although less than digitalized static FOP food labels, and they may also impact healthy food-related behavior differently than other labels do. For instance, consumers could get more information about the product's nutritional information or how such labels grade a given food product. In addition, the location of options such as a button on the first screen or the second screen could also influence healthy food-related behavior. Furthermore, there exists research that has examined the effects of digitalized interactive FOP food labels. Egnell et al. [38] investigated the effects of graded summary, percentage-based nutrient-specific, and no FOP food labels on hypothetical choices in an online grocery context. Interestingly, participants in that study had the option to access

more information regarding the labels or the food product by clicking a specific button. Participants' hypothetical choice regarding healthy foods was higher when exposed to graded summary labels than to percentage-based nutrient-specific labels. No label produced the least hypothetical choice regarding healthy foods. Maubach et al. [39] investigated the effects of graded summary, graded nutrient-specific, percentage-based nutrient-specific, and no FOP food labels on best-worst scaling in a choice experiment. Similarly, participants could get more information regarding nutrients, ingredient lists, and allergens by clicking on a specific button. Their results show that graded nutrient-specific labels had the most impact on hypothetical choices than other conditions. Andrews et al. [40] examined single summary labels, graded nutrient-specific labels, and no FOP food labels on self-reports regarding the healthfulness of the product and nutrient estimations of food products. The participants could click on a button to see nutritional labels on the back of the products. Their results show that graded nutrient-specific labels generated higher nutrient accuracy than did single summary labels. Single summary labels generated higher self-reports regarding healthfulness than the other conditions. Sacks et al. [41] examined the impact of graded nutrient-specific labels and no FOP food labels on purchase. Likewise, the participants were presented with the FOP food labels and could get more information about the labels or nutritional information by clicking on a specific button. Their results indicate that introducing these FOP food labels did not change overall purchases nor sales of products without "red labels." Fuchs and colleagues [42] investigated the effects of interactive FOP food labels on purchase and self-reports of healthy foods in a laboratory-based online grocery store. Specifically, they developed a Google Chrome extension that displayed Nutri-Score for product-specific food products. Their result shows that individuals that were exposed to such static labels purchased on average, more healthy food products than did controls. In addition, the effect was stronger for individuals with low food literacy and individuals that were exposed to such labels showed stronger advocacy for introduction of such labels. Hence, one article shows that digitalized interactive FOP food labels did not influence purchase [41] while one article found an increase in purchase [42], two articles show that digitalized interactive FOP food labels influenced hypothetical choices [38,39], and two articles show that digitalized interactive FOP food labels influenced self-reports of healthy foods [40,42].

Digitalized technology-enabled FOP food labels and their effects on healthy food-related behavior have not been investigated in as much detail as physical or other digitalized FOP food labels. For instance, one could arrange a digitalized technology-enabled FOP food label that presents an overall graded summary label as a personalized, dynamic, and real-time based progress bar based on all products within a virtual basket before or during purchase. Such a progress bar may display how healthy a food shopping cart is or how unhealthy a virtual food cart is. As indicated elsewhere [43], such framing may influence food purchases. However, few articles have investigated the effects of digitalized technology-enabled FOP food labels on healthy food-related behavior. Shin et al. [15] investigated the effects of aggregated dynamic food labels with real-time feedback based on food products in each consumer's virtual basket, and presented the result as a pie chart based on graded summary FOP food labels or based on graded nutrient-specific FOP food labels, in combination with an option to sort products selected by consumers from most to least healthy on consumers food selection. The study used a crossover design. Half of the participants completed grocery shopping first without the dynamic food label and then with the dynamic food label. The other half completed shopping first with the label and then without the label. The participants who were exposed to the labels could select which one of seven different types of FOP food labels they would like to see. The study results show that participants exposed to the aggregated dynamic real-time food label scores selected on average, foods with a higher Nutri-score value, lower amounts of total sugar, and lower calories than those not exposed to such FOP food labels. Hence, one article [15] showed that digitalized technology-enabled FOP food labels increased healthy food choices.

3. Materials and Methods

The procedure for conducting this systematic review was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [44].

3.1. Eligibility Criteria

The articles which were included were (a) peer-reviewed journal articles and books, (b) empirical research articles which presented new data, and (c) written in English. With regard to (d) the first screening phase, articles that had the following text in the title, abstract, or keywords: “cues”, “front-of-package”, “labels”, “point-of-decision”, “symbols”, “icons”, and “logos” and its effect on food-related behaviors were eligible for the final screening phase. After the search, the following variations of the terms were included in order to avoid ambiguity: “cue”, “label”, “package”, “packaging”, “icon”, and “logo”. Regarding (e) the final screening phase, the articles included in this review were based on the full text of the article and included if they investigated FOP food labels on healthy food-related behaviors. FOP food labels were defined as a single summary, graded summary, percentage-based nutrient-specific labels, single nutrient-specific labels, graded nutrient-specific labels, or combined labels. Healthy food-related behaviors measured participants’ purchases, consumptions, hypothetical choices, and self-reports related to healthy foods measured quantitatively. After the search, self-reports were defined by being assessed on a Likert-type scale. Healthy food was defined as either low in sodium, saturated fats, sugar, or calories, or with an excess of protein, unsaturated fats, fiber, or vitamins. Conference articles, other sources, conceptual articles, literature reviews, articles that used secondary data, non-English articles, and articles that violated the first and final screening criteria were excluded.

3.2. Search Strategy

Studies were identified using search engines for academic peer-reviewed journal articles, and the search engines selected were based on the findings by Gusenbauer and Haddaway [45]. The principal search engines that were used for this study were “Web of Science”, “Science Direct”, “PubMed”, and “Wiley Online Library.” The search was performed, and information regarding articles was extracted on the 8 of November 2021. The search consisted of identifying possible eligible articles using the following search string: “front-of-package” AND (“technology” OR “online grocery”). The same search string was used in all the search engines. In addition, no filters were used during the search in all search engines. There were no imposed restrictions on publication dates or journal categories. The search process consisted of extracting the reference information for possible eligible articles by clicking on the “export” option for each search engine and downloading an article information file. The files contained the following information name of the journal, year of publication of the article, author(s) of the article, title of the article, the abstract, and keywords for each article.

3.3. Selection Process

These article information files from the four databases were merged into one common file. Two independent reviewers screened the articles listed in the common article information file based on the eligibility criteria. The reviewers had inter-rater reliability of 85.23% agreement in the first screening phase. The two reviewers resolved disagreements by discussing which eligibility criterion was violated, followed by a reassessment. If the meeting did not result in an agreement, then a third independent reviewer provided a final assessment of whether the article met the eligibility criteria. The reviewers had inter-rater reliability of 72.72% agreement in the final screening phase. Similarly, disagreements for the final screening phase were performed by two independent reviewers, and a final assessment by a third if there were disagreements. The consensus of the two reviewers resolved all disagreements.

3.4. Data Collection Process

The data collection process consisted of using a data collection sheet, and collection was performed by one reviewer. Data were obtained by identifying each of the article's information in the common article information file and based on the full text of the articles. The data of the full-text articles were extracted on 10th December 2021. The data items on the data collection sheet consisted of the year of publication, name of the journal of the article, name of authors, name of title, the abstract, number of observations included in the analysis, unit of analysis, percentage of female participants, research design, controlled or field setting, dependent variable(s), independent variable(s), comparison of data method, effect strength, univariate or multivariate independent variables, findings of the study, type of FOP food labels, physical or digitalized FOP food label, and whether the FOP food labels were static, interactive or enabled by technology. The research designs were categorized into between-participant, within-participant, and non-experimental surveys. The dependent variables were categorized into purchase, consumption, hypothetical choices, and self-reports regarding healthy foods. Self-reports were defined as verbal estimations by participants measured by Likert-type scales. The type of FOP food label was categorized by single summary labels, graded summary labels, percentage-based nutrient-specific, single nutrient-specific labels, and graded nutrient-specific FOP food labels. The findings of the studies were summarized by describing the methods and results of each included study based on the participants, intervention, control condition, and outcome measurement. Physical FOP food labels were defined as labels being presented near the three-dimensional package of a product, digitalized static FOP food labels were defined as being a label presented on a picture of the product, digitalized interactive FOP food labels were defined with the same criteria as digitalized static FOP food labels but with the additional option to view more information of the label or food product, and digitalized FOP food technology-enabled labels were defined as labels that presented information which was personalized, dynamic, and real-time based on participants actions in the study.

3.5. Synthesis of Results

Six syntheses of results were used in this review. First, a methodological overview of each article was synthesized in a table by its article number and the first 11 data items (except item 2) specified in the data collection process. Second, FOP food labels used in included articles were synthesized in a table by article number, year of publication, author(s), whether the study used physical or digitalized FOP food labels, whether they were static, interactive or technology-enabled, and which type of FOP food label was used. Third, the findings of each article were synthesized in a table by article number, year of publication, author(s), and findings which were summarized by the method and results by describing the participants, intervention, control condition, and outcome variable (dependent variable) used in each article. Fourth, the number of articles that investigated physical and digitalized FOP food labels as a function of the year of publication is represented by a bar graph. Fifth, articles that investigated the effects of FOP food labels' presence compared to their absence on the dependent variable were synthesized by presenting how many articles investigated the physical, digitalized, digitalized static, digitalized interactively, and digitalized technology-enabled FOP food labels; and the percentage of articles that found that the dependent variables were under experimental control of these labels. Finally, articles that investigated the effects of FOP food labels' presence compared to their absence across the dependent variables were synthesized by presenting how many articles investigated the physical, digitalized, digitalized static, digitalized interactively, and digitalized technology-enabled FOP food labels, and whether purchase, consumption, hypothetical choice, or self-reports separately changed as a function of these labels.

3.6. Study Risk of Bias Assessment

This study used a risk of bias assessment based on the RoB 2 tool [46] for studies that used randomized controlled trials and an adapted Joanna Briggs Institute (JIB) checklist

for non-randomized controlled studies [47] for all studies included in the review. For the randomized controlled trials studies, each study was assessed for bias due to the randomization process, deviation from intended intervention, missing data, measurement of outcomes, and reported results. An adherence assessment was used for deviations from intervention, and the additional risk of bias assessment was given for crossover and cluster randomized controlled trials. For the non-randomized controlled trials, each study was assessed for risk of bias regarding temporal relations between independent variables and their effects, participants' characteristics across groups, a clear procedure for each intervention, a control condition, multiple measurements of the outcome, missing data, measurement of outcome, and reliability of the outcome. Both the RoB 2 tool and adapted JIB Checklist were used to evaluate an overall risk of bias score, indicated by "Low risk", "Moderate risk", or "High risk" for each study. The original assessment for JIB was changed from "Yes", "No", or "Unclear" to the assessment mentioned above.

4. Results

4.1. Study Selection

A visual representation of the study selection process is shown in Figure 3. The search strategy resulted in the identification of 285 records. Fourteen of them were duplicates. They were removed. Two hundred and seventy-one were screened based on the first screening criteria, and 216 records were excluded for not meeting the criteria. All remaining 55 reports were sought for retrieval and assessed for eligibility. Out of those, a total of 25 reports were excluded based on the final eligibility criteria, as 10 of the reports did not investigate FOP food labels as defined in this review, five of the reports did not investigate behaviors related to healthy foods, four of the reports did not investigate the dependent variable specified in this review, and one report did not use primary data collection. This resulted in a total of 30 articles included in this review [15,33,48–75].

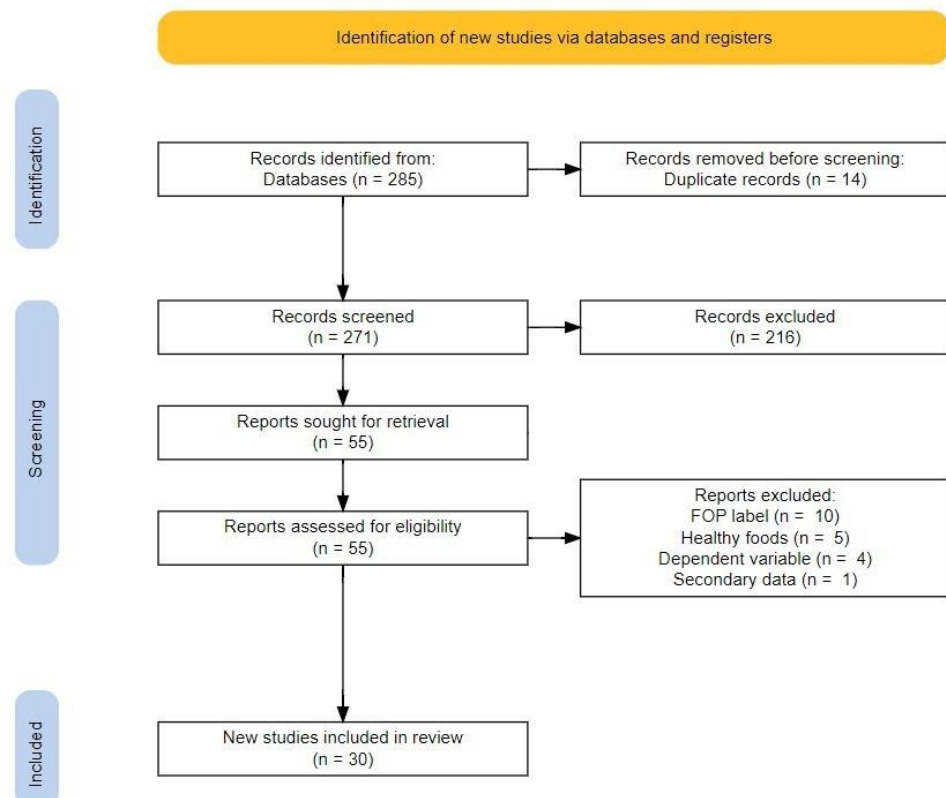


Figure 3. The flowchart shows the identification, screening, and inclusion of records, reports, and articles included on the left and reasons for removal on the right.

4.2. Study Characteristics

The methodological approach for each included article is shown in Appendix A Table A1. The most common units of analysis were participants. The studies had a variability range of 1902 regarding the participants, and approximately two-thirds of the studies had a female participant percentage between 30% and 60%. In regard to the research design of the articles, the majority were between-participant research design (52.9%), followed by within-participant research design (47.1%), and non-experimental surveys (0%). The majority of the studies were conducted in a controlled setting (76.7%). From most to least common approaches for measuring the dependent variable, the articles used self-report (46.7%), hypothetical choice (40%), purchase (11.1%), and consumption (2.2%). The independent variables that were investigated were different types of FOP food labels, labels with different product categories, nutritional information labels, different food products, textual health claims, brands, color-based labels, loss or gain framing, the time limit to shop, caloric information on each ingredient, caloric information relative to other ingredients, amount of labels within a food category, its correspondence to nutritional information, dynamic and real-time feedback, and preparation method for products. The three most common comparisons of data methods were ANOVA, t-tests, and chi-square tests, and the majority of the studies investigated multivariate independent variables.

The FOP food labels from each article are shown in Appendix A, in Table A2. Regarding physical and digitalized FOP food labels, seven articles investigated physical FOP food labels, and 23 articles investigated digitalized FOP food. Out of all included articles, 24 articles investigated static labels, six articles investigated interactively, and one article investigated technology-enabled FOP food labels. Regarding the type of FOP food labels, 24 out of 30 articles investigated nutrient-specific labels, while 12 out of 30 articles investigated summary labels. Specifically, 18 articles investigated graded nutrient-specific labels, 10 investigated single nutrient-specific labels, seven investigated graded summary labels, five investigated single summary labels, and five articles investigated percentage-based nutrient-specific labels.

The findings from each article are shown in Appendix A, in Table A3. Based on the findings of all 30 articles, 18 articles documented different values of the dependent variables in the presence of FOP food labels compared to the absence of such labels. Five articles found different effects of FOP food labels depending on which dependent variable was used. One article found no difference between the presence and absence of FOP food labels. The six remaining articles lacked an absence of label condition. In regard to all articles, 10 articles found differences between different types of FOP food labels, three articles found differences depending on which dependent variable was used, and 17 articles did not compare different types of FOP food labels as categorized by this review (e.g., some of the articles investigated several single nutrient-specific labels) or investigated only one label.

4.3. The Effects of Physical and Digitalized FOP Food Labels

The number of articles that have investigated either physical and digitalized FOP food labels and the year of publication is shown in Figure 4. The figure shows that the number of articles investigating digitalized FOP food labels increased steadily from 2011 to 2019 and that digitalized FOP food labels were higher in 2020 and 2021 than were physical FOP food labels.

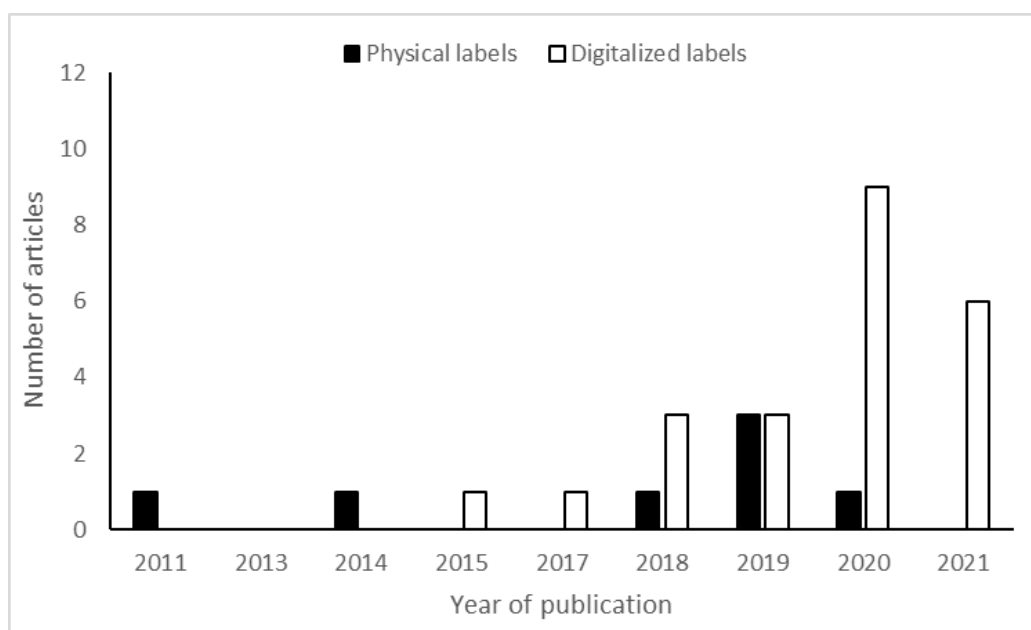


Figure 4. The Y-axis shows the number of articles included in this review, and the X-axis shows the year of publication for its corresponding article. The black bar corresponds to articles that investigated physical FOP food labels while the white bar corresponds to articles that investigated digitalized FOP food labels.

Articles that investigated the effects of the presence of physical and digitalized FOP food labels compared to their absence are shown in Appendix A, in Table A4. The effects of the presence of physical FOP food labels compared to their absence were investigated by six articles in this review. Out of those, five articles documented that the presence of physical FOP food labels was associated with a change in the dependent variables compared to the absence of FOP food labels. In contrast, the remaining articles had different results depending on the dependent variables being measured. The effects of the presence of digitalized static FOP food labels compared to their absence were investigated by 12 articles. Out of those, ten articles documented that the presence of digitalized static FOP food labels was associated with a change in the dependent variables. Two articles documented mixed results depending on which dependent variable was used. Five articles investigated the effects of digitalized interactive FOP food labels. Three of these documented a change in the dependent variable. One article found mixed results, and one article did not find differences. The effects of digitalized technology-enabled FOP food labels were investigated by one article, and it documented that the FOP food labels did change the dependent variables.

Articles in this review that investigated the effects of the presence of physical and digitalized FOP food labels compared to their absence across the dependent variables are shown in Table 1. In regard to purchasing as the dependent variable, one article did not find differences when exposed to physical FOP food labels, no articles examined digitalized static FOP food labels, two out of three articles found differences when exposed to digitalized interactive FOP food labels, and one article found differences when exposed to digitalized technology-enabled FOP food labels compared to the absence of such labels. Regarding consumption as the dependent variable, one article found differences when participants were exposed to physical FOP food labels compared to their absence, and no articles examined digitalized FOP food labels. Regarding hypothetical choice, two articles found differences when exposed to physical FOP food labels, all eight articles found differences when exposed to digitalized static FOP food labels, one out of two articles found differences when exposed to digitalized interactive FOP food labels, and no articles investigated the effects of digitalized technology-enabled FOP food labels. Regarding self-reports as the dependent variable, two out of three articles found differences when exposed

to physical FOP food labels, three out of five articles found differences when exposed to digitalized static FOP food labels, no articles investigated the effects of digitalized interactive FOP food labels and digitalized technology-enabled FOP food labels.

Table 1. The effects of physical and digitalized FOP food labels across dependent variables.

Dependent Variable	Physical	Static	Digitalized Interactive	Technology-Enabled
Purchase	0% (10)		66.67% (1, 3, 20)	100% (25)
Consumption	100% (30)			
Hypothetical choice	100% (4, 11)	100% (6, 7, 11, 12, 15, 16, 28, 29)	50% (5, 14)	
Self-reports	33% (9, 10, 26)	60% (16, 17, 18, 22, 24)		

Note. The table shows the percentage of articles that indicate that the corresponding dependent variable was under full control of physical, digitalized static, digitalized interactive, and digitalized technology-enabled FOP food labels based on articles that had a presence and an absence of FOP food label conditions. Each article's number in the parentheses specifies the articles.

The most effective type of FOP food labels compared to other labels and their impact on purchase, consumption, hypothetical choice, and self-reports regarding healthy foods were also investigated. One article investigated multiple types of FOP food labels regarding physical FOP food labels and found that combined labels were most effective in changing the dependent variable. Specifically, Koenigstrofer et al. [51] investigated the effects of graded nutrient-specific, single summary, and combined FOP food labels on hypothetical choices and found that participants who were exposed to combined FOP food labels selected food products that had the least harmful nutrients based on the SSAG/1 scale [49]. Six articles investigated the effects of multiple types of FOP food labels regarding digitalized static FOP food labels. Three articles identified which type of FOP food label was most effective in changing the dependent variable, while the three remaining articles found inconclusive results. Two articles found graded nutrient-specific labels, and one found that graded summary labels were most effective. Specifically, Gustafson & Zeballos [62] investigated the effects of percentage nutrient-specific and graded nutrient-specific FOP food labels and found that graded nutrient-specific labels were most effective. Hagmann & Siergrist [63] investigated the effects of the graded nutrient-specific and summary labels and found that graded nutrient-specific labels were most effective. Gabor et al. [66] investigated the effects of graded nutrient-specific, graded summary labels, and percentage nutrient-specific labels and found that graded summary labels were the most effective. Deliza et al. [55] investigated percentage nutrient-specific labels, graded nutrient-specific labels, and single nutrient-specific labels, and Lima et al. [70] studied percentage nutrient-specific labels, graded nutrient-specific labels, and single nutrient-specific labels. Antunez et al. [60] investigated percentage nutrient-specific labels and graded nutrient-specific labels and did not find differences in effects as a function of the labels. Three articles investigated the effects of multiple FOP food labels on digitalized interactive FOP food labels. Two of those three articles found that graded summary labels were most effective in changing the dependent variable than other labels. The remaining article found that single nutrient-specific labels were most effective. Specifically, Finkelstein [48] investigated graded nutrient-specific labels and graded summary labels and found that graded summary labels were the most effective. Blitstein et al. [61] investigated graded summary labels, graded nutrient-specific labels, and combined labels and found that graded summary labels were most effective; and Finkelstein et al. [50] investigated single nutrient-specific labels and graded nutrient-specific labels and found that single nutrient-specific labels were most effective. Regarding digitalized technology-enabled FOP food labels, no article investigated the effects of different types of FOP food labels.

4.4. Risk of Bias in Articles

The risk of bias assessment for articles that used a between-participants design with randomization is shown in Appendix A, in Table A5. Out of all 22 articles, 12 articles were assessed as having a high overall risk of bias, nine articles were a moderate risk, and one article was low risk. Regarding the risk of bias domains, a high risk of bias was more common in the deviations from the intended intervention. A moderate risk of bias was more common in reporting of results. Low risk of bias was more common in the missing outcome data domain.

The risk of bias assessment for studies that did not use a between-participant design with randomization is shown in Table A6. Six articles had a high overall risk of bias, and three articles had a moderate overall risk of bias. Regarding the risk of bias domain, both high and moderate risk of bias were more common in multiple measurements of outcome pre- and post-intervention domains. At the same time, nine articles had an overall low risk of bias regarding the temporal order of independent variable and effect, the procedure for interventions, measurement of outcome, and reliability of outcome domain.

5. Discussion

5.1. General Interpretation

This systematic review aimed to present a classification system and investigate the effects of physical and digitalized FOP food labels on healthy food-related behavior. Specifically, the articles that were collected investigated the effects of physical and digitalized static, interactive and technology-enabled FOP food labels on consumer purchases, consumption, hypothetical choices, and self-reports regarding healthy foods. To the best of the authors' knowledge, this study is the first study to do so.

The results show a difference in the dependent variables defined in this review as a function of digitalized FOP food labels when analyzed individually. Based on the articles included in this review, a higher percentage of articles found a difference in purchase and self-reports regarding digitalized FOP food labels compared to the percentage of articles that used physical FOP food labels. A similar percentage of articles found a difference in hypothetical choices regarding digitalized FOP food labels compared to articles that investigated physical FOP. No articles investigated consumption as a function of digitalized FOP food labels. Hence, the results indicate that the effects of digitalized FOP food labels are greater for purchase and self-reports compared to physical FOP food labels. Furthermore, in the context of digitalized static FOP food labels, more articles reported a change of hypothetical choice compared to articles that investigated self-reports.

When analyzed collectively, the results show a difference in the dependent variables defined in this review as a function of digitalized FOP food labels. The results show that the percentage of articles that found differences between the dependent variables was the same when articles investigated physical and digitalized static FOP food labels. The results also show that the percentage of articles that found a difference between the dependent variables was lower as a function of digitalized interactive FOP food labels than physical FOP food labels. In addition, a higher percentage of articles found a difference in the dependent variable as a function of digitalized technology-enabled FOP food labels compared to physical FOP food labels. Hence, the percentage of articles that found an effect was similar for digitalized static, lower for digitalized interactive, and higher for digitalized technology-enabled FOP food labels than physical FOP food labels when the dependent variables were analyzed collectively. However, more studies are needed to evaluate the effects of digitalized FOP food labels.

Lastly, when compared to different types of FOP food labels and their effectiveness in changing healthy food-related behaviors, combined labels were documented as the most effective for physical, graded nutrient-specific for digitalized static, graded summary labels for digitalized interactive FOP, and no articles investigated the effects digitalized technology-enabled FOP food labels. However, these articles did not compare the same type of FOP food label. Further research is needed to identify which type of FOP food labels

are more effective when presented as physical, digitalized static, digitalized interactive, and digitalized technology-enabled FOP food labels.

The articles identified in the introduction and articles which were included in the review had different results in regard to physical labels, to some degree similar results in regard to digitalized static, non-consistent results in relation to digitalized interactive, and was the same article in regard to digitalized technology-enabled FOP food labels. The results of the articles in this review do not align with the results in the literature review. Specifically, one article did not find the difference in purchase [57], one article did find a difference in consumption [75], two articles found a difference in hypothetical choice [51,58], and one did find differences in self-reports article [56] while two articles did not find a difference in self-reports [33,57] as a function of physical FOP food labels. In contrast to previous research, one article did find differences in purchases when self-reports regarding self-control were high [34], one article did not find a difference in hypothetical choice [35], and all three articles found differences in self-reports as a function of physical FOP food labels [19,34,35]. Digitalized static FOP food labels and their effects on healthy food-related behavior based on the articles included in this review are, to some degree, in line with the results of prior research identified in the literature review section. In our systematic review, eight articles did find differences in hypothetical choices [52–54,58,59,62,63,73,74], three articles did find difference in self-reports [63,65,71], while two articles did not find difference in self-reports [64,69] as a function of digitalized static FOP food labels. Based on the studies that were identified in the literature review, two articles did find differences in hypothetical choice [17,37], and two articles did find differences in self-reports [36,37] as a function of digitalized static FOP food labels. The effects of digitalized interactive FOP food labels on healthy food-related behavior, based on the articles included in this review, are non-consistent with effects identified prior research mentioned in the literature review section. In our review, two articles found differences in purchases [48,50] while one article did not find differences [67], one article found differences in hypothetical choice [61] while one article did not find differences [52]. Regarding research in the literature review, one article did not find the difference [41] while one article found an increase in purchase [42], two articles found a difference in hypothetical choice [38,39], and one article found a difference in self-reports [40] as a function of digitalized interactive FOP food labels. The effects of digitalized technology-enabled FOP food labels and their effects on healthy food-related behavior were the same as in articles identified in this review and previous research [15] indicating a lack of research regarding digitalized technology-enabled FOP food labels, as shown in Table 1.

There are several alternative explanations regarding the general interpretation of this review. Firstly, this systematic review found different results when healthy food-related behavior was analyzed collectively or individually. When healthy food-related behaviors were analyzed collectively, then similar percentages of articles that found differences in the dependent variable as a function of physical and digitalized static FOP food labels were found. However, when the percentage of articles was analyzed across the dependent variables, a higher percentage of articles were found that documented a change in self-reports as a function of digitalized static FOP food labels compared to physical FOP food labels. One possible explanation is that the search strategy that was used found more articles that investigated the effects of digitalized static FOP food labels on hypothetical choices. The results may have been different if the search strategy identified an equal number of articles that investigated the effects of physical, digitalized static, digitalized interactive, and digitalized technology-enabled FOP food labels on purchase, consumption, hypothetical choice, and self-report. In addition, hypothetical choices regarding preference often involve repeated evaluations by the participants while self-reports may require a single evaluation. This may have impacted the results. Secondly, more articles support that physical and digitalized FOP food labels change hypothetical choices than do articles that used self-reports as the dependent variable. One possibility is that it may be more practical to measure several self-report measurements, such as ratings of healthfulness, taste, affect,

and so on, through a questionnaire that presents several such questions compared to measuring several hypothetical choices. The increase in measurements with self-report may increase the probability of not finding changes.

These findings imply that physical and digitalized labels may have different impacts on consumer behavior and there may be several possible mechanisms for these findings. First, it may be the case that the actual sight and symbolic representation of food products may have different impacts on healthy food-related behavior. For instance, Huyghe and collages [76] conducted a series of experiments regarding online and offline grocery shopping on healthy food-related behaviors. Their results indicate that symbolic representation of a product may impact self-control and that may impact healthy food purchases [34]. Furthermore, online grocery stores provide the possibility of presenting pre-selected food products along with recipes (meal kits). The effects of digitalized FOP food labels may function differently when they are based on a collection of many products compared to individual products. Finally, consumers can use a variety of sensory modalities to assess a food product before purchasing it in a physical store whereas online grocery stores provide no specific sensory information such as smell and touch. In an online grocery store, one can present textual descriptions of sensory information based on the association between previously purchased products; for instance, a message at the point of purchase that suggests that a particular brand of apple has the same “taste profile” as other previously purchased products. The presence or absence of these variables may influence the effectiveness of certain digitalized FOP food labels.

5.2. Limitation of Evidence Based on Articles and Review

There exist several limitations of evidence based on the articles. Firstly, the majority of the articles included in this review had an overall moderate or high risk of bias. Specifically, reporting of results was the risk of bias domain that had the least “Low risk” assessments. The majority of these articles had a moderate risk of bias, where there was no provided information on a pre-specified statistical analysis plan. Secondly, the majority of the articles investigated the effects of digitalized static FOP food on hypothetical choices or self-reports. There is a lack of articles examining the effects of digitalized static FOP food labels effects on purchase and consumption, the effects of digitalized interactive FOP food labels on consumption and self-reports, and the effects of digitalized technology-enabled FOP food labels in general, except for one article.

Several methodological limitations of this review are also worth addressing. Firstly, the search strategy may have been too restrictive regarding identifying all articles investigating the effects of physical and digitalized FOP food labels. However, this systematic review aimed to investigate the effects of physical and digitalized FOP food labels on healthy food-related behavior and not to identify all previous research that has examined FOP food labels. Furthermore, this systematic review used only principal search systems which do not include Google Scholar. This may have impacted the number of articles that have investigated the effects of digitalized static FOP food labels included in the review. However, the number of articles that investigated interactive and technology-enabled FOP food labels produced by search engines is not likely to be affected. Secondly, one reviewer did the risk of bias assessment and the data collection process, apart from the findings of articles that another independent reviewer assessed. Thirdly, tools regarding the certainty of assessment were not used. However, issues regarding the articles identified were discussed in regard to limitations of evidence based on the studies. Several articles included in this review had an overall moderate to high risk of bias. Hence, presenting a meta-analysis that investigated the degree of effects was not appropriate. Furthermore, several articles used different measurements concerning the dependent variable. For instance, one article could present three food products, and another could present six food products when measuring hypothetical choices regarding healthy food. A meta-analysis would be appropriate if the articles in this review used the same experimental paradigm. However, a meta-analysis was not done due to a large variation in experimental designs.

This review instead investigated how many empirical articles found a difference in healthy food-related behavior as a function of physical and digitalized FOP food labels instead of directly comparing different dependent variables. Lastly, this review did not control for the confounding effects of nutritional fact labels. Future studies could address this and examine the confounding effects of nutritional information labels and digitalized FOP food labels. To control for the confounding effects would require a larger sample of empirical studies that met the inclusion parameters of this study. However, in this study, it was not feasible to perform such an analysis. Future studies could address this and examine the confounding effects of nutritional fact format and digital labeling format.

5.3. Implications and Further Research

Several implications exist based on the findings of this review. Firstly, this review found an increase in research articles regarding digitalized FOP food labels. This trend indicates that investigations into the effects of such labels are increasing and will be important for future online grocery retailing practices. Secondly, this review found one article [15] which investigated the effects of digitalized technology-enabled FOP food labels and found a reliable increase in healthy food purchases and a decrease in unhealthy nutrients while at the same time not showing significant differences in dollars spent per kcal, indicating that one indeed can increase healthy food purchase without decreasing profit. As mentioned, digitalized technology-enabled FOP food labels may increase the number of healthy food purchases, attract new customers, and increase the positive reputation of online grocery stores and brand owners such as Thrive Market, Tesco, Sainsbury, Walmart, and AmazonFresh. Even though digitalized interactive FOP food labels alone may not change purchases, such labels may still provide consumers with accurate descriptions of food products. They may attract new consumers and increase positive word of mouth regarding brand owners and retailers.

One way to advance further studies regarding digitalized technology-enabled FOP food labels is to conduct controlled laboratory experiments regarding how previous neutral symbols or stimuli may acquire a function as a healthy food label in individual analysis. As mentioned, the effects of such labels may increase the purchase of healthy foods for some subgroups [5]. Previous history with interactions with these labels may be one variable that may impact their effectiveness. The majority of the articles studied healthy food labels implemented through public policy. Participants presumably had some history regarding such labels and this may influence the effectiveness of such labels in changing healthy food-related behavior. Although further studies regarding how different FOP food labels impact different subgroups are needed [7], there is also a need to identify how the presentation of information or stimuli, in general, may impact healthy food-related behavior on an individual psychological and behavioral level, and then replicate such findings on a large scale level. Future studies regarding digitalized technology-enabled FOP food labels could, in combination, investigate the effects of automatic self-monitoring of healthy food purchases, presentation of healthy food labels on food products that have not been purchased previously in order to increase variability regarding food choices, decreasing the delay of future consequences by presenting real-time based health-related information such as a decreasing in the chance of illnesses associated with healthy food purchases, self-imposed costs or restriction of unhealthy foods in the combination of single nutrient-specific labels, other consumers FOP food label scores, and immediate or delayed presentations of such labels (e.g., real-time based versus every third purchase based on products in virtual basket). One way to advance further studies regarding digitalized interactive FOP food labels is to examine their effects on hypothetical choice, self-reports, and food consumption. As mentioned, articles that have used self-reports as the dependent variables may have measured various constructs such as healthfulness, trust, familiarity, etc., compared to hypothetical choice. Further studies could investigate such constructs.

6. Conclusions

In conclusion, digitalized interactive and technology-enabled FOP food labels and their effects on healthy food-related behavior remain an unexplored research area. This systematic review identified previous research regarding physical, digitalized static, digitalized interactive, and digitalized technology-enabled FOP food labels and investigated their effects on healthy food-related behavior regarding purchase, consumption, hypothetical choice, and self-reports. When analyzed collectively, a similar percentage of articles demonstrated the effects of physical and digitalized static FOP food labels on healthy food-related behavior. Furthermore, a lower percentage of articles demonstrated the effects of digitalized interactive FOP food labels compared to physical FOP food labels. However, a higher percentage of articles demonstrated the effects of digitalized technology-enabled FOP food labels. When analyzed individually, a higher percentage of articles supported a difference in purchase and self-reports as a function of physical and digitalized FOP food labels. Regarding articles identified in this review that compared different types of FOP food labels, including physical combined, digitalized static graded-nutrient, and digitalized interactive graded summary, FOP food labels were most effective. Our results show that there is an increase in the publication of studies regarding digitalized FOP food labels and their effect on healthy food-related behavior. Knowledge regarding variables that moderate these effects would be important for future studies.

Author Contributions: Conceptualization, A.F. and N.L.; methodology, N.L. and S.P.; software, N.L.; validation, N.L., S.P., A.F. and E.A.; formal analysis, N.L., S.P. and A.F.; investigation, N.L.; resources, A.F.; data curation, N.L. and S.P.; writing—original draft preparation, N.L.; writing—review and editing, S.P., A.F. and E.A.; visualization, N.L.; supervision, A.F. and E.A.; project administration, N.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data is provided in this article or in the Appendix A.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Methodology of the included articles.

Article	Year of Publication	Author(s)	Number of Observations	Unit of Analysis	Percentage Female Participants	Research Design	Controlled or Field Setting	Dependent Variable(s)	Independent Variable(s)	Comparison of Data Method	Univariate or Multivariate Independent Variable(s)
1	2019	Finkelstein et al. [48]	147	Participants	68.8%	Within-participant design	Field setting	Purchase	Multiple traffic light label, Nutri-score label	First difference model	Multivariate independent variables
2	2019	Reyes et al. [49]	Study 1: 600 Study 2: 700	Participants	100%	Within-participant design	Controlled setting	Hypothetical choice, self-report	15 warning labels	Study 1: ANOVA, Bonferroni Study 2: Chi-square, t-test	Multivariate independent variables
3	2020	Finkelstein et al. [50]	146	Participants	78.8%	Within-participant design	Field setting	Purchase, self-report	“Lower calorie” labeling on within-category products, “Lower calorie” labeling on across category products	First difference approach	Multivariate independent variables
4	2014	Koenigstorfer et al. [51]	152	Participants	63.5%	Between-participant design	Controlled setting	Hypothetical choice	Health mark label, traffic lights color-coding label	Two-factorial ANOVA	Multivariate independent variables
5	2019	Siegrist et al. [52]	780	Participants	51.5%	Between-participant design	Controlled setting	Hypothetical choice	Healthy choice label, nutritional information label	Kruskal–Wallis test, Mann–Whitney U test	Multivariate independent variables
6	2021	Miklavac et al. [53]	1000	Participants	49%	Within-participant design, between-participant design	Controlled setting	Self-report, hypothetical choice	Type of product, brand name with labels, health claim	Not specified for conjoint analysis, t-test	Multivariate independent variables
7	2020	Alcantara et al. [54]	1232	Participants	52%	Between-participant design	Controlled setting	Hypothetical choice	Health logo, nutritional warning label	Generalized linear model, Tukey’s test	Multivariate independent variables
8	2020	Deliza et al. [55]	Study 2: 1932	Participants	51%	Between-participant design	Controlled setting	Hypothetical choice, self-report	Guideline daily amount, traffic light system, black magnifier, red magnifier, red circle, black triangle, and black octagon label	ANOVA, generalized linear model, t-test	Multivariate independent variables
9	2019	Lima et al. [56]	141	Participants	60%	Within-participant design	Controlled setting	Self-report	Types of dairy products, traffic light system, familiar brands	ANOVA, Tukey’s test, exploratory factor analysis, parallel analysis, maximum likelihood estimation, pro max	Multivariate independent variables
10	2011	Vyth et al. [57]	Study 1: 25 Study 2: 368	Study 1: Cafeterias Study 2: Participants	Not collected	Within-participant design, between-participant design	Field setting	Purchase, self-report	Choices logo on sandwiches, choices logo on soups, sandwiches, and soups	Generalized estimation equation analysis, t-test	Multivariate independent variables

Table A1. Cont.

Article	Year of Publication	Author(s)	Number of Observations	Unit of Analysis	Percentage Female Participants	Research Design	Controlled or Field Setting	Dependent Variable(s)	Independent Variable(s)	Comparison of Data Method	Univariate or Multivariate Independent Variable(s)
11	2019	Machin et al. [58]	199	Participants	66%	Between-participant design	Controlled setting	Self-report, hypothetical choice	Calorie, added sugar, total fat, saturated fat, and sodium-based warning labels	Chi-square test, <i>t</i> -test	Multivariate independent variables
12	2018	Kim et al. [59]	95	Participants	54.7%	Within-participant design	Controlled setting	Hypothetical choice	Numeric, color-coded, and physical activity-based labels	Chi-square test, one-way ANOVA, Tukey test	Multivariate independent variables
13	2015	Antunez et al. [60]	54	Participants	53%	Within-participant design	Controlled setting	Hypothetical choice	Color without text, color with text, monochromatic without text, monochromatic with text	ANOVA	Multivariate independent variables
14	2020	Blitstein et al. [61]	1452	Participants	83.5%	Between-participant design, within-participant design	Controlled setting	Hypothetical choice, self-report	Summary label, nutrient-specific label, hybrid label, 10-min time limit to shop	Tukey–Kramer adjustment, ANCOVA,	Multivariate independent variables
15	2020	Gustafson & Zeballos [62]	633	Participants	53%	Between-participant design	Controlled setting	Hypothetical choice	Calorie information for each ingredient, calorie information relative to highest calorie item, calorie information relative to lowest calorie item	T-test, linear regression analysis, chi-square tests, Bonferroni Correction	Multivariate independent variables
16	2020	Hagmann & Siegrist [63]	1313	Participants	53.9%	Between-participant design	Controlled setting	Hypothetical choice, self-report	Nutritional information label, multiple traffic light, Nutri-score, Nutri-score on half of the products	Welch’s analysis of variance (ANOVA), Games-Howell post hoc test, Kruskal–Wallis test, Pearson’s <i>r</i> , one-way ANOVA, exploratory <i>t</i> -tests independent samples	Multivariate independent variables
17	2018	Menger-Ogle & Graham [64]	239	Participants	59%	Within-participant design	Field setting	Self-report	“Low fat”, “> 100% RDA of vitamin C”, “35% RDA of vitamin A”, “Low fat, low sugar, transfat free”, “zero cholesterol, zero trans fat, gluten-free, MSG-free” labels	Mediational model, <i>t</i> -test,	Multivariate independent variables
18	2019	Vizcaino & Velasco [65]	Study 1: 133 Study 2: 837 Study 3: 181 Study 4: 201	Participants	Study 1: 38% Study 2: 53% Study 3: 46.7% Study 4: 71.1%	Between-participant design	Controlled setting	Self-report	Traffic light labels, brand familiarity	ANOVA, mediation analysis, multiple moderation regression, moderated-mediation analysis	Multivariate independent variables
19	2020	Gabor et al. [66]	76	Participants	55%	Between-participant design	Controlled setting	Self-report	Nutri-score, multiple traffic lights, guideline daily amount	ANOVA, Tukey’s test	Multivariate independent variables

Table A1. Cont.

Article	Year of Publication	Author(s)	Number of Observations	Unit of Analysis	Percentage Female Participants	Research Design	Controlled or Field Setting	Dependent Variable(s)	Independent Variable(s)	Comparison of Data Method	Univariate or Multivariate Independent Variable(s)
20	2021	Finkelstein et al. [67]	106	Participants	66%	Within-participant design	Field setting	Purchase	Healthier choice, physical activity equivalent, and nutritional information label	First-differenced regressions	Multivariate independent variables
21	2021	Fagerström et al. [68]	30	Participants	46.7%	Within-participant design	Controlled setting	Hypothetical choice	Correspondence of healthy food labels and nutritional information	Share of correct choice	Univariate independent variable
22	2021	Folkvord et al. [69]	192	Participants	63%	Between-participant design	Controlled setting	Self-report	Nutri-score	Chi-square test, MANOVA, Bayesian ANCOVA	Univariate independent variable
23	2018	Lima et al. [70]	Sample 1: 318 Sample 2: 278	Participants	Sample 1: 83% Sample 2: 49%	Between-participant design	Controlled setting	Self-report	Daily guideline amounts, traffic light systems, and warning systems	ANOVA, Tukey's test	Multivariate independent variables
24	2017	Yoo et al. [71]	646	Participants	56%	Within-participant design	Controlled setting	Self-report	Dairy product, sugar reduction claim, traffic light system	ANOVA, generalized linear model	Multivariate independent variables
25	2020	Shin et al. [15]	125	Participants	72%	Between-participant design	Field setting	Purchase, self-report	Nutri-score, physical activity equivalents, calorie, sugar, sodium, saturated fat, and total fat per serving and percentage daily recommended intake dynamic with real-time feedback labels	First difference regression	Multivariate independent variables
26	2018	Acton et al. [33]	675	Participants	53.9%	Between-participant design	Field setting	Self-report	Numeric rating, health star rating, traffic light symbol	Chi-square test, logistic regression model	Multivariate independent variables
27	2020	Rojas-Rivas et al. [72]	498	Participants	73%	Within-participant design	Controlled setting	Self-report	Sodium warning, type of bread, brand, price	Exploratory factor analyses, maximum likelihood and Promax rotation method, mixed logit model	Multivariate independent variables
28	2021	Yang et al. [73]	1215	Participants	62.2%	Within-participant design	Controlled setting	Hypothetical choice, self-report	Health label, low-carbon label, the proportion of brown rice, pre-treatment, price	Mixed logit model,	Multivariate independent variables
29	2021	Mauri et al. [74]	Study 1: 200 Study 2: 272	Participants	Study 1: 66.8% Study 2: 71.7%	Between-participant design	Controlled setting	Hypothetical choice, self-report	Sugar teaspoons, traffic lights,	ANOVA, Mediation testing	Multivariate independent variables
30	2020	Jin et al. [75]	Study 1: 123 Study 2: 144 Study 3: 241	Participants	Study 1: 51.2% Study 2: 49.3% Study 3: 46.9%	Between-participant design	Controlled setting	Self-report, consumption	Physical activity equivalent to calorie label	Moderated regression analysis	Multivariate independent variables

Note. Each included article is shown vertically while the methodological approach used by each article is presented horizontally.

Table A2. Front of package food labels used in included articles.

Article	Year of Publication	Author(s)	Physical or Digitalized FOP Food Label	Static, Interactive, or Technology-Enabled	Type of FOP Food Label
1	2019	Finkelstein et al. [48]	Digitalized	Interactive	Graded nutrient-specific label, graded summary label
2	2019	Reyes et al. [49]	Physical		Singe nutrient-specific label
3	2020	Finkelstein et al. [50]	Digitalized	Interactive	Singe nutrient-specific label
4	2014	Koenigstorfer et al. [51]	Physical		Graded nutrient-specific label, single summary label, combined label
5	2019	Siegrist et al. [52]	Digitalized	Interactive	Single summary label
6	2021	Miklavec et al. [53]	Digitalized	Static	Graded nutrient-specific label
7	2020	Alcantara et al. [54]	Digitalized	Static	Single nutrient-specific label
8	2020	Deliza et al. [55]	Digitalized	Static	Percentage nutrient-specific label, graded nutrient-specific label, single nutrient-specific labels
9	2019	Lima et al. [56]	Physical		Graded nutrient-specific label
10	2011	Vyth et al. [57]	Physical		Single summary label
11	2019	Machin et al. [58]	Physical		Single nutrient-specific label
12	2018	Kim et al. [59]	Digitalized	Static	Graded nutrient-specific label
13	2015	Antunez et al. [60]	Digitalized	Static	Percentage nutrient-specific label, graded nutrient-specific label
14	2020	Blitstein et al. [61]	Digitalized	Interactive	Graded summary label, graded nutrient-specific label, combined label
15	2020	Gustafson & Zeballos [62]	Digitalized	Static	Graded nutrient-specific label, percentage nutrient-specific label
16	2020	Hagmann & Siegrist [63]	Digitalized	Static	Graded nutrient-specific label, graded summary label
17	2018	Menger-Ogle & Graham [64]	Digitalized	Static	Single nutrient-specific label
18	2019	Vizcaino & Velasco [65]	Digitalized	Static	Graded nutrient-specific label, single nutrient-specific label

Table A2. Cont.

Article	Year of Publication	Author(s)	Physical or Digitalized FOP Food Label	Static, Interactive, or Technology-Enabled	Type of FOP Food Label
19	2020	Gabor et al. [66]	Digitalized	Static	Graded nutrient-specific label, graded summary label, percentage nutrient-specific label
20	2021	Finkelstein et al. [67]	Digitalized	Interactive	Single nutrient-specific label, graded nutrient-specific label
21	2021	Fagerstrøm et al. [68]	Digitalized	Static	Single summary label
22	2021	Folkvord et al. [69]	Digitalized	Static	Graded summary label
23	2018	Lima et al. [70]	Digitalized	Static	Percentage nutrient-specific label, graded nutrient-specific label, single nutrient-specific labels
24	2017	Yoo et al. [71]	Digitalized	Static	Graded nutrient-specific label
25	2020	Shin et al. [15]	Digitalized	Technology-enabled	Graded summary label, graded nutrient-specific label
26	2018	Acton et al. [33]	Physical		Graded summary label
27	2020	Rojas-Rivas et al. [72]	Digitalized	Static	Single nutrient-specific label
28	2021	Yang et al. [73]	Digitalized	Static	Single summary label
29	2021	Mauri et al. [74]	Digitalized	Static	Graded nutrient-specific label
30	2020	Jin et al. [75]	Physical		Graded nutrient-specific label

Note. Each included article is shown vertically while information regarding the front of package labels used is presented in the last row.

Table A3. Findings from included articles.

Article	Year of Publication	Author(s)	Findings
1	2019	Finkelstein et al. [48]	Consumers shopped at online grocery stores and were exposed to (a) Multiple traffic light labels, (b) Nutri-score labels, or (c) no FOP food labels conditions. The results show that both labels increased the purchase of healthy products with no difference between labels. In contrast, the Nutri-score label increased average Nutri-score selection higher than multiple traffic light labels and no label.
2	2019	Reyes et al. [49]	Study 1: Participants were instructed to select between 2 out of 15 yogurts with different warning labels and asked to rate visibility, understanding, intend purchase score, ability to modify intend to purchase, and socio-demographical information. The results show that five distinct labels were associated with greater visualization, intended purchase score, and ability to modify intended purchase. Study 2: New participants were instructed to select one out of two warning labels which were based on the five warning labels in a previous study, and used the same measurement as the previous study. The results show that the stop sign label was associated with a greater effect on all ratings.
3	2020	Finkelstein et al. [50]	Consumers shopped at online grocery stores and were exposed to (a) “Lower calorie” label on 20% of foods within a product category, (b) “Lower calorie” label on 20% of all foods, or (c) no FOP food labels conditions. The results show that within-category labeling increased purchase of labeled foods compared to no label, no differences in within- and across- category labeling, and no evidence of a decrease in calories purchased in the latter.
4	2014	Koenigstorfer et al. [51]	Participants were randomly assigned to either (a) health mark and traffic light labels present, (b) health mark present and traffic light absent, (c) health mark absent and traffic light present, and (d) no labels. The results show that participants exposed to both labels selected healthier foods compared to other conditions.
5	2019	Siegrist et al. [52]	Participants were randomly assigned to (a) combined healthy choice and nutritional information label, (b) healthy choice label, (c) nutritional information label, and (d) no label condition; they were presented pairs of food and instructed to select the healthiest product. Healthy choice labels were presented on healthier options and nutritional information labels on both options. The results show that the nutritional information label slightly improved healthy choices, combined labels produced similar results, and that healthy choice labels alone and no label produced similar results.
6	2021	Miklavac et al. [53]	Participants were presented with fictive products with different combinations of types of products (soft drink, yogurt, and chocolate), brand name (three neutral circles, one heart, or three hearts), and claim (no claim, general claim, specific claim), and asked to rate how healthy the product was. Later, participants were assigned in (a) a heart symbol label condition and (b) no heart symbol label condition, presented for four existing brands of water bottles where one of the products in the former condition had a heart symbol, and instructed to rate how healthy the product was compared to tap water. The results show that the type of product, claims, and brand name had the highest impact in that order, and that the water bottle with heart symbols had the highest impact on the rating.

Table A3. Cont.

Article	Year of Publication	Author(s)	Findings
7	2020	Alcantara et al. [54]	Participants were allocated to either (a) health logo condition, (b) nutritional warning condition, and (c) no label condition, presented with three products each from a different category, and instructed to select which one they would like to buy. The results show that nutritional warnings were more effective than health logos in increasing product selection in all product categories, although both increased product selection compared to the no-label condition.
8	2020	Deliza et al. [55]	Participants were allocated to either (a) guideline daily amount, (b) traffic-light system, (c) black magnifier, (d) red magnifier, (e) red circle, (f) black triangle, and (g) black octagon label condition, and were presented with three products each having a different label and product category. Half of the participants were instructed to select the healthy product while the other half selected the unhealthy product. Later, participants were instructed to rate how healthy the product was. The results show that traffic-light, red circle, black triangle, black octagon, black magnifier, and guideline daily amount labels from, most to least in that order, were associated with healthier responses. Guideline daily amounts were associated with higher ratings of healthfulness than warning labels.
9	2019	Lima et al. [56]	Participants were presented with food products with different combinations of dairy products (yogurt, cheese, and chocolate-flavored milk), traffic light system (yes vs. no), and brand (well-known vs. unknown), were presented one product at a time, and instructed to rate how healthy the product was. The result shows the relative impact on ratings, from most to least, were the type of dairy product, traffic light system, and brand. The yogurt with the traffic light system and a familiar brand was on average, rated as healthier.
10	2011	Vyth et al. [57]	Consumers in 25 different cafeterias were exposed for cycles of nine weeks of (a) baseline condition with no Choices logo, (b) Choices logo on sandwiches, soups, and fresh fruits, and (c) postintervention period without the label, each condition lasting three weeks. Cycles were repeated three times. Consumers' purchases and employees near the cafeterias self-reports regarding attitudes, self-efficacy, intention, and whether they used the logo, were measured. The intervention did not significantly affect employees' lunchtime food choices. However, the results show that fruits sales were higher in the logo condition compared to its absence, while purchases of sandwiches and soups were similar across the conditions.
11	2019	Machin et al. [58]	Participants were allocated to (a) warning label condition or (b) no label condition; they were exposed to 15 snack products based on six food categories (fruit, alfajor, cereal bar, cracker, cookies, and peanuts; and were instructed to select a snack they would like to consume. The results show that participants allocated to the warning label condition selected fewer products that were excessive in at least one nutrient than participants in the no label condition.
12	2018	Kim et al. [59]	Participants were allocated to (a) color-coded calorie label condition, (b) physical activity-based condition, or (c) numeric calorie label condition; they were instructed to choose one burger/sandwich, snack/sides, and beverage; each category had six options. The results show that participants being exposed to the physical activity-based label, color-coded label, and numeric label led from most to least, to fewer calories selected.

Table A3. Cont.

Article	Year of Publication	Author(s)	Findings
13	2015	Antunez et al. [60]	Participants were exposed to a series of three products with a combination of the type of label (color or no color; text or no text) and a number of excess nutrients (all medium; one excessive nutrient content) and were asked to indicate which of three labels were low-fat and classify which product had lowest salt content. The results show that the percentage of correct responses was higher during color-coded than monochromatic labels for low-fat ratings but not for low salt ratings.
14	2020	Blitstein et al. [61]	Participants were allocated to (a) summary label condition, (b) nutrient-specific label condition, (c) hybrid label condition, or (d) no label condition; participants had either a time constraint of 10 min for shopping or were without such time constraints; and were instructed to select the six healthiest products for their family. The results show that the participants exposed to summary or hybrid labels made healthier choices than those exposed to nutrient-specific labels. The time constraint led to less healthier choices than no time constraint for participants exposed to summary or hybrid labels but not for nutrient-specific labels.
15	2020	Gustafson & Zeballos [62]	Participants were allocated to (a) calorie information condition, (b) calorie information relative to highest calorie item, (c) calorie information relative to lowest calorie item, and (d) no label condition; they were instructed to select which items they would like for constructing a fictive sandwich. The results show that participants exposed to relative calorie labels had fewer selected calories than those with no label. There were no significant differences between the calorie label and no label condition.
16	2020	Hagmann & Siegrist [63]	Participants were allocated to (a) nutritional information condition, (b) multiple traffic light condition, (c) Nutri-score condition, (d) Nutri-score on half of products condition, and (e) no label condition; they were presented with two products and instructed to select the healthiest option. The results show that the proportion of correct choices was higher for participants exposed to the Nutri-score label than respondents in other conditions.
17	2018	Menger-Ogle & Graham [64]	Participants were exposed to two of four possible food products with labels, instructed to rate how likely they were to purchase the product, the influence of such messages on their own purchase behavior, the healthfulness of the product, and the truthfulness of the message being presented. The results based on mediation models show that labels such as “healthful for children” influenced product perceptions while labels like “tasty” influenced purchase intention.
18	2019	Vizcaino & Velasco [65]	Study 1: Participants were allocated in either (a) traffic light condition or (b) no label condition, were presented a yogurt, and asked to rate how likely they were to purchase. Study 2: Participants were allocated in either (a) familiar brand and traffic light label, (b) unfamiliar brand and label, (c) familiar brand and no label, and (d) unfamiliar brand and no label, and were instructed to rate the trustworthiness of the product. Study 3: Used the same procedure as the second study but used different food categories. Study 4: Used the same procedure as study 2, used different foods and performed a moderation-mediation model. The results of these studies show a higher degree of purchase ratings when exposed to traffic lights, that familiar brands with traffic lights did produce interaction effects, and that brand trust may mediate the interaction of traffic lights and brand familiarity.

Table A3. Cont.

Article	Year of Publication	Author(s)	Findings
19	2020	Gabor et al. [66]	Participants were allocated to (a) multiple traffic light conditions, (b) Nutri-score condition, and (c) guideline daily amounts label condition; presented food products, instructed to rate how healthy the product is and how often they consumed such products. The results show that Nutri-score, multiple traffic lights, and guideline daily amounts condition produced high to low ratings of healthfulness and consumption frequency in that order.
20	2021	Finkelstein et al. [67]	Consumers shopped at an online grocery store and were exposed to (a) healthier choice label condition, (b) healthier choice and physical activity equivalent labels condition, and (c) no label condition; while their purchases were recorded and used to derive total calories, Grocery Purchase Quality Index 2016, weighted average Nutri-scores, sugar, sodium, saturated fat, and calories per dollar spent. The results show that healthier choices increased purchases of labeled products. In contrast, healthier choice labels combined with physical activity equivalents did not lead to a greater increase in healthy food purchases.
21	2021	Fagerstrøm et al. [68]	Participants were exposed to (a) correspondence between healthy food labels and nutritional information labels, (b) non-correspondence between healthy food labels, (c) healthy food labels on both products, and (d) no label conditions; presented with two food products with their respective nutritional information, and instructed to select the healthier product. The results show that approximately two-thirds of the participants chose the healthier option when there was a correspondence. Approximately one-third of participants continued to select the healthier option when there was non-correspondence.
22	2021	Folkvord et al. [69]	Participants were allocated in either (a) Nutri-score condition or (b) no label condition; they were instructed to rate how appealing the product looked, how tasty the product looked, and how likely they were to purchase the product. The results show that the participants' ratings of appeal, ratings of tastiness, and purchase intention did not differ between the groups.
23	2018	Lima et al. [70]	Participants (parents and children) were allocated to (a) guideline daily amounts, (b) traffic light systems, or (c) warning system conditions; and instructed to rate how healthy the product was and how often they consume such products. The results show that ratings of healthfulness were lower for participants in the traffic light and warning systems condition, than in the guideline daily system. Based on the parents, the guideline daily amount system was associated with higher healthfulness scores, and warning labels had more impact on ratings than other labels, while the labels influenced children less.
24	2017	Yoo et al. [71]	Participants were exposed to several fictive products with different combinations of (a) dairy products (yogurt, chocolate-flavored milk, and vanilla milk dessert), (b) sugar reduction claim (present or absent), and (c) traffic light system (present or absent); presented with the products one at a time and instructed to rate how much they would like the product. The results show that participants were influenced by product type, sugar reduction claim, and traffic light system from most to least in that order.

Table A3. Cont.

Article	Year of Publication	Author(s)	Findings
25	2020	Shin et al. [15]	Consumers shopped in an online grocery store and were exposed to either (a) dynamic food labels with real-time feedback based on selected products in a virtual basket or (b) no food label condition; consumers' purchases were used to derive weighted average Nutri-score per serving, total calories and sugar purchased, calories per dollar purchased, and average servings of calories, sugar, sodium, total fat, and saturated fat. The results show that the average Nutri-score was higher, and all other measures were lower for participants in the label condition than the participants in the no label condition.
26	2018	Acton et al. [33]	Participants were allocated to (a) numeric rating food label, (b) health star rating, (c) simplified traffic light symbol or, (d) no label condition; presented with three beverages with varying degrees of healthiness, all of them which had the label corresponding to the condition; and were instructed to rate the healthiness of the product. The results show that participants exposed to health star rating were more likely to select moderately healthy for moderately healthy beverages, than when exposed to other labels.
27	2020	Rojas-Rivas et al. [72]	Participants were exposed to pairs of products with different combinations of type of bread (white or whole wheat), brand (unknown or known), sodium warning (present or absent), and price (75, 85, or 100USD); and instructed to select between the two products or a "none of these breads" option. The results show that participants were influenced by sodium warning, brand, and type of bread from most to least in that order, although the type of bread was not statistically significant.
28	2021	Yang et al. [73]	Participants were exposed to two food products with different combinations of (a) types of health labels, (b) types of low-carbon labels, (c) proportions of brown to white rice, (d) cooking method, and (e) price; and were instructed to select which one they prefer. The results show that health and low-carbon labels in the form of symbols were associated with a higher willingness to pay than brief text claims about health or low-carbon. All labels had higher impact on choice than cooking method but lower than the proportion of brown to white rice.
29	2021	Mauri et al. [74]	Study 1: Participants were exposed to two foods with (a) two or six sugar teaspoons labels and (b) red or green traffic light labels and were instructed to select the product that best reflects their preference. Study 2: Participants were allocated in either (a) traffic light label condition, (b) sugar teaspoons label condition, or (c) no label condition; they were instructed to select one of three products that they would like to buy. After the selection, the ingredients of the products with different degrees of simplicity were shown. Participants were instructed to rate their preference for labels, ingredient information, and degree of the healthiness of the product. These studies show that labels had a small increase in healthier food selection. Participants exposed to sugar teaspoon labels chose, on average, a higher proportions of healthy foods than participants exposed to traffic light labels. In addition, the effects of sugar teaspoons are also impacted by food category, and ingredient composition influences ratings of healthiness.

Table A3. Cont.

Article	Year of Publication	Author(s)	Findings
30	2020	Jin et al. [75]	Study 1: Participants were allocated to either (a) physical activity equivalent calorie label condition or (b) no label condition; instructed to rate how hungry they were, exposed to a food product, instructed to consume the product, rate how much they liked the product and their dieting tendencies, and to run on a treadmill for as long or as intensely as they chose. Study 2: Participants were allocated similarly to in study 1, used another food product, were instructed to complete a lexical decision task consisting of non-words, neutral words unrelated to energy balance, target energy balance-related words, and were later instructed to run on a treadmill as in study 1. Study 3: Participants were allocated to (a) presence of label and energy-balance tasks, (b) presence of label and absence of energy-balance task, (c) absence of label and presence of energy-balance task, or (d) absence of label and energy-balance task conditions; instructed to conduct a language test, to construct a four-word sentence and, similarly as to previous studies, taste food and run on a treadmill. These studies show that participants with high dietary tendencies consumed fewer calories and burned more calories in the treadmill condition compared to non-dieters, that such effects were greater for dieters compared to non-dieters, that such labels affect response time to energy balance-related words in a higher degree to dieters compared to non-dieters, and that dieters in the presence of label and absence of energy-balance conditions had higher energy expenditures compared to absent of energy-balance condition.

Note. Each included article is shown in the first column, while the findings of the articles are presented in the last column. The findings of each article are summarized by the participants, intervention, comparison, outcome (PICO), and results.

Table A4. The effects of physical and digitalized FOP food labels.

Dependent Variable Was Affected by the FOP Format	Physical	Digitalized		
		Static	Interactive	Technology-Enabled
Full	83.3% (4, 9, 11, 26, 30)	83.3% (6, 7, 12, 15, 16, 18, 24, 27, 28, 29)	60% (1, 3, 14)	100% (25)
Partial	16.7% (10)	16.7% (17, 22)	20% (20)	0%
No	0%	0%	20% (5)	0%
Total number of articles	6	12	5	1

Note. The table shows the percentage of articles that indicate that the dependent variable was under full, partial, or no control as a function of physical, all digitalized, digitalized static, interactive, and technology-enabled FOP food labels. Articles that contained a study that did not have an absence of FOP food label conditions were not included in this table. The numbers in the parentheses correspond to the article number included in the review. The total number of articles which investigated physical, digitalized static, interactive, and technology-enabled FOP food labels are shown in the last row.

Table A5. Risk of bias assessment for included articles that used randomized control trials.

Article	Study	Before Study		During Study		After Study		Overall Risk of Bias
		Randomization Process	Deviations from Intended Interventions	Missing Outcome Data	Measurement of Outcome	Reporting of Results	Carryover or Timing Effects	
1	Study 2	Low	Low	Low	Low	Low	Low	Low
3		Low	Low	Low	Low	Moderate	Low	Moderate
4		Low	Low	Low	Low	Moderate		Moderate
5		Moderate	Low	Low	Low	Moderate		High
6		Moderate	Low	Low	Low	Moderate		High
7		Low	Low	Low	Low	Moderate		Moderate
8		Low	Low	Low	Low	Moderate		Moderate
10		Moderate	Low	Low	Low	Moderate	Moderate	High
11		Low	High	Low	Moderate	Moderate		High
12		Moderate	Moderate	Low	Low	Moderate	Moderate	High
14	Study 2, 3, and 4	Low	Low	Low	Low	Moderate		Moderate
15		Low	Low	Low	Low	Moderate		Moderate
16		Low	Low	Low	Low	Moderate		Moderate
18		Moderate	High	Low	Low	Moderate		High
19		Moderate	Low	Low	Low	Moderate		High
20		Low	Moderate	Low	Low	Low	Low	Moderate
22		Moderate	High	Low	Low	Moderate		High
23		Moderate	Low	Low	Moderate	Moderate		High
25		Low	Low	Low	High	Moderate	Low	High
26		Moderate	Low	Low	Moderate	Moderate		High
29	Study 2	Low	Low	Low	Low	Moderate	Moderate	High
30	Study 1, 2, and 3	Moderate	Low	Low	Low	Moderate		Moderate

Note. Each included article is shown vertically, while the risk of bias assessment based on the RoB 2 tool domains is shown horizontally.

Table A6. Risk of bias assessment for included articles that used non-randomized control trials.

Article ID	Study	Temporal Order of Independent Variable and Effect	Participant Characteristics across Groups	Procedure for Interventions	Control Condition	Multiple Measurements of Outcome Pre- and Post-Intervention	Missing Data	Measurement of Outcome	Reliability of Outcome	Appropriate Analysis	Overall Risk
2	Study 1 and 2	Low	Low	Low	High	High	Moderate	Low	Low	Low	High
9		Low	Low	Low	Low	Moderate	Moderate	Low	Low	Low	High
13	Study 2	Low	Low	Low	Moderate	Moderate	Moderate	Low	Low	Low	High
17		Low	Low	Low	Low	High	Moderate	Low	Low	Low	High
18	Study 1	Low	Moderate	Low	Low	High	Low	Low	Low	Low	High
21		Low	Low	Low	Low	Low	Low	Low	Low	Moderate	Moderate
24		Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate
27		Low	Low	Low	Low	Moderate	Low	Low	Low	Low	Moderate
28		Low	Low	Low	Low	Moderate	Low	Low	Low	Moderate	High

Note. Each included article is shown vertically, while the risk of bias assessment based on the adapted JIB tool is shown horizontally.

References

- Chooi, Y.C.; Ding, C.; Magkos, F. The epidemiology of obesity. *Metabolism* **2019**, *92*, 6–10. [CrossRef] [PubMed]
- Poelman, M.; Strak, M.; Schmitz, O.; Hoek, G.; Karssenberg, D.; Helbich, M.; Ntarladima, A.-M.; Bots, M.; Brunekreef, B.; Grobbee, R. Relations between the residential fast-food environment and the individual risk of cardiovascular diseases in The Netherlands: A nationwide follow-up study. *Eur. J. Prev. Cardiol.* **2018**, *25*, 1397–1405. [CrossRef]
- Alaimo, K.; Olson, C.M.; Frongillo, E.A. Family food insufficiency, but not low family income, is positively associated with dysthymia and suicide symptoms in adolescents. *J. Nutr.* **2002**, *132*, 719–725. [CrossRef]
- World Obesity. All countries off track to meet 2025 WHO targets on obesity. 2020. Available online: <https://cdn.easo.org/wp-content/uploads/2020/03/03053339/World-Obesity-Day-Template-Press-Release-2020-FINAL-SB-edit-.pdf> (accessed on 1 September 2022).
- Campos, S.; Doxey, J.; Hammond, D. Nutrition labels on pre-packaged foods: A systematic review. *Public health nutrition* **2011**, *14*, 1496–1506. [CrossRef] [PubMed]
- World Health Organization. *Global Strategy on Diet, Physical Activity and Health*; World Health Organization: Geneva, Switzerland, 2004.
- An, R.; Shi, Y.; Shen, J.; Bullard, T.; Liu, G.; Yang, Q.; Chen, N.; Cao, L. Effect of front-of-package nutrition labeling on food purchases: A systematic review. *Public Health* **2021**, *191*, 59–67. [CrossRef]
- Song, J.; Brown, M.K.; Tan, M.; MacGregor, G.A.; Webster, J.; Campbell, N.R.; Trieu, K.; Ni Mhurchu, C.; Cobb, L.K.; He, F.J. Impact of color-coded and warning nutrition labelling schemes: A systematic review and network meta-analysis. *PLoS Med.* **2021**, *18*, e1003765. [CrossRef] [PubMed]
- Temple, N.J. Front-of-package food labels: A narrative review. *Appetite* **2020**, *144*, 104485. [CrossRef]
- Ikonen, I.; Sotgiu, F.; Aydinli, A.; Verlegh, P.W. Consumer effects of front-of-package nutrition labeling: An interdisciplinary meta-analysis. *J. Acad. Mark. Sci.* **2020**, *48*, 360–383. [CrossRef]
- Sanjari, S.S.; Jahn, S.; Boztug, Y. Dual-process theory and consumer response to front-of-package nutrition label formats. *Nutr. Rev.* **2017**, *75*, 871–882. [CrossRef]
- Hersey, J.C.; Wohlgenant, K.C.; Arsenault, J.E.; Kosa, K.M.; Muth, M.K. Effects of front-of-package and shelf nutrition labeling systems on consumers. *Nutr. Rev.* **2013**, *71*, 1–14. [CrossRef]
- Fagerström, A.; Richartz, P.; Pawar, S.; Larsen, N.M.; Sigurdsson, V.; Eriksson, N. The relative importance of healthy food labels when shopping for groceries online. *Procedia Comput. Sci.* **2019**, *164*, 538–545. [CrossRef]
- Fagerström, A.; Eriksson, N.; Sigurdsson, V. Investigating the impact of Internet of Things services from a smartphone app on grocery shopping. *J. Retail. Consum. Serv.* **2020**, *52*, 101927. [CrossRef]
- Shin, S.; van Dam, R.M.; Finkelstein, E.A. The effect of dynamic food labels with real-time feedback on diet quality: Results from a randomized controlled trial. *Nutrients* **2020**, *12*, 2158. [CrossRef] [PubMed]
- Vyth, E.L.; Steenhuis, I.H.; Brandt, H.E.; Roodenburg, A.J.; Brug, J.; Seidell, J.C. Methodological quality of front-of-pack labeling studies: A review plus identification of research challenges. *Nutr. Rev.* **2012**, *70*, 709–720. [CrossRef]
- Talati, Z.; Egnell, M.; Herberg, S.; Julia, C.; Pettigrew, S. Food choice under five front-of-package nutrition label conditions: An experimental study across 12 countries. *Am. J. Public Health* **2019**, *109*, 1770–1775. [CrossRef]
- Schuldt, J.P. Does green mean healthy? Nutrition label color affects perceptions of healthfulness. *Health Commun.* **2013**, *28*, 814–821. [CrossRef] [PubMed]
- Roberto, C.A.; Shivaram, M.; Martinez, O.; Boles, C.; Harris, J.L.; Brownell, K.D. The Smart Choices front-of-package nutrition label. Influence on perceptions and intake of cereal. *Appetite* **2012**, *58*, 651–657. [CrossRef] [PubMed]
- Savoie, N.; Harvey, K.L.; Binnie, M.A.; Pasut, L. Consumer perceptions of front-of-package labelling systems and healthiness of foods. *Can. J. Public Health* **2013**, *104*, e359–e363. [CrossRef]
- Miklavac, K.; Pravst, I.; Raats, M.M.; Pohar, J. Front of package symbols as a tool to promote healthier food choices in Slovenia: Accompanying explanatory claim can considerably influence the consumer's preferences. *Food Res. Int.* **2016**, *90*, 235–243. [CrossRef]
- Chan, J.; McMahon, E.; Brimblecombe, J. Point-of-sale nutrition information interventions in food retail stores to promote healthier food purchase and intake: A systematic review. *Obes. Rev.* **2021**, *22*, e13311. [CrossRef] [PubMed]
- Piqueras-Fiszman, B.; Spence, C. Sensory expectations based on product-extrinsic food cues: An interdisciplinary review of the empirical evidence and theoretical accounts. *Food Qual. Prefer.* **2015**, *40*, 165–179. [CrossRef]
- Granheim, S.I.; Løvhaug, A.L.; Terragni, L.; Torheim, L.E.; Thurston, M. Mapping the digital food environment: A systematic scoping review. *Obes. Rev.* **2022**, *23*, e13356. [CrossRef]
- Pitts, S.B.J.; Ng, S.W.; Blitstein, J.L.; Gustafson, A.; Niculescu, M. Online grocery shopping: Promise and pitfalls for healthier food and beverage purchases. *Public Health Nutr.* **2018**, *21*, 3360–3376. [CrossRef]
- Nikolova, H.D.; Inman, J.J. Healthy choice: The effect of simplified point-of-sale nutritional information on consumer food choice behavior. *J. Mark. Res.* **2015**, *52*, 817–835. [CrossRef]
- Inman, J.J.; Nikolova, H. Shopper-facing retail technology: A retailer adoption decision framework incorporating shopper attitudes and privacy concerns. *J. Retail.* **2017**, *93*, 7–28. [CrossRef]
- Mattilsynet. Nøkkelhullet. Available online: https://mattilsynet-xp7prod.enonic.cloud/api/_/attachment/inline/6e1b560e-8bb9-4fc0-95b8-1440abcbd484:85f2681b8ae3ba901d0cc3c65fae86242df2e821/Profilprogram%20for%20varemerket%20N%C3%B8kkelhullet%20-%20versjon%202021.pdf (accessed on 1 September 2022).

29. Ministère des Solidarités et de la Santé. Nutri-Score: Un Étiquetage Nutritionnel Pour Favoriser une Alimentation Équilibrée. Available online: <https://solidarites-sante.gouv.fr/prevention-en-sante/preserver-sa-sante/nutrition/nutri-score/article/nutri-score-un-etiquetage-nutritionnel-pour-favoriser-une-alimentation> (accessed on 1 September 2022).
30. Food and Drink Federation. GDA Labelling: A Tool to Help Improve Food Literacy of Consumers. Available online: <https://www.gdalabel.org.uk/gda/front-of-pack-labelling.html> (accessed on 1 September 2022).
31. de Saud, M. Modifica Decreto Supermo N 977, de 1996, Reglamento Sanitario de Los Alimentos. Available online: https://www.minsal.cl/sites/default/files/decreto_etiquetado_alimentos_2015.pdf (accessed on 1 September 2022).
32. Department of Health. How to Use Health Star Ratings. Available online: <http://www.healthstarrating.gov.au/internet/healthstarrating/publishing.nsf/Content/How-to-use-health-stars> (accessed on 1 September 2022).
33. Acton, R.B.; Vanderlee, L.; Hammond, D. Influence of front-of-package nutrition labels on beverage healthiness perceptions: Results from a randomized experiment. *Prev. Med.* **2018**, *115*, 83–89. [\[CrossRef\]](#)
34. Koenigstorfer, J.; Groeppel-Klein, A.; Kamm, F. Healthful food decision making in response to traffic light color-coded nutrition labeling. *J. Public Policy Mark.* **2014**, *33*, 65–77. [\[CrossRef\]](#)
35. Julia, C.; Blanchet, O.; Méjean, C.; Péneau, S.; Ducrot, P.; Allès, B.; Fezeu, L.K.; Touvier, M.; Kesse-Guyot, E.; Singler, E. Impact of the front-of-pack 5-colour nutrition label (5-CNL) on the nutritional quality of purchases: An experimental study. *International J. Behav. Nutr. Phys. Act.* **2016**, *13*, 1–9. [\[CrossRef\]](#)
36. Raats, M.M.; Hieke, S.; Jola, C.; Hodgkins, C.; Kennedy, J.; Wills, J. Reference amounts utilised in front of package nutrition labelling; impact on product healthfulness evaluations. *Eur. J. Clin. Nutr.* **2015**, *69*, 619–625. [\[CrossRef\]](#)
37. Khandpur, N.; Sato, P.d.M.; Mais, L.A.; Martins, A.P.B.; Spinillo, C.G.; Garcia, M.T.; Rojas, C.F.U.; Jaime, P.C. Are front-of-package warning labels more effective at communicating nutrition information than traffic-light labels? A randomized controlled experiment in a Brazilian sample. *Nutrients* **2018**, *10*, 688. [\[CrossRef\]](#)
38. Egnell, M.; Boutron, I.; Péneau, S.; Ducrot, P.; Touvier, M.; Galan, P.; Buscail, C.; Porcher, R.; Ravaud, P.; Hercberg, S. Front-of-pack labeling and the nutritional quality of students' food purchases: A 3-arm randomized controlled trial. *Am. J. Public Health* **2019**, *109*, 1122–1129. [\[CrossRef\]](#) [\[PubMed\]](#)
39. Maubach, N.; Hoek, J.; Mather, D. Interpretive front-of-pack nutrition labels. Comparing competing recommendations. *Appetite* **2014**, *82*, 67–77. [\[CrossRef\]](#)
40. Andrews, J.C.; Burton, S.; Kees, J. Is simpler always better? Consumer evaluations of front-of-package nutrition symbols. *J. Public Policy Mark.* **2011**, *30*, 175–190. [\[CrossRef\]](#)
41. Sacks, G.; Tikellis, K.; Millar, L.; Swinburn, B. Impact of 'traffic-light' nutrition information on online food purchases in Australia. *Aust. New Zealand J. Public Health* **2011**, *35*, 122–126. [\[CrossRef\]](#) [\[PubMed\]](#)
42. Fuchs, K.L.; Lian, J.; Michels, L.; Mayer, S.; Toniato, E.; Tiefenbeck, V. Effects of Digital Food Labels on Healthy Food Choices in Online Grocery Shopping. *Nutrients* **2022**, *14*, 2044. [\[CrossRef\]](#) [\[PubMed\]](#)
43. Kim, Y.; Kim, S.; Arora, N. GMO Labeling Policy and Consumer Choice. *J. Mark.* **2022**, *86*, 21–39. [\[CrossRef\]](#)
44. Page, M.J.; McKenzie, J.E.; Bossuyt, P.M.; Boutron, I.; Hoffmann, T.C.; Mulrow, C.D.; Shamseer, L.; Tetzlaff, J.M.; Akl, E.A.; Brennan, S.E. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *Syst. Rev.* **2021**, *10*, 1–11. [\[CrossRef\]](#)
45. Gusenbauer, M.; Haddaway, N.R. Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. *Res. Synth. Methods* **2020**, *11*, 181–217. [\[CrossRef\]](#) [\[PubMed\]](#)
46. Higgins, J.P.; Savović, J.; Page, M.J.; Elbers, R.G.; Sterne, J.A. (Eds.) Assessing risk of bias in a randomized trial. In *Cochrane Handbook for Systematic Reviews of Interventions*, 2nd ed.; Wiley: Hoboken, NJ, USA, 2019; pp. 205–228.
47. Joanna Briggs Institute. *Checklist for Quasi-Experimental Studies (Non-Randomized Experimental Studies): Critical Appraisal Tools for Use in JBI Systematic Reviews*; JBI: Adelaide, Australia, 2020.
48. Finkelstein, E.A.; Ang, F.J.L.; Doble, B.; Wong, W.H.M.; van Dam, R.M. A randomized controlled trial evaluating the relative effectiveness of the multiple traffic light and nutri-score front of package nutrition labels. *Nutrients* **2019**, *11*, 2236. [\[CrossRef\]](#) [\[PubMed\]](#)
49. Reyes, M.; Garmendia, M.L.; Olivares, S.; Aqueveque, C.; Zacarías, I.; Corvalán, C. Development of the Chilean front-of-package food warning label. *BMC Public Health* **2019**, *19*, 1–11. [\[CrossRef\]](#)
50. Finkelstein, E.A.; Ang, F.J.L.; Doble, B. Randomized trial evaluating the effectiveness of within versus across-category front-of-package lower-calorie labelling on food demand. *BMC Public Health* **2020**, *20*, 1–10. [\[CrossRef\]](#) [\[PubMed\]](#)
51. Koenigstorfer, J.; Wasowicz-Kirylo, G.; Styśko-Kunkowska, M.; Groeppel-Klein, A. Behavioural effects of directive cues on front-of-package nutrition information: The combination matters! *Public Health Nutr.* **2014**, *17*, 2115–2121. [\[CrossRef\]](#) [\[PubMed\]](#)
52. Siegrist, M.; Hartmann, C.; Lazzarini, G.A. Healthy choice label does not substantially improve consumers' ability to select healthier cereals: Results of an online experiment. *Br. J. Nutr.* **2019**, *121*, 1313–1320. [\[CrossRef\]](#) [\[PubMed\]](#)
53. Miklavac, K.; Hribar, M.; Kušar, A.; Pravst, I. Heart Images on Food Labels: A Health Claim or Not? *Foods* **2021**, *10*, 643. [\[CrossRef\]](#) [\[PubMed\]](#)
54. De Alcantara, M.; Ares, G.; de Castro, I.P.L.; Deliza, R. Gain vs. loss-framing for reducing sugar consumption: Insights from a choice experiment with six product categories. *Food Res. Int.* **2020**, *136*, 109458. [\[CrossRef\]](#) [\[PubMed\]](#)

55. Deliza, R.; de Alcantara, M.; Pereira, R.; Ares, G. How do different warning signs compare with the guideline daily amount and traffic-light system? *Food Qual. Prefer.* **2020**, *80*, 103821. [\[CrossRef\]](#)
56. Lima, M.; De Alcantara, M.; Rosenthal, A.; Deliza, R. Effectiveness of traffic light system on Brazilian consumers perception of food healthfulness. *Food Sci. Hum. Wellness* **2019**, *8*, 368–374. [\[CrossRef\]](#)
57. Vyth, E.L.; Steenhuis, I.H.; Heymans, M.W.; Roodenburg, A.J.; Brug, J.; Seidell, J.C. Influence of placement of a nutrition logo on cafeteria menu items on lunchtime food choices at Dutch work sites. *J. Am. Diet. Assoc.* **2011**, *111*, 131–136. [\[CrossRef\]](#)
58. Machín, L.; Curutchet, M.R.; Giménez, A.; Aschemann-Witzel, J.; Ares, G. Do nutritional warnings do their work? Results from a choice experiment involving snack products. *Food Qual. Prefer.* **2019**, *77*, 159–165. [\[CrossRef\]](#)
59. Kim, E.; Tang, L.R.; Meusel, C.; Gupta, M. Optimization of menu-labeling formats to drive healthy dining: An eye tracking study. *Int. J. Hosp. Manag.* **2018**, *70*, 37–48. [\[CrossRef\]](#)
60. Antúnez, L.; Giménez, A.; Maiche, A.; Ares, G. Influence of interpretation aids on attentional capture, visual processing, and understanding of front-of-package nutrition labels. *J. Nutr. Educ. Behav.* **2015**, *47*, 292–299.e291. [\[CrossRef\]](#) [\[PubMed\]](#)
61. Blitstein, J.L.; Guthrie, J.F.; Rains, C. Low-income parents' use of front-of-package nutrition labels in a virtual supermarket. *J. Nutr. Educ. Behav.* **2020**, *52*, 850–858. [\[CrossRef\]](#) [\[PubMed\]](#)
62. Gustafson, C.R.; Zeballos, E. The effect of presenting relative calorie information on calories ordered. *Appetite* **2020**, *153*, 104727. [\[CrossRef\]](#) [\[PubMed\]](#)
63. Hagmann, D.; Siegrist, M. Nutri-Score, multiple traffic light and incomplete nutrition labelling on food packages: Effects on consumers' accuracy in identifying healthier snack options. *Food Qual. Prefer.* **2020**, *83*, 103894. [\[CrossRef\]](#)
64. Menger-Ogle, A.D.; Graham, D.J. The influence of front-of-package nutrition claims on food perceptions and purchase intentions among Nepali consumers. *Food Qual. Prefer.* **2018**, *66*, 160–170. [\[CrossRef\]](#)
65. Vizcaíno, F.V.; Velasco, A. The battle between brands and nutritional labels: How brand familiarity decreases consumers' alertness toward traffic light nutritional labels. *J. Bus. Res.* **2019**, *101*, 637–650. [\[CrossRef\]](#)
66. Gabor, A.M.; Stojnić, B.; Ostić, D.B. Effects of different nutrition labels on visual attention and accuracy of nutritional quality perception—Results of an experimental eye-tracking study. *Food Qual. Prefer.* **2020**, *84*, 103948. [\[CrossRef\]](#)
67. Finkelstein, E.A.; Doble, B.; Ang, F.J.L.; Wong, W.H.M.; van Dam, R.M. A randomized controlled trial testing the effects of a positive front-of-pack label with or without a physical activity equivalent label on food purchases. *Appetite* **2021**, *158*, 104997. [\[CrossRef\]](#)
68. Fagerström, A.; Richartz, P.; Arntzen, E.; Sigurdsson, V. An explorative study on heuristic effects of healthy food labels in an online shopping situation. *Procedia Comput. Sci.* **2021**, *181*, 709–715. [\[CrossRef\]](#)
69. Folkvord, F.; Bergmans, N.; Pabian, S. The effect of the Nutri-Score label on consumer's attitudes, taste perception and purchase intention: An experimental pilot study. *Food Qual. Prefer.* **2021**, *94*, 104303. [\[CrossRef\]](#)
70. Lima, M.; Ares, G.; Deliza, R. How do front of pack nutrition labels affect healthfulness perception of foods targeted at children? Insights from Brazilian children and parents. *Food Qual. Prefer.* **2018**, *64*, 111–119. [\[CrossRef\]](#)
71. Yoo, H.-J.; Machín, L.; Arrúa, A.; Antúnez, L.; Vidal, L.; Giménez, A.; Curutchet, M.R.; Ares, G. Children and adolescents' attitudes towards sugar reduction in dairy products. *Food Res. Int.* **2017**, *94*, 108–114. [\[CrossRef\]](#) [\[PubMed\]](#)
72. Rojas-Rivas, E.; Antúnez, L.; Cuffia, F.; Otterbring, T.; Aschemann-Witzel, J.; Giménez, A.; Ares, G. Time orientation and risk perception moderate the influence of sodium warnings on food choice: Implications for the design of communication campaigns. *Appetite* **2020**, *147*, 104562. [\[CrossRef\]](#) [\[PubMed\]](#)
73. Yang, X.; Chen, Q.; Xu, Z.; Zheng, Q.; Zhao, R.; Yang, H.; Ruan, C.; Han, F.; Chen, Q. Consumers' preferences for health-related and low-carbon attributes of rice: A choice experiment. *J. Clean. Prod.* **2021**, *295*, 126443. [\[CrossRef\]](#)
74. Mauri, C.; Grazzini, L.; Ulqinaku, A.; Poletti, E. The effect of front-of-package nutrition labels on the choice of low sugar products. *Psychol. Mark.* **2021**, *38*, 1323–1339. [\[CrossRef\]](#)
75. Jin, H.; Li, Y.a.; Li, D.; Zheng, J. The effects of physical activity calorie equivalent labeling on dieters' food consumption and post-consumption physical activity. *J. Consum. Aff.* **2020**, *54*, 723–741. [\[CrossRef\]](#)
76. Huyghe, E.; Verstraeten, J.; Geuens, M.; Van Kerckhove, A. Clicks as a healthy alternative to bricks: How online grocery shopping reduces vice purchases. *J. Mark. Res.* **2017**, *54*, 61–74. [\[CrossRef\]](#)