Consumers’ Perceptions of Five Front-of-Package Nutrition Labels: An Experimental Study Across 12 Countries

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Received: 25 July 2019; Accepted: 12 August 2019; Published: 16 August 2019

Abstract: Consumers’ perceptions of five front-of-pack nutrition label formats (health star rating (HSR), multiple traffic lights (MTL), Nutri-Score, reference intakes (RI) and warning label) were assessed across 12 countries (Argentina, Australia, Bulgaria, Canada, Denmark, France, Germany, Mexico, Singapore, Spain, the UK and the USA). Perceptions assessed included liking, trust, comprehensibility, salience and desire for the label to be mandatory. A sample of 12,015 respondents completed an online survey in which they rated one of the five (randomly allocated) front-of-pack labels (FoPLs) along the perception dimensions described above. Respondents viewing the MTL provided the most favourable ratings. Perceptions of the other FoPLs were mixed or neutral. No meaningful or consistent patterns were observed in the interactions between country and FoPL type, indicating that culture was not a strong predictor of general perceptions. The overall ranking of the FoPLs differed somewhat from previous research assessing their objective performance in terms of enhancing understanding of product healthiness, in which the Nutri-Score was the clear front-runner. Respondents showed a strong preference for mandatory labelling, regardless of label condition, which is consistent with past research showing that the application of labels across all products leads to healthier choices.

Keywords: front-of-pack nutrition label; traffic light; health star; Nutri-Score; reference intake; warning label

1. Introduction

In response to rising rates of obesity around the world [1], front-of-pack labels (FoPLs) are increasingly being applied to pre-packaged foods to inform consumers about the nutritional value of these foods and help them to make healthier choices [2–4]. A large body of research supports the notion that FoPLs are more effective in achieving these aims compared to the provision of no nutrition information or just a nutrition facts panel (generally found on the back or side of packs) [5–9].

Of the different FoPL formats currently in use around the world, most can be classified as reductive or interpretive [4,10]. Reductive FoPLs provide factual information about a food (such as the amounts of key nutrients within a food) with minimal interpretation (such as the food’s contribution to an adult’s recommended daily intake). Interpretive FoPLs may contain similar information (i.e., amounts of key nutrients) but also use aids like colour to indicate the healthiness of the food. The reference
intakes (RI) and multiple traffic lights (MTL) are prominently studied examples of reductive and interpretive labels respectively [8,9,11,12].

Interpretive FoPLs can further be divided into nutrient-specific or summary indicator formats. Interpretive nutrient-specific formats (such as the MTL) provide information on the individual nutrients within a food, while interpretive summary indicator formats provide an overall evaluation of the nutritional quality of the product. The warning label is an example of another interpretive nutrient-specific format that has recently been mandated in a number of countries [4]. This FoPL typically appears as a black hexagon with the text “High in” followed by saturated fat, salt, sugar, or calories when a predetermined threshold is exceeded. The Nutri-Score is an example of an interpretive summary indicator, assigning foods with a colour-coded rating from A to E. Finally, the health star rating (HSR) similarly features a summary indicator but also displays nutrient-specific information alongside the indicator, making it a hybrid FoPL. Visual depictions of these FoPLs can be found in Figure 1.

![Figure 1](image-url)

**Figure 1.** Examples of different front-of-pack label (FoPL) formats and their classifications: (a) multiple traffic lights; (b) warning labels; (c) Nutri-Score; (d) reference intakes; and (e) health star rating.

Studies have examined how the FoPLs described above influence people’s understanding of nutrition information and affect food choices [8,9,11,12]. Given the challenges of conducting research in supermarkets [13], these studies have typically been carried out online or within a laboratory setting [14]. The latter designs allow a high degree of control over the variables being assessed. However, it is possible that respondents are more motivated and less time-pressured to make healthy choices in these contexts. Asking consumers about how they perceive different labels (e.g., whether they like them, trust them, find them easy to use) could provide additional information on how likely shoppers are to actually use a given label. In addition, consumers’ attitudes towards FoPLs can affect whether or not governments choose to implement them [12,15]. One example of this comes from France, where consumers petitioned French retailers and food manufacturers to implement the Nutri-Score [15]. This eventually resulted in official recognition from the French government and uptake by some large retailers and manufacturers [15].

Past research on consumers’ perceptions of various FoPLs shows that people like simplified labels but want to know how the information underlying the label was derived and do not like to feel they are being coerced [12]. In past studies, consumers have reported positive attitudes towards
the MTL [16–25], HSR [26], Nutri-Score [27,28] and RI [20,21,29–31]. However, a direct comparison of perceptions of these FoPLs (and warning labels) has not been performed to date.

FoPL comparison testing has global policy implications. In 2016, the International Association of Consumer Food Organizations proposed that the Codex Committee on Food Labelling develop a new global standard for interpretive FoPLs [32]. A unifying standard was described as having the ability to potentially “protect existing laws from World Trade Organization (WTO) challenge, and encourage and empower other countries to issue nutrition regulations with higher public health impact without fear of WTO disputes” (p. 2, [32]). If a common FoPL standard is to be used across many countries, it is of critical importance to investigate which FoPLs are most effective and well-received across many countries. Testing different FoPL formats provides information that can be considered when determining appropriate elements to include in global FoPL standards.

The FOP-ICE (Front-Of-Pack International Comparative Experiment) project was borne out of efforts to address this issue. Using a randomised experimental design, the FOP-ICE study assessed reactions to five different FoPLs (HSR, MTL, Nutri-Score, RI, warning label) among a large (n = 12,015), diverse sample of consumers from 12 countries (Argentina, Australia, Bulgaria, Canada, Denmark, France, Germany, Mexico, Singapore, Spain, the UK and the USA). Results on the relative effectiveness of the five FoPLs to enhance consumers’ understanding of the healthiness of food products showed that the Nutri-Score performed best across all countries, followed by the MTL [33]. The aim of the present study was to further interrogate the FOP-ICE study data by examining how respondents’ perceptions of FoPLs vary according to FoPL type and country of residence. Perceptions were assessed in terms of liking, trust, comprehensibility, salience and desire for the label to be compulsory. It was hypothesised that respondents would be most favourable to interpretive labels, as past research has shown that these are most useful in guiding consumers to healthier food choices [8,9,11,12].

2. Materials and Methods

Relevant information on the methodology of the present study is reported below. Further details on the broader FOP-ICE project can be found at http://www.ANZCTR.org.au/ACTRN12618001221246.aspx and elsewhere [33].

2.1. Participants

Respondents (n = 12,015) were recruited from 12 countries (Argentina, Australia, Bulgaria, Canada, Denmark, France, Germany, Mexico, Singapore, Spain, the UK and the USA) to participate in an online survey. All respondents gave their informed consent for inclusion before they participated in the study. The protocol of the present study was approved by the Curtin University Human Research Ethics Committee (approval reference: HRE2017-0760) and the Institutional Review Board of the French Institute for Health and Medical Research (IRB Inserm n_17-404). Recruitment was undertaken by an ISO-accredited international web panel provider (PureProfile). To ensure a diverse sample, quotas were applied so that the sample was evenly split according to gender, age (within the following brackets: 18–30 years, 31–50 years, >50 years) and income level (low, medium and high) within each country. Once a quota had been filled, panel members falling within that demographic group were not eligible to participate. Income brackets for each country were calculated around the median household income (based on various national statistical databases) for that country. A bracket of +/-33% was created around the median income to represent a ‘medium’ income band. Any incomes that fell below or above those figures were considered low or high, respectively. Key participant demographic data can be found in Table 1.
Table 1. Key respondent demographic information.

| Country | All Countries | Argentina | Australia | Bulgaria | Canada | Denmark | France | Germany | Mexico | Singapore | Spain | UK | USA |
|---------|---------------|-----------|-----------|----------|--------|---------|--------|---------|--------|-----------|-------|----|-----|
| n       | 11812         | 992       | 987       | 987      | 984    | 978     | 977    | 985     | 987    | 989       | 984   | 990| 972 |

| n % | 5889 | 50 | 492 | 50 | 492 | 50 | 490 | 50 | 490 | 50 | 492 | 50 | 485 | 50 |
|-----|------|----|-----|----|-----|----|-----|----|-----|----|-----|----|-----|----|
| Females | 5923 | 50 | 504 | 51 | 495 | 50 | 497 | 50 | 494 | 50 | 486 | 50 | 492 | 50 |

| Gender | Males | 3951 | 33 | 329 | 33 | 323 | 33 | 348 | 35 | 332 | 34 | 316 | 32 | 326 | 33 |
|        | Females | 3969 | 34 | 330 | 33 | 332 | 34 | 366 | 37 | 323 | 33 | 326 | 33 | 323 | 33 |
| Age, Years | 18–30 | 3892 | 33 | 333 | 34 | 332 | 34 | 273 | 28 | 329 | 33 | 336 | 34 | 328 | 34 |
|          | 31–50 | 3926 | 33 | 331 | 33 | 321 | 33 | 323 | 28 | 333 | 34 | 329 | 33 | 333 | 34 |
|          | >50 years | 3951 | 33 | 331 | 33 | 321 | 33 | 273 | 28 | 333 | 34 | 329 | 33 | 333 | 34 |

| Level of Income | Low | 3896 | 33 | 331 | 33 | 321 | 33 | 273 | 28 | 333 | 34 | 329 | 33 | 333 | 34 |
| Medium | 3985 | 34 | 331 | 33 | 332 | 34 | 350 | 35 | 329 | 33 | 336 | 34 | 329 | 33 |
| High   | 3931 | 33 | 330 | 33 | 334 | 34 | 364 | 37 | 321 | 33 | 313 | 32 | 324 | 33 |


2.2. Procedure

The survey began with some background questions (e.g., gender, age, income, grocery buyer status, education level, nutrition knowledge and diet quality). Next, respondents were presented with three sets of three fictional food products with no FoPL on-pack. They were then randomised to one of the five FoPL conditions (HSR, MTL, Nutri-Score, RI, or warning label) and presented with the same food products (this time with a FoPL on-pack). In both the no-FoPL and FoPL scenarios, respondents were asked to (i) rank the three products within each set according to healthiness and (ii) select which product they would be most likely to buy (see [33] for results relating to healthiness rankings). At the conclusion of the study, respondents were presented with 9 items assessing their perception of the FoPL they had just seen. The items, which were assessed on a scale from 1 (strongly disagree) to 9 (strongly agree), were as follows:

- I like this label;
- I trust this label;
- This label is easy to understand;
- This label took too long to understand;
- This label is confusing;
- This label provides me with the information I need;
- This label does not stand out;
- It should be compulsory for this label to be shown on packaged food products;
- Food companies should be able to choose whether they apply this label to their packaged foods.

2.3. Analysis

Data analysis was performed in SPSS (version 25, SPSS Inc., Chicago, IL, USA). Given that some items were positively valanced and others were negatively valanced, respondents who provided the same response across all items (except those who responded with a 5, which was the mid-point of the scale) were removed from analyses ($n = 203$; 2% of the sample). This was a cautionary measure to eliminate potentially invalid responses. A 12 (country) × 5 (FoPL condition) ANCOVA was conducted on each perception item. The interaction between country and FoPL was also included as an independent variable. The $p$-value cut-off for significance (with a Bonferroni correction for 9 tests) was set to 0.005. Age, gender, income bracket, education, grocery buyer status, nutrition knowledge and diet were included as covariates. Post hoc comparisons among FoPLs and countries were performed with a Sidak correction for multiple comparisons applied to each survey item. The estimated marginal means for the different FoPLs (as well as the aggregated mean) and the FoPL by country interactions were graphed for the perception items where a significant main effect of FoPL or interaction between FoPL and country was observed, along with 99% confidence intervals to facilitate comparisons across all FoPLs.

3. Results

The mean score, standard deviation and intercorrelation for each perception item are shown in Table 2. Liking of and trust in a label were the most highly correlated items ($r = 0.65$). An unexpectedly low correlation ($r = -0.16$) was noted between the items assessing whether the label viewed by the respondent should be compulsory and whether food companies should be able to choose to apply the label. This may have been due to some respondents interpreting the latter item as asking whether food companies should have a choice to include the label vs. no label or interpreting it as asking whether companies should include the label vs. another label format. This item also showed the largest spread (SD $= 2.78$), indicating that there was less agreement among respondents on this item. Thus, no further analyses are reported on this item. The item assessing whether FoPLs should be compulsory on packs received the highest mean score ($M = 7.13$), indicating that respondents felt very strongly about this issue. In fact, 36.9% of the sample selected the highest score (9—‘strongly agree’) on this item.
Table 2. Means, standard deviations and Pearson correlation coefficients between the perception items.

|                              | Mean | Standard Deviation | I Like This Label | I Trust This Label | This Label is Easy to Understand | This Label Took Too Long to Understand | This Label is Confusing | This Label Does Not Stand Out | This Label Provides Me with the Information I Need |
|------------------------------|------|--------------------|-------------------|--------------------|-----------------------------------|----------------------------------------|--------------------------|-------------------------------|-----------------------------------------------|
| I like this label+           | 6.5  | 2.0                |                   | 0.65               |                                   |                                        |                          |                               |                                               |
| I trust this label+          | 6.3  | 2.0                |                   | 0.65               |                                   |                                        |                          |                               |                                               |
| This label is easy to understand+ | 7.0  | 2.0                | 0.58              | 0.54               |                                   |                                        |                          |                               |                                               |
| This label took too long to understand-- | 3.8  | 2.5                | −0.20             | −0.15              | −0.43                             |                                        |                          |                               |                                               |
| This label is confusing--     | 3.7  | 2.4                | −0.29             | −0.24              | −0.47                             | 0.70                                   |                          |                               |                                               |
| This label does not stand out-- | 4.9  | 2.4                | −0.13             | −0.06              | −0.12                             | 0.39                                   | 0.38                      |                               |                                               |
| It should be compulsory for this label to be shown on packaged food products+ | 6.6  | 2.0                | 0.64              | 0.64               | 0.59                              | −0.22                                  | −0.31                     | −0.08                         | −0.02a                                       |
|                              | 7.1  | 2.0                | 0.52              | 0.49               | 0.48                              | −0.19                                  | −0.26                     | −0.02a                        | 0.55                                         |

* Positively valanced item. – Negatively valanced item * p = 0.04. All other correlations significant at * p < 0.005.
FoPL condition and country were significant predictors in the ANCOVAs across all 8 items \((p < 0.0001)\). Graphs showing the distribution of means according to the different levels of these variables are presented in Figures 2 and 3.

![Graphs showing the distribution of means](image-url)
Some notable trends were observed among the FoPLs across the different perception items. Across all the FoPLs included in the present study, the MTL was perceived most favourably. It received the highest scores out of all the FoPLs on four criteria (trust, liking, ease of understanding and providing needed information), the second highest score on the item assessing whether the FoPL should be compulsory and the second lowest score on the item “This label does not stand out”. Respondents were ambivalent about the RI and Nutri-Score and neutral about the warning label and HSR. The RI received the highest mean scores for being confusing and not standing out, although it was relatively well trusted and perceived to be appropriate as a compulsory FoPL. The Nutri-Score received the lowest mean scores on trust, being easy to understand, providing enough information and being
appropriate as a compulsory label on food packs, but it was relatively well liked and was perceived as standing out more than the other FoPLs. The warning label was the easiest label to interpret (scoring highest on ease of understanding and lowest on being confusing and taking too long to understand) but received the lowest score for liking. Perceptions of the warning label in relation to the other criteria tended to lie somewhere between those of the other FoPLs. The HSR received a relatively high score on the “does not stand out” item and fell somewhere between the other FoPLs for all the other items.

The country x FoPL interaction was significant ($p < 0.005$) for 6 of the 8 perception items: “I trust this label”, “This label is easy to understand”, “This label took too long to understand”, “This label provides me with the information I need”, “This label does not stand out” and “It should be compulsory for this label to be shown on packaged food products”. Graphs showing the interaction for these items can be seen in Figure 3.

![Graph showing interaction for perception items](image-url)
Figure 3. Cont.
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Figure 3. Mean scores across perception items according to country and FoPL type. Note: Graphs show estimated marginal means for countries adjusted for age, gender, SES, grocery buyer status, level of education, diet and nutrition knowledge. Error bars show 99% confidence intervals.

Looking across the interactions, no consistent trends were observed across the items. Patterns of differences between countries were not the same across different FoPL conditions or different perception items.

4. Discussion

This study explored consumers' perceptions of five FoPLs that are currently used around the world. The results show that irrespective of how favourably the different FoPLs were perceived or the country of residence, there was a clear demand for front-of-pack nutrition information to be made available. This was demonstrated in the very high mean score (7 out of 9) and a third of the sample selecting 9 (‘strongly agree’) for the item assessing whether the FoPL to which they were exposed should be compulsory on packs. Previous research supports the need for mandatory FoPLs, with supermarket studies reporting increased sales of healthier foods when FoPLs are applied to all products within a category rather than just a selection of products [34–37]. Although FoPLs should aid consumers in assessing the healthiness of individual products in isolation, they are most useful when they also allow consumers to compare healthiness across multiple products [38]. Some FoPLs, such as the warning label, only work if they are compulsory given that food manufacturers have no incentive to apply a FoPL across their product range when the aim of the FoPL is to reduce purchases of a product. Furthermore, past experience with the HSR has shown that when FoPLs are not mandatory, they skew towards appearing on healthier products [39], and this can reduce consumer trust in the system as a whole [39,40].

Looking at perceptions of the individual FoPLs studied, it is evident that the MTL was most favourably perceived. Respondents liked and trusted this FoPL the most and felt it provided the information they needed and was the easiest to understand. Perceptions of the RI and Nutri-Score were mixed. Respondents reported that the RI stood out the least and was the most confusing, but they showed relatively high trust in it and felt it should be compulsory on packs. Conversely, the Nutri-Score reportedly stood out the most and was easiest to understand but was the least trusted and least desired as a compulsory FoPL. Although the warning label was considered easiest to interpret, it was least liked. This may be due to the stark negative nature of this label. Finally, the HSR was perceived to stand out the least, which may go some way towards explaining why this FoPL tended to fall somewhere in between the other FoPLs on the other perception dimensions. It is important to note that the absolute differences between the FoPLs tended to be small (i.e., rarely more than 0.5 points difference on the 5-point scale), and thus, in some cases, it is more informative to consider the rating that was averaged across all FoPLs. These findings suggest that, on the whole, respondents were favourable towards FoPLs in general.
Looking at trends among FoPLs that share similar features, it is clear that the coloured FoPLs (MTL and Nutri-Score) stood out the most and were most liked. The more simplified FoPLs (Nutri-Score and warning labels) were seen as not providing enough information and were least trusted and less likely to be desired as compulsory. Other findings from this dataset found the Nutri-Score to be most useful in assisting consumers to accurately identify the healthiest food from a choice set [33]. This is discrepant with the present results showing that this FoPL was perceived to not provide enough information and to be harder to understand. These results suggest that consumers could benefit from education on the credibility of highly interpretive FoPLs such as the Nutri-Score to foster trust in the system, motivate consumers to make use of it and bring perceptions in line with performance.

Respondents were most in favour of the MTL and RI being compulsory on food packs. This is interesting given that other results from this same dataset show that these two FoPLs produce opposite outcomes on objective understanding [33]. Specifically, the MTL led to more positive outcomes (after the Nutri-Score) while the RI performed most poorly. These results are in line with previous studies demonstrating that consumers perceive that more information is better [41]. However, most consumers are not equipped to interpret all this information due to factors such as low levels of nutrition knowledge [42], time pressure [12] and competing priorities [43]. This is evident when results from the perception elements assessed in the present study (which show that consumers desire more information) are compared to the objective understanding results [33] (which show that understanding of food healthiness is not always improved by more information). Fortunately, respondents’ perceptions were not always discrepant with objective understanding, as was the case with the MTL, which performed relatively well across both objective understanding and consumer preference. Although some differences were noted between countries, no meaningful or consistent patterns were present in the interactions between country and FoPL type.

It is important to note that certain elements of the study design are likely to have influenced the results. First, the between-subjects design meant that respondents provided ratings for only one FoPL. If respondents had been asked to rank the FoPLs, a clearer hierarchy may have emerged. However, only one FoPL was shown in order to keep the experimental tasks (completed before the perception ratings) to a management time limit. That differences were found among FoPLs using a design that is less sensitive for detecting differences is notable. Second, respondents were asked to provide their opinions directly after using a specific FoPL to make decisions about food healthiness and choice. This means that FoPL perceptions were grounded in the first-hand experience of respondents, which increases the ecological validity of the findings. However, one limitation is that the experimental process did not permit replication of any tactile experiences that would be available to customers in real-world supermarkets.

5. Conclusions

Overall, the results suggest that interpretive aids such as colour are viewed favourably by consumers but oversimplified FoPL formats risk excluding information that is desired by consumers and as a consequence being less trusted. Across the large and diverse sample of respondents, there was strong demand for FoPLs to be compulsory on food packs. This is an important message for policy makers to take away from these findings and is consistent with results from previous studies showing that FoPLs are most effective when applied to all products within a choice set, thus facilitating product comparisons and reducing the cognitive load on shoppers. Perceptions are just one dimension on which consumers’ reactions to FoPLs can be assessed. Future work should consider how food choices in the real world are affected across culturally diverse groups.

Author Contributions: Z.T. performed data analyses and interpretation and drafted and revised the paper. C.J. and S.P. conceptualised the project in collaboration with S.H. S.P. supervised the data analyses and interpretation, participated in the writing and critically revised the paper for important intellectual content. C.J. and M.E. interpreted the data and critically revised the paper for important intellectual content. All authors had full access to all of the data in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. All authors have read and approved the final manuscript.
Funding: The present study received funding from Santé Publique France (French Agency for Public Health) and Curtin University.

Acknowledgments: The authors would like to thank all scientists in charge of the translations: Pilar Galan, Karen Assmann: Valentina Andreeva and Sinne Smed, who contributed to the creation of the different versions of the online survey. We also thank all researchers and doctoral students who tested the online survey.

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

References
1. NCD Risk Factor Collaboration. Trends in adult body-mass index in 200 countries from 1975 to 2014: A pooled analysis of 1698 population-based measurement studies with 19·2 million participants. Lancet 2016, 387, 1377–1396. [CrossRef]
2. World Health Organisation. European Food and Nutrition Action Plan 2015–2020. Available online: http://www.euro.who.int/__data/assets/pdf_file/0008/253727/64wd14e_FoodNutAP_140426.pdf (accessed on 18 June 2019).
3. World Health Organisation. Report of the Commission on Ending Childhood Obesity. Available online: Apps.who.int [PubMed]
4. Kanter, R.; Vanderlee, L.; Vandevijvere, S. Front-of-package nutrition labelling policy: Global progress and future directions. Public Health Nutr. 2018, 21, 1399–1408. [CrossRef] [PubMed]
5. Cowburn, G.; Stockley, L. Consumer understanding and use of nutrition labelling: A systematic review. Public Health Nutr. 2005, 8, 21–28. [CrossRef] [PubMed]
6. Ni Mhurchu, C.; Gorton, D. Nutrition labels and claims in New Zealand and Australia: A review of use and understanding. Aust. N. Z. J. Public Health 2007, 31, 105–112. [CrossRef]
7. Nelson, D.; Graham, D.; Harnack, L. An Objective Measure of Nutrition Facts Panel Usage and Nutrient Quality of Food Choice. J. Nutr. Educ. Behav. 2014, 46, 589–594. [CrossRef] [PubMed]
8. 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]
9. Hawley, K.L.; Roberto, C.A.; Bragg, M.A.; Liu, P.J.; Schwartz, M.B.; Brownell, K.D. The science on front-of-package food labels. Public Health Nutr. 2013, 16, 430–439. [CrossRef]
10. Kelly, B.; Jewell, J. What Is the Evidence on the Policy Specifications, Development Processes and Effectiveness of Existing Front-Of-Pack Food Labelling Policies in the WHO European Region; WHO Regional Office for Europe: Copenhagen, Denmark, 2018.
11. Cecchini, M.; Warin, L. Impact of food labelling systems on food choices and eating behaviours: A systematic review and meta-analysis of randomized studies. Obes. Rev. 2016, 17, 201–210. [CrossRef]
12. Grunert, K.G.; Wills, J.M. A review of European research on consumer response to nutrition information on food labels. J. Public Health 2007, 15, 385–399. [CrossRef]
13. 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]
14. Hieke, S.; Taylor, C.R. A Critical Review of the Literature on Nutritional Labeling. J. Consum. Aff. 2012, 46, 120–156. [CrossRef]
15. Julia, C.; Hercberg, S. Development of a new front-of-pack nutrition label in France: The five-colour Nutri-Score. Public Health Panor. 2017, 3, 712–725.
16. Maubach, N.; Hoek, J.; Mather, D. Interpretive front-of-pack nutrition labels. Comparing competing recommendations. Appetite 2014, 82, 67–77. [CrossRef] [PubMed]
17. Méjean, C.; Macouillard, P.; Péneau, S.; Hercberg, S.; Castetbon, K. Perception of front-of-pack labels according to social characteristics, nutritional knowledge and food purchasing habits. Public Health Nutr. 2013, 16, 392–402. [CrossRef]
18. Méjean, C.; Macouillard, P.; Péneau, S.; Lassale, C.; Hercberg, S.; Castetbon, K. Association of Perception of Front-Of-Pack Labels with Dietary, Lifestyle and Health Characteristics. PLoS ONE 2014, 9, e90971. [CrossRef] [PubMed]
19. Savoie, N.; Barlow, K.; 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] [PubMed]
20. Emrich, T.E.; Mendoza, J.E.; L’Abbé, M.R. Effectiveness of Front-of-pack nutrition symbols: A pilot study with consumers. *Can. J. Diet. Pract. Res.* 2012, 73, 200–203. [CrossRef]

21. Möser, A.; Hoeckens, C.; Van Camp, J.; Verbeke, W. Simplified nutrient labelling: consumers’ perceptions in Germany and Belgium. *J. Consum. Prot. Food Saf.* 2010, 5, 169–180. [CrossRef]

22. Méjean, C.; Macouillard, P.; Pénault, S.; Hercberg, S.; Castetbon, K. Consumer acceptability and understanding of front-of-pack nutrition labels. *J. Hum. Nutr. Diet.* 2013, 26, 494–503. [CrossRef]

23. Gorton, D.; Ni Mhurchu, C.; Chen, M.; Dixon, R. Nutrition labels: A survey of use, understanding and preferences among ethnically diverse shoppers in New Zealand. *Public Health Nutr.* 2008, 12, 1359–1365. [CrossRef]

24. Kelly, B.; Hughes, C.; Chapman, K.; Louie, J.C.-Y.; Dixon, H.; Crawford, J.; King, L.; Daube, M.; Slevin, T. Consumer testing of the acceptability and effectiveness of front-of-pack food labelling systems for the Australian grocery market. *Health Promot. Int.* 2009, 24, 120–129. [CrossRef] [PubMed]

25. Murphy, M.; Fallows, S.; Bonwick, G. Parents’ use and understanding of front-of-pack food labelling, and the impact of socio-economic status. *Proc. Nutr. Soc.* 2008, 67, 413. [CrossRef]

26. Pettigrew, S.; Talati, Z.; Miller, C.; Dixon, H.; Kelly, B.; Ball, K. The types and aspects of front-of-pack food labelling schemes preferred by adults and children. *Appetite* 2017, 109, 115–123. [CrossRef] [PubMed]

27. Julia, C.; Pénault, S.; Buscail, C.; Gonzalez, R.; Touvier, M.; Hercberg, S.; Kesse-Guyot, E. Perception of different formats of front-of-pack nutrition labels according to sociodemographic, lifestyle and dietary factors in a French population: Cross-sectional study among the NutriNet-Santé cohort participants. *BMJ Open 2017*, 7, e016108. [CrossRef] [PubMed]

28. Ducrot, P.; Méjean, C.; Julia, C.; Kesse-Guyot, E.; Touvier, M.; Fezeu, L.; Hercberg, S.; Pénault, S. Effectiveness of front-of-pack nutrition labels in French adults: Results from the NutriNet-Sante cohort study. *PLoS ONE* 2015, 10, e0140898. [CrossRef] [PubMed]

29. Babio, N.; Vicent, P.; López, L.; Benito, A.; Basulto, J.; Salas-Salvadó, J. Adolescents’ ability to select healthy food using two different front-of-pack food labels: A cross-over study. *Public Health Nutr.* 2014, 17, 1403–1409. [CrossRef] [PubMed]

30. Emrich, T.E.; Qi, Y.; Mendoza, J.E.; Lou, W.; Cohen, J.E.; L’Abbé, M.R. Consumer perceptions of the Nutrition Facts table and front-of-pack nutrition rating systems. *Appl. Physiol. Nutr. Metab.* 2013, 38, 417–424. [CrossRef] [PubMed]

31. Lowe, B.; de Souza-Monteiro, D.M.; Fraser, I. Nutritional labelling information: Utilisation of new technologies. *J. Mark. Manag.* 2013, 29, 1337–1366. [CrossRef]

32. Codex Alimentarius Commission. Proposal for New Work Concerning a Global Standard for Front of Pack Interpretive Nutrition Labelling. Available online: http://www.fao.org/who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FMeetings%252FCX-714-43%252FCR%252FF43%252FCRDX17x.pdf (accessed on 6 December 2019).

33. Egnell, M.; Talati, Z.; Hercberg, S.; Pettigrew, S.; Julia, C.; Egnell, M.; Talati, Z.; Hercberg, S.; Pettigrew, S.; Julia, C. Objective Understanding of Front-of-Package Nutrition Labels: An International Comparative Experimental Study across 12 Countries. *Nutrients* 2018, 10, 1542. [CrossRef] [PubMed]

34. Sutherland, L.A.; Kaley, L.A.; Fischer, L. Guiding Stars: The effect of a nutrition navigation program on consumer purchases at the supermarket. *Am. J. Clin. Nutr.* 2010, 91, 10905–1094S. [CrossRef] [PubMed]

35. Rahkovsky, I.; Lin, B.-H.; Lin, C.-T.J.; Lee, J.-Y. Effects of the Guiding Stars Program on purchases of ready-to-eat cereals with different nutritional attributes. *Food Policy* 2013, 43, 100–107. [CrossRef]

36. Sacks, G.; Rayner, M.; Swinburn, B. Impact of front-of-pack ‘traffic-light’ nutrition labelling on consumer food purchases in the UK. *Health Promot. Int.* 2009, 24, 344–352. [CrossRef] [PubMed]

37. Sacks, G.; Tikellis, K.; Millar, L.; Swinburn, B. Impact of ‘traffic-light’ nutrition information on online food purchases in Australia. *Aust. N. Z. J. Public Health* 2011, 35, 122–126. [CrossRef] [PubMed]

38. Newman, C.; Burton, S.; Craig Andrews, J.; Netemeyer, R.; Kees, J. Marketers’ Use of Alternative Front-of-Package Nutrition Symbols: An Examination of Effects on Product Evaluations. *J. Acad. Mark. Sci.* 2017, 46, 453–476. [CrossRef]

39. Jones, A.; Shahid, M.; Neal, B.; Jones, A.; Shahid, M.; Neal, B. Uptake of Australia’s Health Star Rating System. *Nutrients* 2018, 10, 997. [CrossRef] [PubMed]
40. Lawrence, M.; Dickie, S.; Woods, J.; Lawrence, M.A.; Dickie, S.; Woods, J.L. Do Nutrient-Based Front-of-Pack Labelling Schemes Support or Undermine Food-Based Dietary Guideline Recommendations? Lessons from the Australian Health Star Rating System. *Nutrients* 2018, 10, 32. [CrossRef]

41. Dana, L.M.; Chapman, K.; Talati, Z.; Kelly, B.; Dixon, H.; Miller, C.; Pettigrew, S. Consumers’ Views on the Importance of Specific Front-of-Pack Nutrition Information: A Latent Profile Analysis. *Nutrients* 2019, 11, 1158. [CrossRef] [PubMed]

42. Miller, L.M.S.; Cassady, D.L. The effects of nutrition knowledge on food label use. A review of the literature. *Appetite* 2015, 92, 207–216. [CrossRef]

43. Sanlier, N.; Karakus, S.S. Evaluation of food purchasing behaviour of consumers from supermarkets. *Br. Food J.* 2010, 112, 140–150. [CrossRef]

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