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A systematic review of consumers' responses to health claims in the context of other on-pack nutrition information

Introduction

Poor diet is the main cause of a range of diseases, including coronary heart disease, hypertension, Type 2 diabetes and some forms of cancer.¹ These diseases are among the leading global causes of mortality^{2,3} and are more prevalent among people of lower socioeconomic status.⁴ Improving diets at the population level has the potential to significantly reduce the prevalence of these diseases and improve quality of life.⁵⁻⁷ Evidence-based policies that help guide consumers towards nutritionally healthier food choices are therefore needed. One such policy that has been adopted in many countries is the provision of nutrition information on packaged foods.⁸

There are 3 main sources of nutrition information that can appear on food packets: the nutrition facts panel (NFP), front-of-pack labels (FoPLs) and health claims. NFPs appear on the back or side of food packs and detail the levels of key nutrients within a product.^{9,10} NFPs are the most comprehensive source of on-pack nutrition information and their presentation format is often standardized. FoPLs, which appear on the front of packs, provide a simplified summary of some of the information contained in the NFP.^{10,11} Health claims include any form of text (and sometimes graphics) that occur on the front-of-pack describing a health benefit of the food product. Although health claims have the potential to increase consumer understanding of specific nutrient-disease relationships,¹² they are primarily used by food manufacturers as marketing devices that provide information about the positive aspects of a food product, rather than a balanced summary of its nutritional value.¹³ 'Health claim' is an umbrella term for a number of specific types of claims that can be classified as follows^{10,14,15}:

- (1) Implied health claims: refer to the health benefit of a product without specifying the mechanism via which this occurs (e.g., “Carb Conscious”¹⁶).
- (2) Nutrient claims: relate to the presence or absence of a particular nutrient within the product (e.g., “Low in salt”) or compare the level of nutrient in one product with another product (e.g., “Reduced salt”).
- (3) General level health claims (or structure-function claims): relate nutrients in the food to a positive physical outcome (e.g., “Reduced saturated fat to help reduce total blood cholesterol”).
- (4) Higher level health claims (or disease risk reduction claims): refer specifically to serious diseases (e.g., “Contains calcium that can reduce your risk of osteoporosis”).

While most claims are simply expressed as words on the front of a packet, some incorporate alternative presentation formats (e.g., the USA FDA report card graphic¹⁷ or logos¹⁰).

Consumer interpretation of health claims

Nutrient claims have the potential to mislead when they promote one positive nutrient but fail to point out the presence of negative nutrients within the same product. For example, products carrying fruit and vegetable claims have been found to contain much higher levels of energy, saturated fat, sugar and sodium than fresh fruit and vegetables.¹⁸ While consumers may increase their fruit and vegetable intake with these products, they may also increase their intake of other negative nutrients. Similarly, when general and higher level health claims describe the disease risk reduction benefits of consuming certain nutrients, they neglect to mention that a person can still develop the disease while consuming this nutrient and that other nutrients may be present that are associated with increased disease risk.¹⁹

Health claims also have the potential to mislead consumers about the healthiness of nutritionally poor foods.¹⁹ Across a broad range of products, Kaur et al.²⁰ found that those with health claims were only marginally healthier overall than similar products without health claims. This appeared to be mostly due to their lower levels of total fat and saturated fat, but not sugar or sodium. Studies quantifying the healthiness of products such as non-alcoholic beverages, cereal bars, breakfast cereals and prepared meals have found that the presence of a health claim does not correlate with overall product healthiness as defined by the US Food and Drug Administration, the UK Office of Communications or Food Standards Australia New Zealand.²¹⁻²³

In addition to health claims being potentially misleading due to marketing practices, consumers can fall prey to cognitive biases that lead them to believe that products with health claims are healthier than they are. For example, there is a tendency to generalize the information in a claim to other product attributes (e.g., assuming a low cholesterol product is also low in fat), which is known as the halo effect.²⁴ Additionally, the mere presence of a health claim on a product can lead people to believe the product is healthier than a similar product with no claim, which is known as a positivity bias²⁴. The combination of these cognitive biases and the common occurrence of health claims on less healthy foods can lead to consumers making suboptimal food choices.^{14,15,25-27}

Although many consumers report being skeptical of health claims,^{13,28} studies have found that they still pay attention to them and sometimes even change their behavior (e.g., eat greater quantities of a 'low fat' product) in the presence of health claims.²⁹⁻³² The potential of health claims to influence consumers' beliefs about products and product choices, sometimes in

misleading ways, means this persuasive and pervasive form of nutrition information warrants rigorous scrutiny from public health researchers and advocates.

International regulations

In response to health claims being used as marketing tools, governments around the world have implemented regulations in an effort to help consumers accurately use claims on food packages and enhance public health. Current health claim regulations vary by country and according to the type of claim being made. Some countries place restrictions on which food products are allowed to carry health claims. In the USA, Australia, New Zealand and the European Union, nutrient claim regulations require compliance with set standards (such as the nominated nutrient meeting or exceeding a minimum required level³³⁻³⁵), meaning the product is sufficiently healthy to qualify to feature this type of claim.

For general and higher level health claims, regulations typically focus on wording. The level of evidence required to support the link between specific nutrients and diseases varies between countries. In the USA, food manufacturers are permitted to make claims based on weaker levels of evidence (by using ‘qualified claims’) or stronger evidence (by using ‘unqualified claims’). Qualified claims describe the strength of scientific evidence on which the claim is based and often include disclaimers (e.g., “Limited and not conclusive scientific evidence suggests...”³⁶). Unqualified claims are those for which there is significant scientific agreement and no disclaimer is required. Food manufacturers in the USA can select from either a list of pre-approved health claims that do not require qualification because they are supported by significant scientific agreement or a list of qualified health claims that have a lower level of scientific agreement.

Other countries have stricter regulations that only allow manufacturers to make health claims for which there is significant scientific agreement on the nutrient–disease relationship. In Australia, food manufacturers wishing to make a health claim must select from a list of 200+ pre-approved general health claims or 13 pre-approved higher level health claims that have been established through a scientific systematic review process.³⁷ Companies can also self-substantiate a food-health relationship by following set procedures and applying to have one added to the list. In the European Union, member states can select from a list of approved health claims that have been developed by the European Food Safety Authority (based on a list of general or higher level claims previously submitted to the Authority for prior approval) and have been deemed to be substantiated by scientific evidence.³⁸

Another commonly used regulatory measure is the provision of specific nutrition information in the form of an NFP. As of 2014, the majority of countries with some form of nutrition labelling legislation had mandated the display of an NFP on the back-of-pack, while other countries required the inclusion of an NFP whenever a health claim was made.³⁹ There have also been suggestions for front-of-pack labels (FoPLs) to be mandated when a health claim is present.⁴⁰ As FoPLs occur in closer proximity to health claims than NFPs⁴⁰ and have been found to be more effective than NFPs in conveying nutrition information to consumers,^{9,41–45} mandating the provision of a FoPL could be more effective in supporting consumers to critically evaluate health claims than mandating the presence of an NFP.

The mandated inclusion of an NFP and the proposal to include FoPLs in the presence of a health claim constitute efforts to provide consumers with an accurate and balanced overview of product healthiness and counteract any skewed information conveyed in health claims.¹⁹ Given that so many countries have mandated the use of an NFP in the presence of a health

claim, it is important to understand how these two sources of nutrition information interact and therefore if this regulation is likely to achieve the desired outcomes. Numerous studies have empirically tested how health claims are interpreted in the context of other on-pack nutrition information.^{16,17,24,30,36,46–60} However, a synthesis of these studies is currently lacking and past reviews (the key findings of which are described below) have focused on the effects of health claims in isolation. This systematic review sought to clarify whether NFPs and/or FoPLs can counteract cognitive biases created by health claims and guide consumers to more accurate judgements of product healthiness.

Study rationale

Over the last decade, several reviews have summarized how consumers perceive and process health claims.^{14,15,25–27} These reviews describe how the type of food featuring the claim, aspects of a claim itself and the characteristics of individuals (e.g., age, sex, nutrition knowledge, motivation) affect outcomes such as attention, trust, attitudes, understanding, persuasiveness of health claims and purchase intentions.

The overarching conclusion of past reviews is that the mere presence of a health claim can induce certain biases that cause consumers to believe that products that are positive in one aspect are healthier overall and healthier than similar products with no claim.^{14,15,25–27}

However, most studies do not incorporate other nutrition information such as NFPs or FoPLs into their experimental designs.^{29,61–66} This does not reflect the real world where (i) regulations often require the provision of an NFP⁸ and (ii) FoPLs are increasingly appearing on food packs.¹¹ Thus the extent to which cognitive biases in response to health claims are affected by other sources of nutrition information warrants further examination. To facilitate future work in this area, this systematic review critiques and synthesizes existing research on

the combined effects of health claims and other sources of nutrition information (specifically NFPs and FoPLs) to better understand how additional nutrition information affects the relationship between health claims and product evaluations.

Method

Search strategy

A search of the databases Web of Science, Ovid, Scholar, Science Direct, SCOPUS, ProQuest and Wiley Online Library using the search terms (“health claim*” OR “nutri* claim”) AND (“food label*” OR “front of pack”) was conducted for all available English language articles published prior to the 1st of May 2016. The reference lists of previous reviews^{14,15,25–27} were also checked for any studies not captured in the database search. Finally, researchers in the field were contacted and asked to suggest any relevant articles in press. This search strategy returned a total of 827 articles (after duplicates were deleted). Conference presentations, reviews, unpublished dissertations/theses or any other works not published in peer reviewed journals (e.g., government reports, market research) were excluded due to a lack of rigorous peer review. Article titles were screened for relevance. In total, 22 relevant articles (with 24 studies) were identified for inclusion in the systematic review (see Figure 1). The first author performed the literature search, article screening and data extraction. All authors reviewed the studies meeting the inclusion criteria and the data extracted from them. Minor disagreements were resolved through discussion.

FIGURE 1 ABOUT HERE

Inclusion criteria

Studies were included if they examined health claims (on mock or real packaged foods) in combination with NFPs and/or FoPLs as independent variables. A range of study designs was considered for inclusion, such as between and within subjects designs, randomized controlled designs, quasi experimental designs and cross-sectional designs (e.g., paper and pencil or online surveys). Reported outcomes needed to relate to the primary outcome of food choice behavior or eligible secondary outcomes (potential mediators of food choice behavior), including attention paid to nutrition information, attitudes towards and evaluations of food products and/or purchase intentions. No studies were found measuring purchase behavior.

Method of analysis

This systematic review provides a narrative overview of the studies meeting the inclusion criteria. The manipulation of health claims, the NFP and FoPLs (in terms of presence or absence, nutritional profile displayed or the type of health claim or FoPL used) was not consistent across studies. Furthermore, a range of outcome variables was measured. Thus a quantitative analysis (such as meta-analysis) was not possible for this data. However, Table 1 quantifies the direction of outcomes of interest for each study.^{16,17,24,30,36,46–60,67,68}

Results

Study characteristics

Table 1 shows the key characteristics and findings of the studies included in the review (see Appendix A for a detailed table of studies). Fifteen studies included nutrient claims,^{16,17,24,30,36,46–49,57–60,67,68} 9 studies included higher level health claims,^{17,36,46,51,55–58,67} 3 studies included general level health claims,^{57,58,67} 2 studies included implied claims^{16,54} and

the remaining studies used some combination of these, another claim format or did not specify.^{24,48,49,52,53} Thirteen studies assessed the primary outcome of food choice behavior, purchase intentions or willingness to pay^{17,24,30,46,47,49,50,57–60,67,68} and 17 assessed secondary outcomes such as product evaluations. The majority of studies used surveys and randomly allocated participants to different survey conditions,^{16,17,24,30,36,46–60,67} while 1 study used observations in a food retail setting.⁵³ Thirteen studies used between subjects designs,^{16,17,24,30,36,47,48,50–52,54–56} 3 studies used within-subjects designs^{53,57,58} and 5 used both.^{46,59,60,67,68}

The methods used to study the interaction between health claims and other nutrition information can be categorized into three designs of varying methodological strength. The most basic design, which featured in 8 studies, involved manipulating the presence/absence or type of health claim while presenting the same NFP on all mock packs, but not measuring its usage.^{17,36,46,55–59} The second design involved measuring attention to health claims and NFPs. Of the two studies adopting this approach, one looked at how attention was differentially allocated to health claims and NFPs⁵³ while the other looked at how attention to each source of information impacted on food product evaluations.²⁴ Finally, the most rigorous studies (n = 12) manipulated the presence/absence of a claim, the presence/absence of either NFPs or FoPLs and/or the nutrition profiles shown in NFPs and/or FoPLs.^{16,30,47–52,54,60,67,68}

TABLE 1 ABOUT HERE

Interaction between health claims and NFPs

Outcomes of studies including (but not measuring usage of) an NFP

Two studies^{17,56} compared the effects of different claim types (such as short and long claims and claims that varied in their level of scientific support) on evaluations of the foods when NFPs were held constant. Since these two studies did not include a ‘no claim’ control condition, they could not test for the presence of any cognitive biases. Four studies^{36,55,57,58} manipulated the presence/absence of a health claim, using the same NFP across all products, and found that participants were more positive towards the product when a health claim was present rather than absent. This applied to nutrient and general level claims, but was stronger for higher level claims^{57,58} and claims that were shorter in length.^{55,56} Furthermore, evaluations of products were positively correlated with the level of scientific support communicated in a claim, particularly when the level of support was explained through the graphic report card format (see Figure 2).^{17,36}

FIGURE 2 ABOUT HERE

Two studies examined how participants’ willingness to pay for products with NFPs changed with the addition of a health claim. Barreiro-Hurle et al.⁴⁶ found that adding a nutrient or higher level health claim to products already featuring NFPs increased the amount participants were willing to pay for these products. Conversely, Ran et al.⁶⁹ found no effect of including a nutrient claim on willingness to pay for foods that also featured an NFP. Overall, these studies provide evidence that health claims induce cognitive biases. Since the information in the NFP was not manipulated and its usage was not measured, these studies did not test whether the NFP had any effect on outcomes and thus do not provide evidence of any interaction effects associated with the presence of both health claims and NFPs.

Outcomes of studies measuring NFP use

Two studies improved on the limitations of the previous studies by measuring attention to health claims and NFPs. McCullum and Achterberg⁵³ observed adolescents' behaviors in a real shopping context and subsequently interviewed them on their purchase decisions. Participants reported relying more on health claims than NFPs when making purchase decisions. On average, they were five times more likely to use front-of-pack rather than back-of-pack nutrition information when selecting which product to buy. However, since participants' use of health claims and NFPs on individual products was not linked with the healthiness of their food purchases, it is not possible to know how these sources of nutrition information interacted to influence behavior.

Roe et al.²⁴ presented participants with real products (brand names removed) for which NFPs remained constant but the health claims varied (either through presence/absence or type of claim). The researchers asked participants questions about the products while noting whether they turned over the pack to look at the back. When a nutrient or higher level health claim was present on the front of the pack, participants reported greater purchase intentions and perceived healthiness and were less likely to consult the NFP than if no claim was present. This effect was stronger for higher level health claims compared to nutrient claims.

Participants who chose to view NFPs reported purchase intentions that were more aligned with the healthiness of the product. However, this was confounded with individual-level attributes in that participants with greater knowledge of and motivation to use nutrition information were more likely to refer to NFPs. Since reactions to a healthy versus an unhealthy NFP were not tested, these studies cannot provide definitive evidence of whether NFPs are capable of attenuating the positivity bias. To shed light on this, the next section reviews studies in which NFPs were manipulated.

Outcomes of studies involving NFP manipulation

The ten studies in which both health claims and NFPs were experimentally manipulated provide the most useful information on the interaction between these two sources of nutrition information. By varying one aspect of the pack at a time (e.g., the health claim) and holding others constant, these studies could isolate and quantify any effects on the outcome measures. The studies in this section used between and within subjects designs to assess the impact of a variety of claims (including implied, nutrient and health claims) and NFPs on product evaluations, perceptions of overall healthiness and specific health benefits, perceived credibility of the health claim and the manufacturer, purchase intentions and choice behavior.

In 5 studies, health claims induced cognitive biases, but these disappeared when NFPs were provided along with the health claim.^{16,30,48,52,54} Labiner-Wolfe et al.¹⁶ found that implicit and explicit versions of a low-carbohydrate nutrient content claim led to more favorable evaluations of a food product with regard to weight management, healthiness and caloric content compared to the no claim condition. However, when an NFP was made available that varied in healthiness, participants' evaluations became more consistent with the nutrition profile shown in the NFP regardless of the claim's presence. Similarly, Mitra et al.⁵⁴ found that the positive effects of implied health claims (e.g., "Does your heart good") disappeared once an unhealthy NFP was shown to participants.

Kemp et al.³⁰ found that an NFP that varied in its level of fat and carbohydrate had a stronger effect than 'low fat' and 'low carbohydrate' nutrient claims on participants' evaluations of the fat and carbohydrate content within the foods, as well as their perceived likelihood of gaining weight and developing heart disease. Ford et al.⁴⁸ found that an NFP and a combined nutrient and general level health claim had separate main effects on perceptions of

healthiness, with NFPs exhibiting a much stronger main effect. When both were shown together, healthiness ratings were influenced more by the favorability of the NFP and did not change significantly with the presence or absence of a health claim.

Mazis and Raymond⁵² presented participants with relatively unhealthy products featuring health claims that had been contested by the Federal Trade Commission and/or consumer groups. They found that participants' beliefs about the nutritional value of the foods tended to be more accurate among participants who saw an unhealthy NFP and a health claim compared to those who only saw the health claim. Furthermore, when participants were asked to rate whether they thought the product was a good source of the specific nutrient mentioned in the health claim, those participants who viewed the unhealthy NFP were less likely to rate the product as a good source of the nutrient.

Two studies also looked at how conflicting information provided in NFPs and health claims affects people's trust in the claim and the food manufacturer. Garretson and Burton⁴⁹ found that conflict between a nutrient claim (e.g., "low in fat") and the NFP (e.g., 21g of fat, 10g of saturated fat) not only led to lower purchase intentions but also negative brand attitudes and lower trust in the claim. Similarly, Keller et al.⁵⁰ found that a conflict in these sources of nutrition information lead to reduced perceptions of manufacturer credibility. In both these studies, the effect was stronger when the nutrient claim related to fat as opposed to fiber or calories. These studies can be interpreted as indicating that the presence of an unhealthy NFP that conflicts with the health claim provides a more accurate picture of the product's nutritional value and can lead consumers to disregard the information in the health claim and doubt the credibility of the claim and the product manufacturer.

Several studies found that health claims were more influential than NFPs, regardless of the favorability of the latter. Kozup et al.⁵¹ found that while NFPs had a stronger effect than higher level health claims on the perceived credibility of the claim, attitudes toward the product and purchase intentions, health claims had a stronger effect than NFPs on the perceived risk of developing heart disease or having a stroke as a result of consuming the product. In Dixon et al.'s study⁴⁷, where participants evaluated 15 pairs of products and indicated which they would buy from the pair, the attenuating effect was only found in participants who actively made the choice to view NFPs. Specifically, participants who viewed at least one NFP within the pair before making a choice (44% of participants, $n = 682$) were more likely to state a preference for the healthier product compared to those who did not view NFPs. Similarly, Ran et al.⁶⁰ found the majority of participants were willing to pay more for apple juice featuring a vitamin C nutrient claim. However, those who chose to view the Vitamin C level in the NFP reported a lower willingness to pay.

In summary, most of the studies reviewed above support the idea that when claims are presented in isolation they can induce cognitive biases. This seemed to apply regardless of the type of claim (e.g., implicit, nutrient or health claims). The inclusion of NFPs appeared to reduce or eliminate this bias in most (but not all) studies.^{16,30,47-51,52,54}

Critique of health claim x NFP interaction studies

Most of the studies reviewed above suggest that participants make considered judgments about the product based on thorough evaluations, rather than being biased by health claims. There are reasons to believe that this is not representative of typical consumer behavior. In particular, the design of many of the studies reported above likely resulted in the NFP being more salient than it would be in a real shopping context.^{16,30,48,50-52,54} In some studies, the

printed out images of the front and back of food packs were often shown side by side, which gave the health claim and NFP equal prominence. In other studies, participants were specifically instructed to view the back of pack information or the experimenters controlled the information participants saw by presenting only the front of the pack, only the back of the pack or both to certain participants.^{16,52,54} This is not representative of how NFPs are actually used.⁷⁰⁻⁷² In studies where participants need to actively chose to view NFPs, usage is usually self-reported by participants and observed by researchers to be lower than for health claims.^{47,53,57,58} Furthermore, Roe et al.²⁴ demonstrated that the presence of a health claim reduces the likelihood of the NFP being viewed.

Of the studies testing the attenuating effect of NFPs, only one study was conducted in a realistic supermarket setting,⁵³ and the results showed that participants were naturally inclined to pay more attention to health claims than NFPs. Similarly, in Dixon et al.'s study,⁴⁷ where participants needed to actively choose to view the NFP, the majority of participants did not do so and subsequently made less healthy choices than the minority who viewed NFPs. Similarly, the positivity bias was only attenuated in Ran et al.'s⁶⁰ study among participants whose eye tracking data indicated they looked at NFPs. Thus, the finding that the NFP reduces the cognitive biases created by health claims lacks ecological validity.

Interaction between health claims, FoPLs and NFPs

When both a FoPL and an NFP are present on pack, studies have shown that consumers are more likely to make use of the former.^{42,45,70,71} It has also been demonstrated that consumers are better at differentiating between products with varying nutrition profiles when they are exposed to FoPLs, particularly the Multiple Traffic Lights (MTL) FoPL (see Figure 2), compared to NFPs.^{9,41-45} Being able to differentiate between healthy and unhealthy products

is an essential prerequisite to making healthy choices.^{73,74} This is important to consider in real world contexts where consumers need to repeatedly compare food products during shopping trips.

To date, only two studies have looked at the interaction between FoPLs, health claims and NFPs.^{67,68} Both studies were conducted online and participants were given the option to view the NFP if they clicked/hovered their mouse over a designated area on the screen. This design has higher ecological validity than most of the studies discussed in the previous section since participants were required to exert extra effort to view the NFP.

In McLean et al.'s study,⁶⁸ different levels of sodium (high or low) were crossed with different types of FoPLs (none, the Daily Intake Guide (DIG: see Figure 2) or the MTL) and nutrient claims (none, 'reduced salt' or 'low salt', with the 'low salt' claim excluded from any high sodium products). Participants were given the option to view each product's NFP, but NFP use was not measured, preventing inclusion of this variable in analyses. In the experiment, participants viewed choice sets of three products and selected the one they would choose to buy. The presence of a claim, compared to no claim, on a high sodium product increased the probability of that product being selected, suggesting a positivity bias. Furthermore, if a product featured a 'reduced salt' claim but no FoPL, participants were equally likely to select the high or low sodium version of that product, suggesting that the claim, rather than the NFP, was guiding their decisions. By comparison, the presence of FoPLs led to greater discrimination between the high and low sodium products. Participants made healthier choices when the DIG was present (compared to no FoPL), but they made the most healthy choices when the MTL was present. Health claims interacted with the FoPLs such that a 'reduced salt' claim alongside a favorable FoPL facilitated the highest level of

uptake for the low sodium product, especially in the MTL condition. Overall, the presence of the MTL led to lower uptake of high sodium products and greater uptake of low sodium products, while the combination of the MTL and a health claim lead to the greatest uptake of low sodium products.

Maubach et al.⁶⁷ conducted a best-worst scaling choice experiment in which they crossed different levels of product healthiness (healthy, moderate or unhealthy), different types of FoPLs (none, the DIG, the MTL or a star rating) and claims (none, nutrient claim, general level health claim or higher level health claim) and measured NFP use. A positivity bias was evident in unhealthy products as they were more likely to be rated as ‘best’ if they featured a health claim rather than no claim. This bias was strongest for general level health claims and occurred regardless of whether a star rating or the DIG was also present on the pack.

However, when the MTL was present, the positivity bias disappeared and the presence of the MTL was the strongest predictor of whether products would be rated accurately as best or worst. Across all choice sets, the mean proportion of participants choosing to view at least one NFP was 38%, which is in line with usage rates reported in previous studies.^{47,72} A higher frequency of NFP views was related to more accurate ratings of healthiness. However, the greatest accuracy occurred when NFP views were high *and* the MTL was present. These results are consistent with those of McLean et al.⁶⁸ in showing that the MTL, rather than health claims or only NFPs, had the strongest effect on participants’ evaluations.

Discussion

Previous reviews have reported that health claims can induce cognitive biases in which products are evaluated more favorably compared to similar products without health claims.^{14,15,25–27} The present review replicates and extends these findings by showing that this

effect is slightly more prevalent among higher level health claims^{24,36,46,51,55,57,58,67} but does not seem to hold for implied^{16,54}, nutrient^{16,24,30,46–48,57,58,60,67,68} and general level health^{48,57,58,67} claims. It also appears to apply across a wide variety of outcomes, including those related to choice or purchase behavior^{24,46,47,53,57,58,60,67,68} and food product evaluations.^{16,24,30,36,48,51,52,54,55,57,58} This systematic review extends earlier reviews by focusing on the interaction between health claims and other sources of nutrition information. The findings suggest that NFPs (if attended to) and FoPLs can considerably reduce cognitive biases on product evaluations and purchase intentions created by health claims. The evidence for FoPLs attenuating this bias, however, is much stronger than for NFPs.

Although several studies described herein found that NFPs could attenuate cognitive biases created by health claims,^{16,30,48–52,54} the design of these studies often made the NFPs highly salient, with participants being instructed to look at the NFP in some cases. This does not resemble a real world shopping context where consumers must make the choice to look at the NFP^{53,57,58,70–72} and, even if they do, may have difficulty interpreting it.^{9,41–45} As such, these findings are likely only to apply to those individuals with greater nutrition-related motivation and knowledge. Future research could explore whether greater education on NFPs could improve consumer understanding and use of this information.

The two studies incorporating health claims, FoPLs and NFPs provided a more realistic scenario by requiring that participants actively choose to view the NFP.^{67,68} While participants' product ratings increased in accuracy as NFP views increased, this only applied to the minority of participants who chose to view the NFPs and their accuracy was still enhanced by the presence of FoPLs (particularly the MTL).⁶⁷ This finding is in line with that of many other studies showing that when participants are presented with NFPs and FoPLs,

the latter is viewed more frequently^{45,70-72} and the combination of the two leads to more accurate product evaluations than the NFP alone.^{9,41-45} This suggests that the provision of a FoPL (particularly the MTL), rather than provision of the NFP, is most effective in helping participants correctly identify healthy and unhealthy products and reduce any cognitive biases created by health claims. This is likely to be because FoPLs appear in closer proximity to health claims, are more trusted than health claims and are easier to understand than the NFP.^{9,41-45,75}

Limitations

For quality control purposes, only articles published in peer reviewed journals were included in this review. This may be viewed as a limitation of this study as a number of government agencies have conducted research on the effectiveness of different sources of nutritional information. While this systematic review provided comprehensive coverage of peer reviewed studies looking at the interaction between health claims and other sources of nutrition information, it is somewhat limited by its qualitative nature. However, a meta-analysis would not have been feasible as the different designs used across studies do not allow for direct comparison of their effects. Of those studies that fit into the same design category (e.g., a 2(no claim, nutrient claim) x 3 (no NFP, healthy NFP, unhealthy NFP) design), the number of studies was too small to perform this statistical analysis. As noted above, a number of studies in this review had design limitations and researchers should in the future consider the simple ways in which they can increase the ecological validity of their studies (e.g., by requiring participants to exert effort to view the NFP and/or imposing a time constraint). The results of the studies including FoPLs should be interpreted with caution because only two published peer reviewed articles could be found comparing NFPs, health claims and FoPLs. Nonetheless, these studies were well designed and provide useful insights.

Finally, it is important to acknowledge that food purchase decisions are influenced not only by nutrition information but an array of other factors (such as taste, price, advertising and habit)^{76,77} that were not taken into account in the studies reviewed here.

Policy implications

This review did not find a large difference in the effect of nutrient content and health claims on product evaluations and intentions to purchase products. In many countries the regulations around the use of nutrient claims are less strict than those for higher level health claims. If both are equally likely to induce cognitive biases, it follows that the same regulations should be applied to both of these (and other) types of health claims. The findings of this systematic review indicate that, for the purpose of prompting consumers to choose healthier food products, mandating the use of FoPLs in addition to the NFP on food packs with health claims could be a more effective regulatory strategy than mandating the NFP alone. It is important to note that the NFP was designed to make the nutritional properties of a food transparent rather than act as a driver for healthy food choices⁷⁸. Furthermore, there appears to be a small but meaningful number of consumers who actively view the NFP.^{47,67}

Therefore, current evidence supports the inclusion of NFPs on food packs. For the remaining majority of consumers who are not sufficiently motivated or knowledgeable to interpret this volume of information, FoPLs provide useful simplified information for assessing the healthiness of foods.

Conclusion

This systematic review has shown that NFPs and FoPLs can reduce the cognitive biases created by health claims and shift consumer evaluations and purchase intentions from less

healthy to more healthy foods. The NFP, however, can only be effective in guiding healthier choices if consumers actively choose to view it and are able to interpret it correctly. Research suggests that this often does not happen. Furthermore, this review suggests that FoPLs, which are more salient on the front of food packages, may have a stronger effect on counteracting the cognitive biases created by health claims.

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Figure 1 PRISMA flow chart of studies included and excluded by search stage

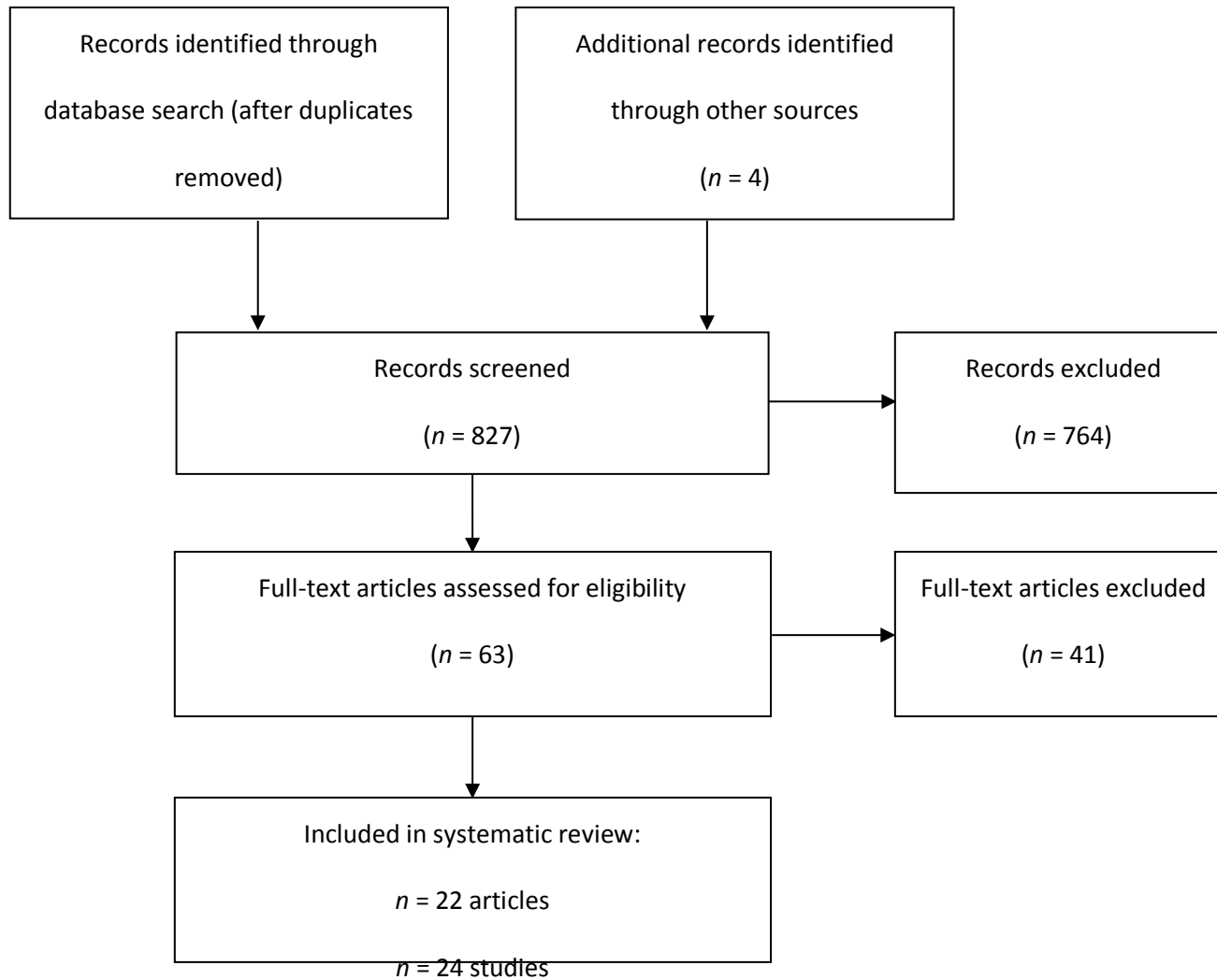
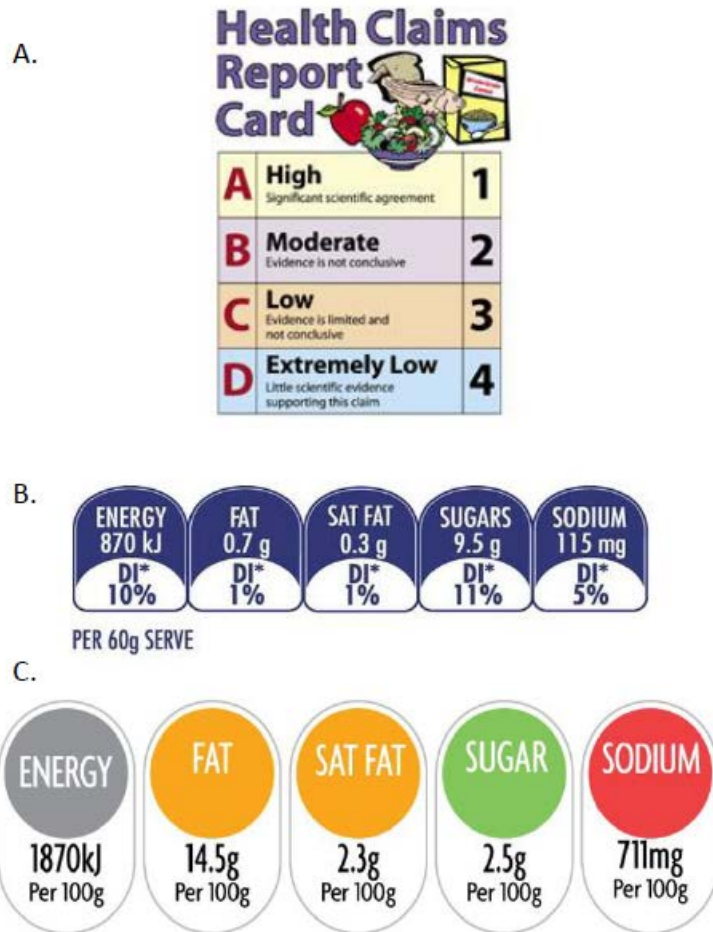


Figure 2 Nutrition information graphics



A: Graphic report card; B: Daily Intake Guide (DIG); C: Multiple Traffic Lights (MTL)

Table 1: Key characteristics of included studies

Study	Sample	NFP/FoPL format	Claim format	Outcomes measured	Evidence of cognitive biases	Evidence for NFP/FoPLs attenuating cognitive biases
Barreiro-Hurle et al. (2010) ⁴⁶	400	NFP: Not manipulated. Click to view.	<ul style="list-style-type: none"> • No claim • Nutrient claim • Higher level health claim 	Willingness to pay	+/-	-
Dixon et al. (2011) ⁴⁷	1551	NFP: Healthy or unhealthy. Click to view.	<ul style="list-style-type: none"> • No claim • Nutrient claim 	Perceived healthiness Food choice	+/-	+/-
Ford et al. (1996) ⁴⁸	325	NFP: Healthy or unhealthy. Present or absent. Forced to view or not forced to view.	<ul style="list-style-type: none"> • No claim • Nutrient claim • Nutrient claim + general level health claim 	Ratings health-related beliefs.	+	+
Garretson & Burton (2000) ⁴⁹	382	NFP: Healthy, moderate or unhealthy. Shown next to health claim.	<ul style="list-style-type: none"> • No claim • Nutrient claim • Nutrient claim + general level health claim 	Perceived risk of disease. Brand attitude. Trust in claim and manufacturer Purchase intentions	-	N/A
Hooker & Teratanavat (2008) ³⁶ Study 1	186	NFP: Not manipulated. Forced to view.	Higher level health claim with FDA report card level: <ul style="list-style-type: none"> • A, with report card graphic • A, without report card graphic • D, with report card graphic • D, without report card graphic 	Product attitudes. Perceived health benefit.	+/-	N/A
Hooker & Teratanavat (2008) ³⁶ Study 2	109	NFP: Not manipulated. Forced to view.	<ul style="list-style-type: none"> • Nutrient claim • Qualified higher level health claim • Unqualified higher level health claim • Report card graphic • Report card text • Embedded claim 	Product attitudes.	N/A	N/A

Study	Sample	NFP/FoPL format	Claim format	Outcomes measured	Evidence of cognitive biases	Evidence for NFP/FoPLs attenuating cognitive biases
			<ul style="list-style-type: none"> • Point-counterpoint claim • Structure-function claim 			
Kapsak et al. (2008) ¹⁷	5642	NFP: Not manipulated. Click to view.	<ul style="list-style-type: none"> • Nutrient claim • Qualified higher level health claim • Unqualified higher level health claim • Report card graphic • Report card text • Embedded claim • Point-counterpoint claim • Structure-function claim 	Healthiness. Product attitudes. Purchase intentions.	N/A	N/A
Keller et al. (1997) ⁵⁰	460	NFP: Healthy, moderate or unhealthy. Shown next to health claim.	<ul style="list-style-type: none"> • No claim • Nutrient claim 	Ratings of nutrient levels. Nutrition attitude. Manufacturer credibility. Purchase intentions.	-	N/A
Kemp et al. (2007) ³⁰	186	NFP: Healthy or unhealthy. Present or not present. Shown next to health claim.	<ul style="list-style-type: none"> • No claim • Nutrient claim 	Ratings of nutrient levels. Perceived risk of disease. Nutrition perceptions. Purchase intentions.	+	+
Kozup et al. (2003) ⁵¹ Study 1	147	NFP: Healthy or unhealthy. Present or not present. Shown next to health claim.	<ul style="list-style-type: none"> • No claim • Higher level health claim 	Perceived risk of disease. Nutrition attitude. Attitude toward the product. Manufacturer credibility	+	+/-
Labiner-Wolfe et al. (2010) ¹⁶	4320	NFP: Healthy or unhealthy. Present or not present. Click to view.	<ul style="list-style-type: none"> • No claim • Implicit claim • Implicit claim with a disclaimer • Explicit nutrient claim • Explicit nutrient claim with a disclaimer • Claim with NFP side by side 	Weight management. Calories. Healthiness.	+	+

Study	Sample	NFP/FoPL format	Claim format	Outcomes measured	Evidence of cognitive biases	Evidence for NFP/FoPLs attenuating cognitive biases
Maubach et al. (2014) ⁶⁷	768	NFP: Healthy or unhealthy. Present or not present. Click to view. FoPLs: • None • Daily Intake Guide • Star rating • Multiple Traffic Lights	<ul style="list-style-type: none"> • No claim • Nutrient claim • General level health claim 	Purchase intentions	+	+/-
Mazis & Raymond (1997) ⁵²	180	NFP: Present or absent.	<ul style="list-style-type: none"> • Claims that had been contested by a consumer group or the FTC • Uncontested claims 	Ratings of nutrients	+	+
McCullum & Achterberg (1997) ⁵³	90	NFP: Real products. Not manipulated.	Naturally occurring claims on real food packets	Attention	N/A	N/A
McLean et al. (2012) ⁶⁸	691	NFP: Healthy or unhealthy. Click to view. FoPLs: • None • Daily Intake Guide • Multiple Traffic Lights	<ul style="list-style-type: none"> • No claim • Nutrient claim 	Purchase intentions	+	+/-
Mitra et al. (1999) ⁵⁴	410	NFP: Healthy, moderate or unhealthy. Forced to view or not forced to view.	<ul style="list-style-type: none"> • No claim • Implied health claim 	Perceived healthiness. Ratings of nutrients.	+	+
Ran et al. (2015) ⁵⁹	89	NFP: Not manipulated. Click to view.	<ul style="list-style-type: none"> • No claim • Nutrient claim 	Willingness to pay	-	N/A
Ran et al. (2016) ⁶⁰	98	NFP: Healthy or unhealthy. Click to view.	<ul style="list-style-type: none"> • No claim • Nutrient claim 	Willingness to pay	+/-	+/-

Study	Sample	NFP/FoPL format	Claim format	Outcomes measured	Evidence of cognitive biases	Evidence for NFP/FoPLs attenuating cognitive biases
Roe et al. (1999) ²⁴	1403	NFP: Real products. Not manipulated. Views recorded.	<ul style="list-style-type: none"> • No claim • Nutrient claim • Nutrient claim + higher level health claim 	Healthiness Purchase intentions	+	+/-
Wansink (2003) ⁵⁵	229	NFP: Not manipulated. Choice to view.	<ul style="list-style-type: none"> • Short higher level health claim on front and long higher level claim on back • Long higher level health claim on front • No claim 	Perceived risk of disease	+	N/A
Wansink et al. (2004) ⁵⁶	118	NFP: Not manipulated. Choice to view.	<ul style="list-style-type: none"> • Short higher level health claim on front and long higher level claim on back • Long higher level health claim on front 	Product attitudes	N/A	N/A
Wong et al (2013) ⁵⁷	506	NFP: Not manipulated. Click to view.	<ul style="list-style-type: none"> • No health claim • Higher level health claim • General level health claim • Nutrient claim 	Attitude towards product. Purchase intentions.	+	N/A
Wong et al. (2014) ⁵⁸ Study 1	721	NFP: Not manipulated. Click to view.	<ul style="list-style-type: none"> • No health claim • Higher level health claim • General level health claim • Nutrient claim 	Attitude towards product. Purchase intentions.	+	N/A
Wong et al. (2014) ⁵⁸ Study 2	710	NFP: Not manipulated. Click to view.	<ul style="list-style-type: none"> • No health claim • Higher level health claim • General level health claim • Nutrient claim 	Attitude towards product. Purchase intentions.	+	N/A

Note: '+' = consistent positive association, '-' = consistent negative association, '+/-' = mixed findings, N/A = not applicable/not tested