The impact of the Nutri-Score nutrition label on perceived healthiness and purchase intentions

Joyce De Temmerman *, Eva Heeremans, Hendrik Slabbinck, Iris Vermeir

Faculty of Economics and Business Administration, Ghent University, Tweekerkenstraat 2, 9000, Ghent, Belgium

A R T I C L E I N F O

Keywords:
Nutri-score
Front-of-pack label
Healthy consumer behavior
Perceived healthiness
Purchase intentions

A B S T R A C T

Making healthier food choices easier at the time of purchase is a challenge for public policy makers. The Nutri-Score can be an effective tool for guiding and steering consumers toward more informed, healthier purchasing decisions. This research investigates the impact of the presence of the Nutri-Score and its five categories on consumers' perceived healthiness perceptions and purchase intentions. Consumers in the EU took part in two online experiments, in which they rated products from different categories, with or without Nutri-Scores, in terms of their perceived healthiness and purchase intentions. The presence of the Nutri-Score enabled respondents to assess the healthiness of products better; furthermore, it offers the potential to boost sales of healthy products, without affecting sales of unhealthy products. Perceived healthiness mediates the relationship between Nutri-Score categories and purchase intentions, and focusing on the healthiness of products can give producers a competitive advantage, regardless of whether it is a manufacturer brand or a private label. These findings offer actionable insights for public policy makers and manufacturers; they also suggest the need to embrace the Nutri-Score as the standard front-of-pack label to help fight the increasing obesity pandemic.

1. Introduction

As a global epidemic, obesity contributes to approximately 2.8 million deaths annually (World Health Organization, 2017a), prompting growing considerations of the relationship between nutrition and health (World Health Organization, 2004). Globally, governments seek effective preventive actions, including efforts to make consumers' healthier food choices easier at the time of purchase (Nishida, Uauy, Kumanyika, & Shetty, 2004). That is, even though product manufacturers are required to display nutritional information in a detailed nutrition box on the back of food packaging, this information is often difficult for consumers to read and understand (Kivets & Simonson, 2000). In contrast, front-of-pack (FOP) labels provide more limited, simpler, more visible information about critical nutritional elements (World Health Organization, 2018). Consumers are more inclined to rely on simpler labels in their decision making (Becker, Bello, Sundar, Peltier, & Bix, 2015), so FOP labels represent a promising means to address the obesity epidemic (Nestle & Jacobsen, 2000).

Among the several FOP labels developed in recent years, this research focuses on the Nutri-Score (NS), which provides a clear summary of key nutrients and aims to make comparisons across products easier for consumers, at a glance (Santé Publique France, 2018). We seek to determine its impact on perceived healthiness and purchase intentions, in the pursuit of three main research contributions. First, we take a consumer perspective and specifically address the impact of the NS, rather than comparing it with other FOP nutrition labels. When they are shopping, consumers mostly evaluate product healthiness according to the different NS categories, not different FOP nutrition labels. In this sense, our research offers strong practical relevance. Second, we consider how focusing on the healthiness of products influences purchase intentions. The NS seems to offer the potential to boost sales of healthy products, without affecting sales of unhealthy products, implying that manufacturers of both healthy and unhealthy products could implement the NS. Third, with our novel perspective, we seek to link the impact of the NS to brand types and find that focusing on product healthiness can help a firm gain a competitive advantage, regardless of whether it uses a manufacturer brand or private label. With this evidence, various stakeholders can be assured that NS offers the optimal FOP nutrition label; we recommend embracing it as the standard.

1.1. Packaging

When products are largely homogeneous in their core attributes, manufacturers must attract consumers' attention on the basis of other attributes (Clement, Kristensen, & Grønhaug, 2013), such as packaging. Packaging is crucial to purchasing processes; consumers use it at the point of purchase (De Pelsmacker, Geuens, & Van den Bergh, 2017), where more than 70% of purchase decisions take place (Nielsen, 2016; Point-Of-Purchase Advertising International, 2014). In particular, packaging can powerfully influence (un)healthy food choices (Gutjar, Graaf, Palascha, & Jager, 2014; Hallez, Qutteina, Raedschelders, Boen, & Smits, 2020), with potential implications for obesity concerns. Furthermore, packaging can affect product perceptions, such as when displayed claims of health benefits on unhealthy food products exert negative effects on perceived healthfulness (Bialkova, Sasse, & Fenko, 2016).

Consumers who are more concerned about their health and the food they consume attend more to and demand simpler product information and nutrition labels (Grunert, Wills, & Fernandez-Celemin, 2010; Silayoi & Speece, 2007; Talati, Egnell, Hercberg, Julia, & Pettigrew, 2019; World Health Organization, 2004). With appropriate product information, consumers are better able to make careful, well-considered, sufficiently informed choices (Coulson, 2006). Yet consumers do not always read all the product information on packaging (e.g., nutrition box, ingredients), whether because they face time pressures or struggle to understand the meaning of the nutrition information (Bartels, Tillack, & Jordan Lin, 2018; Graham, Orquin, & Visschers, 2012; Grunert et al., 2010; Sharf et al., 2012).

1.2. Front-of-pack labels

To meet the needs of the current market, which cites the increasing importance of easier-to-understand product information (Gomez, Werle, & Corneille, 2017; Silayoi & Speece, 2007), many countries require FOP labels, and several designs are currently in use (Food and Agriculture Organization of the United Nation, 2016). Defined as "simplified information about the most important nutritional aspects and characteristics of food" (L'Abbé, McHenry, & Emrich, 2012), FOP labels represent a combined initiative of governments, product manufacturers, and retailers to direct consumers toward healthier food choices (World Health Organization, 2018). Labels on the front of packaging can help consumers choose healthier products because they provide product information at a glance (Hersey, Wohlgenant, Arsenault, Kosa, & Muth, 2013; Van Kleef & Dagevos, 2015) and attract attention (Bialkova & Trijp, 2010). In turn, FOP labels offer the promise of reducing obesity and its associated chronic illnesses (Canada Parliament, 2007; European Heart Network, 2006; Institute of Medicine of the National Academies, 2010).

In their theoretical framework, Grunert and Wills (2007) propose dividing FOP labels into two categories: (1) nutrient-specific indicators that provide detailed information (e.g., Dietary Reference Intakes, Multiple Traffic Light labels, Warning Symbols) (Grunert & Wills, 2007; Ikonen, Sotgiu, Aydinli, & Verlegh, 2019; Temple, 2020) or (2) summary indicators with an overall score of the nutritional quality of the product (e.g., Tick, Green Keyhole, Choices, Health Star Rating, SENS, NuVal, NS) (Grunert & Wills, 2007; Ikonen et al., 2019). Summary labels can appear on both more and less nutritional products, which means that consumers who engage in very unhealthy eating habits are still confronted by them (Temple, 2020). However, by greatly simplifying nutritional quality into a single score, some important information (e.g., salt for people with high blood pressure) is lost (Temple, 2020).

1.3. Nutri-Score

The NS is a summary, color-coded, graded FOP label (Grunert & Wills, 2007) that shows a scale of five colors, from dark green to red. The NS combines positive characteristics (i.e., fruit, vegetables and nuts, fiber, protein and rapeseed, walnut and olive oils content) with negative characteristics (i.e., energy, total sugar, saturated fatty acids and sodium content) to achieve a score between −15 (most healthy) and +40 (least healthy) (Julia & Hercberg, 2017a). As Fig. 1 shows, this score is reduced to a combination of a letter (A to E) and a color (from dark green to red), where A reflects the highest nutritional quality and E the lowest (Julia & Hercberg, 2017b). The central, yellow category C helps discourage dichotomous thinking (Julia & Hercberg, 2017a).

The NS is not a substitute for the detailed nutrition box, which remains legally required (European Commission, n. d.). Instead, it provides a way to simplify complex nutrition information (World Health Organization, 2017b) and thereby guide or steer consumers toward healthier purchasing choices (Julia & Hercberg, 2017b), as well as incentivize manufacturers to improve the nutritional composition of their products (Santé Publique France, 2018; Vyth, Steenhuis, Roodenburg, Brug, & Seidell, 2010).

It has been officially recommended in several European countries (e.g., France, Belgium, Spain), reflecting their health authorities' belief that the NS can help them counteract the obesity epidemic (Flemish Institute for Healthy Living, 2018). The European Commission currently supports implementation on a voluntary basis (Julia & Hercberg, 2017a), though proponents, including retail and food industry giants such as Nestlé, Danone, Ahold Delhaize, and Carrefour, have expressed support for a standard that makes the NS the only FOP nutrition label for the entire European Union (Flemish Institute for Healthy Living, n. d.; The European Consumer Organisation, 2020). Recognition of a single, reliable FOP label at the European level can help avoid a situation in which manufacturers of unhealthy products continue to fail to inform consumers about the sugar or fat in their products (Foodwatch, 2018).

In response to these developments, researchers have begun to investigate perceptions and understanding of the NS. Many studies compare it with other FOP nutrition labels, showing that the NS is the easiest to identify, requires the least time to understand across different product categories (Ducrot et al., 2015a; Egnell, Talati, Hercberg, Pettigrew, & Julia, 2018), and is the most preferred label (Julia et al., 2017). In addition, it appears to have the greatest effect on consumers who lack nutritional knowledge, which represents a very promising result (Ducrot et al., 2015b). According to Crosetto, Lacroix, Muller, and Ruffieux (2018), consumers also tend to simplify even this already greatly simplified food label when making food choices, by applying three "extreme" categories to define a product as good, neutral, or bad. The five NS categories were defined deliberately to discourage dichotomous thinking (Julia & Hercberg, 2017a), yet it appears that consumers make little distinction between the healthiness of products with dark green and light green (A and B) labels or those with orange and red (D and E) labels. Crosetto et al. (2018) argue that consumers behave as if there were only three categories. We test this claim among a sample of Flemish adults but also consider how a simplified view of perceived healthiness might relate to purchase intentions.

Fig. 1. Nutri-Score label.

In research that addresses the influence of the NS on purchase intentions and food choices, it appears more effective in stimulating healthy food choices and improving the nutritional quality of shopping baskets than other FOP labels (Crosetto et al., 2018; Flemish Institute for Healthy Living, n. d.; Julia & Hercberg, 2017a; Poquet et al., 2019). Moreover, the NS is the only label that led consumers to add products with significantly lower amounts of (saturated) fat and salt to their shopping carts (Ducrot et al., 2016). These findings suggest potentially higher purchase intentions for healthy products (A and B) and lower purchase intentions for unhealthy products (D and E). We aim to determine if this difference in purchase intentions arises between products with or without NS and for all five NS categories.

1.4. Branding

Furthermore, the NS might have distinct effects for different brand types. Both private labels and manufacturer brands have added the NS to their packaging, including Nestlé, Danone, Bonduelle, Alpro, Materne, and McCain, as well as prominent retailers in Belgium (Delhaize and Colruyt) and France (Intermarché, Auchan, Leclerc, and Carrefour) (Flanders Today, 2018). We predict the potential for differential effects because consumers who mainly buy manufacturer brands are very brand aware and usually prefer to buy as many branded products as possible, which they value more (Goldsmith, Flynn, Goldsmith, & Stacey, 2010). If prices increase, private label consumers tend to switch to alternatives more readily than consumers who buy manufacturer brands, implying their lower brand loyalty (Goldsmith et al., 2010). These findings lead us to predict that consumers who purchase private labels may respond more strongly to seeing a NS than consumers who buy manufacturer brands, because they are less brand loyal. In particular, the effect of the NS on purchase intentions may arise for both private labels and manufacturer brands, but because consumers are more loyal to the latter, the effect may be stronger for private labels than for manufacturer brands.

To test these considerations and factors, we conduct two studies of the presence of the NS and its different categories on perceived healthiness and purchase intentions for (un)healthy food products. Furthermore, we check for any additional differences in perceived healthiness and purchase intentions between manufacturer brands and private labels.

2. Study 1

With Study 1, we test whether the presence of the NS influences perceived healthiness and purchase intentions, as well as whether the effects differ across NS categories.

2.1. Pretest

To select equally attractive products for the main study, we conducted a pretest with 52 respondents. In this within-subjects design, respondents rated the attractiveness of nine ready-to-eat meals on a 7-point semantic differential scale (1 = "very unattractive," 7 = "very attractive"). To ensure some level of consistency, the nine products represented the same brand and had transparent packaging (Appendix D), but three of them would have scored A on the NS, three were NS B meals, and three were NS C meals. We used exactly the same NS labels as they appear on the products in the shops. That is, the NS did not appear on the products, but with this pretest, we sought to select one meal from each NS category that respondents considered equally attractive. Because most ready-to-eat meals earn NS of A, B, or C (Vlaams Instituut Gezond Leven, 2018), we chose not to include D and E categories in this study.

We conducted a repeated measures analysis of variance (ANOVA) with product attractiveness as the dependent variable. In the within-subjects design, each participant rated nine food products (Appendix A), which revealed three products, each from a different NS category, that were equally attractive. Mauchly's test indicated a violation of the assumption of sphericity (χ^2 (2) = 7.18, p = .028), so we corrected the degrees of freedom using Huynh-Feldt estimates of sphericity ($\varepsilon = 0.91$). The results revealed no significant differences in attractiveness across the products identified for category A ($M_A = 3.08$, $SD = 1.57$), B ($M_B = 3.13$, $SD = 1.56$), and C ($M_C = 3.23$, $SD = 1.49$; F (1.82, 92.94) = 0.19, p = .807, $\eta^2 = 0.004$), so we include them in the main study.

2.2. Main study

2.2.1. Method

We recruited 303 respondents (62% women, $M_{age} = 30.82$ years, SD = 14.06) to participate in an online experiment. A research assistant recruited a convenience sample of respondents in Flanders–one of the first regions in which the NS was introduced, and with an awareness of 91% the NS is very well known among the Flemish population (Test Aankoop, 2020)–using announcements on various social media, emails, and general recruitment platforms of a university. The research assistant was instructed to sample different age ranges (Appendix C), women and men, and people with different education levels. We included an attention check to ensure the robustness of the results (Kung, Kwok, & Brown, 2018). Eleven respondents failed the attention check, so we eliminated them from further analysis. A total of 292 respondents (61% women, $M_{age} = 30.37$ years, $SD = 14.01$) remained for further analysis.

Each participant saw a picture of one of the three ready-to-eat meals selected in the pretest, accompanied with its NS or not (Appendix D). Thus we developed a 3 (NS category: A vs. B vs. C) × 2 (NS: present vs. not present) between-subjects design. The respondents were randomly assigned to one of the six conditions and asked to rate the product on several rating scales, presented in a random order. Perceived healthiness was measured on a 7-point semantic differential scale (Adams & Geuens, 2007), anchored by "unhealthy–healthy," "low in fat–high in fat," "low in calories–high in calories," "low in vitamins–high in vitamins," and "not nutritious–nutritious" (α = 0.82). After recoding the second and third items, we averaged these scores to obtain a general perceived healthiness score. To measure purchase intentions, we used a 7-point Likert scale (Baker & Churchill, 1977), composed of four items: "I would buy this product when I see it in the store," "I would consider this product when I intend to buy a ready-to-eat meal," "I would like to test this product," and "I will buy this product in the store" (α = 0.93). Perceived tastiness was measured on a 7-point Likert scale composed of "This product has a good taste," "This product makes me hungry," "This product tastes great," "This product has a pleasant texture," and "This product makes me want to eat" (α = 0.91). For perceived quality, respondents indicated, on a 7-point semantic differential scale, their overall rating of the product (1 = "very low quality," 7 = "very high quality").

2.2.2. Results

Perceived quality. In a 3 × 2 between-subjects ANOVA with perceived quality as the dependent variable and age included as a covariate, we found no significant main effect of the presence of the NS on perceived quality (F (1, 285) = 1.58, p = .691, $\eta^2 = 0.00$) but a significant main effect of the NS category (F (2285 = 3.44, p = .033, $\eta^2 = 0.02$). Age related significantly to perceived quality too (F (1, 285) = 5.76, p = .017, $\eta^2 = 0.02$). Fig. 2 reveals the significant interaction between NS presence and NS category (F (2, 285) = 3.36, p = .036, $\eta^2 = 0.02$), such that a product in category C ($M_{C\text{-}NS} = 3.40$, $SD = 1.10$) evoked lower quality perceptions than products in category A ($M_{A\text{-}NS} = 4.17$, SD = 1.11, p = .002) or B ($M_{B\text{-}NS} = 3.97$, $SD = 1.07$, p = .022), but only when the NS was present. For a product in category A, the presence of the NS led to marginally significantly higher perceptions of quality than if the NS was not present ($M_{A\text{-}NoNS} = 3.79$, $SD = 1.05$, p = .074). For a product in category C, it produced marginally significantly lower perceptions of quality than if the NS was not present ($M_{C\text{-}NNS} = 3.77$, $SD = 1.02$, p = .075).

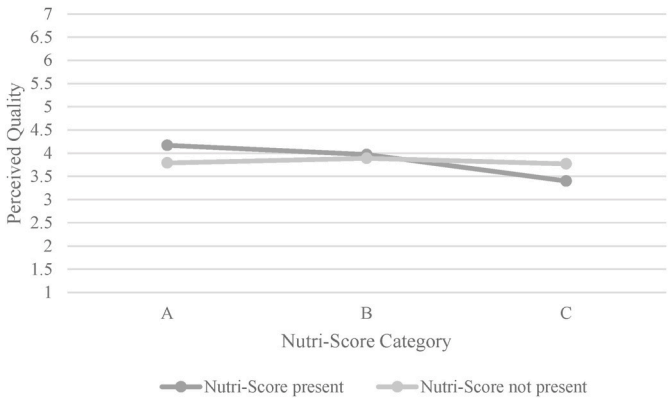

Fig. 2. Interaction effect of NS presence and NS category on perceived quality.

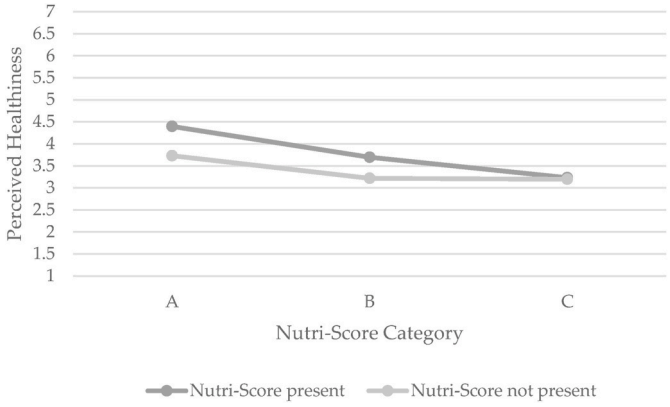

Fig. 3. Interaction effect of NS presence and NS category on perceived healthiness.

Perceived tastiness. To check whether a NS influences perceived tastiness, we conducted another 3 × 2 between-subjects ANOVA with perceived tastiness as the dependent variable and age as a covariate again. We found no significant main effect of NS presence (F (1, 285) = 0.05, p = .820, η^2 = 0.00) or NS category (F (2, 285) = 1.58, p = .208, η^2 = 0.01) on perceived tastiness, nor did age related significantly to this outcome (F (1, 285) = 2.50, p = .115, η^2 = 0.01). Finally, no significant interaction arose between NS presence and NS category (F (2, 285) = 1.25, p = .287, η^2 = 0.01).

Perceived healthiness. In the 3 × 2 between-subjects ANOVA with perceived healthiness as the dependent variable and age as a covariate, we found significant main effects of both NS presence (F (1, 285) = 11.42, p = .001, η^2 = 0.04) and NS category (F (2, 285) = 17.10, p < .001, η^2 = 0.11) on perceived healthiness. The covariate age was not significantly related to perceived healthiness (F (1, 285) = 2.61, p = .108, η^2 = 0.01). Fig. 3 also indicates a marginally significant interaction between NS presence and NS category (F (2, 285) = 2.50, p = .084, η^2 = 0.02). When a NS was present, respondents perceived products as healthier, though only for products in category A ($M_{A\text{-}NS}$ = 4.40, SD = 1.29; $M_{A\text{-}NNS}$ = 3.73, SD = 1.29, p = .002) or B ($M_{B\text{-}NS}$ = 3.70, SD = 0.84; $M_{B\text{-}NNS}$ = 3.22, SD = 0.94, p = .015). Furthermore, products in category A appeared healthier than those in categories B and C ($M_{C\text{-}NS}$ = 3.23, SD = 0.92, p < .001), and those in category B seemed marginally significantly healthier than products in category C (p = .079). Without an NS, the results indicate that products in category A were considered healthier than products in category B (p = .033) or C ($M_{C\text{-}NNS}$ = 3.20, SD = 0.78, p = .039).

Purchase intentions. The 3 × 2 between-subjects ANOVA with purchase intention as the dependent variable and age as a covariate revealed no significant main effect of NS presence on purchase intentions (F (1, 285) = 0.01, p = .920, η^2 = 0.00). Instead, we found a marginally significant main effect of NS category on purchase intentions (F (2, 285) = 2.58, p = .078, η^2 = 0.02), as well as a significant relation of age (F (1, 285) = 4.39, p = .037, η^2 = 0.02). No significant interaction emerged between NS presence and NS category (F (2, 285) = 0.83, p = .439, η^2 = 0.01). A product in category A ($M_{A\text{-}NS}$ = 3.49, SD = 1.68) evoked stronger purchase intentions than a product in category C ($M_{C\text{-}NS}$ = 2.71, SD = 1.38; p = .045) but only if the NS was present.

2.2.3. Mediation analyses

We also sought to determine whether perceived healthiness mediates the relationship between NS category and purchase intentions. For our three NS category conditions, we created two dummy variables: one to compare categories A and C (Dummy A: NS A = 1, NS B = 0, NS C = 0) and one to compare categories B and C (Dummy B: NS A = 0, NS B = 1, NS C = 0). In a mediation analysis with purchase intentions as the dependent variable, Dummy A is the independent variable, and Dummy B represents a covariate, with perceived healthiness as the mediator. We found a significant positive effect of NS category on purchase intentions (B = 0.78, SE = 0.31, t (145) = 2.52, p = .013). To test the underlying process, we use bias-corrected bootstrapping and generate a 95% confidence interval (CI) around the indirect effect of perceived healthiness; evidence of mediation exists if the CI excludes 0 (Hayes, 2017). The analysis (10,000 bootstrap samples; bias-corrected CIs) revealed a significant indirect mediation effect (ab = .71, SE = 0.21; 95% lower level CI [LLCI] = 0.354, 95% upper-level CI [ULCI] = 1.191). As predicted, NS A (vs. NS C) increased perceived healthiness, which subsequently increased purchase intentions (Fig. 4).

In a similar mediation analysis with purchase intentions as the

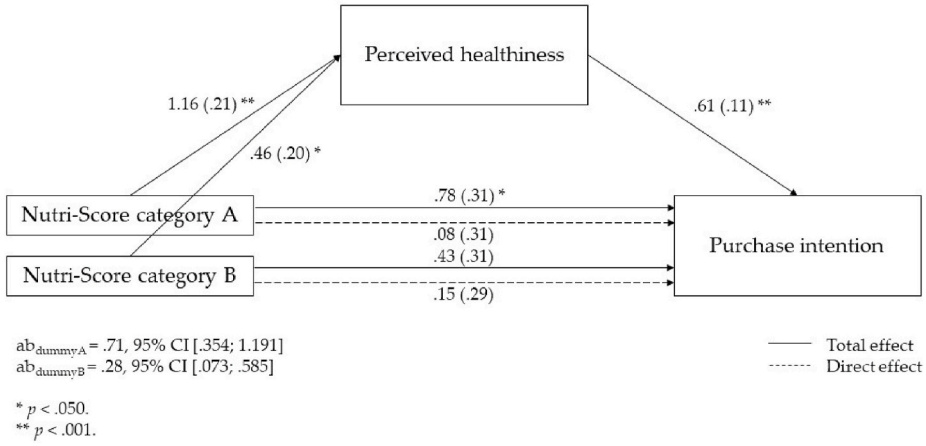

Fig. 4. Effect of NS categories A and B on purchase intentions via perceived healthiness.

dependent variable and perceived healthiness as a mediator, Dummy B becomes the independent variable, and Dummy A is a covariate. We found no significant total effect of NS category on purchase intentions ($B = 0.43$, $SE = 0.31$, $t(145) = 1.40$, $p = .163$), but the bias-corrected CIs revealed a significant indirect mediation effect ($ab = 0.28$, $SE = 0.13$; 95% LLCI = 0.073, 95% ULCI = 0.585) (Mackinnon, Krull, & Lockwood, 2000; Zhao, Lynch, & Chen, 2010). As predicted, NS B (vs. NS C) increased perceived healthiness and thus purchase intentions (Fig. 4).

3. Study 2

With Study 1, we determine that the NS had a positive effect on perceived quality, perceived healthiness, and purchase intentions. The respondents also seemed to distinguish the perceived healthiness of NS A versus NS B, without any effect on perceived tastiness. Notably, we found no trade-off between quality and healthiness. However, Study 1 has some limitations. First, it only includes the NS categories A, B, and C. Second, the between-subjects design is not realistic; in actual shopping situations, consumers choose among different options. Therefore, we include NS categories D and E and use a mixed design in Study 2 to test if the presence of the NS influences perceived healthiness across all five NS categories. In addition, we investigate whether its presence results in higher purchase intentions for healthy products and lower purchase intentions for unhealthy products. That is, does the presence of the NS stimulate healthier choices? Finally, with Study 2 we aim to investigate whether the effects differ for manufacturer brands versus private labels.

3.1. Method

We recruited 441 respondents (69% women, $M_{age} = 37.66$ years, $SD = 14.89$) to participate in an online study. As in the previous study, respondents were recruited in Flanders, as a convenience sample (Appendix C). The study was announced on various social media, emails, and general recruitment platforms of the university. Twenty-six respondents responded incorrectly to the attention check, so we eliminated them from further analysis. A total of 415 respondents (69% women; $M_{age} = 37.28$ years, $SD = 14.93$) remained for further analysis.

The 2 (NS: present vs. not present) × 2 (brand: manufacturer brand vs. private label) mixed design includes repeated measures for the NS category. Each participant was randomly assigned to one of four conditions (between-subjects factor). Then in each condition, respondents saw four products per NS category, for a total of 20 product pictures (within-subjects factor), shown in a random order. For each NS category, we selected four manufacturer branded products and four private-label products. Specifically, we selected manufacturer brands, then searched for a private label that posted the same NS and also offered comparable packaging to the manufacturer brand's. With this matching process, we limited any influences of other packaging elements (e.g., color, shape). To ensure appropriate links, we checked that the NS appeared on all products; if not, we calculated the score and added it. Thus, we derived 20 best matches (Appendix E), across the cookies, dairy products, preserves and sauces, and non-alcoholic drinks categories. Perceived healthiness and purchase intentions are the dependent variables, such that respondents rated each food item on these two scales, presented in a random order. We measured perceived healthiness on a 7-point semantic differential scale (1 = "unhealthy," 7 = "healthy"). For purchase intentions, we used a 7-point Likert scale with three items: "I will buy this product," "Next time I am buying a [product category], I will choose this product," and "I prefer this product to other [product category]" (Mai & Hoffmann, 2015). The internal consistency (Cronbach's alpha) of this scale ranges from 0.89 to 0.96 for all 20 products.

After evaluating the 20 products, respondents answered general questions about their subjective nutritional knowledge, the importance of healthy food, dieting behavior, and familiarity with the NS prior to this study. Consumers with more nutritional knowledge are better able to understand and correctly interpret food labels (Wardle, Parmenter, & Waller, 2000), and they include nutrition labels more often in their decision-making process (Drichoutis, Lazaridis, & Nayga, 2005; Grunert et al., 2010). To measure subjective nutritional knowledge, we used a 7-point Likert scale with seven items: "I have quite a bit of knowledge about food and beverages," "Within my group of friends, I am one of the experts in food and beverages," "I don't often come across new information about food and beverages that I did not know about," "Compared to others, I have little knowledge about food and beverages," "I am up to date with the most up-to-date information on food and beverages," "I don't feel well informed about food and beverages," and "I know quite a bit about food and beverages" (α = .87) (Flynn & Goldsmith, 1999). The fourth and sixth items were reversed. We measured perceptions of the importance of healthy food because consumers who are more motivated to eat healthy tend to look at all available nutritional information (Turner, Skubisz, Pandya, Silverman, & Austin, 2014) and make more use of food labels (Hess, Visschers, & Siegrist, 2012) to search for healthier alternatives within a product range (Petrovici & Ritson, 2006). For this measure, we used a 7-point Likert scale with five items: "Every time I buy a food product, I check the nutritional information," "I generally try to eat and drink food products with a low fat and sugar content," "I usually feel guilty if I eat or drink fat or sugar," "I keep a close eye on the type of products I eat and drink," and "I practice sports" (α = .71) (Desai & Ratneshwar, 2003). Dieting behavior is another important covariate, in that consumers who indicate that they restrict their diets also tend to use nutrition labels more (Ollberding, Wolf, & Contento, 2011; Soederberg Miller et al., 2015). To measure this behavior, we used a 7-point Likert scale with three items: "I try to lose weight by eating less," "I choose food that is low in fats because I am trying to lose weight," and "I am currently watching my food to lose weight" (α = 0.84) (Lowe, 1993). The last covariate is familiarity with the NS; familiarity helps people understand the labels, enhances their trust in them, and thus increases their usage during decision making (Grunert et al., 2010; Van Herpen, Seiss, & Van Trijp, 2012). We used a 7-point semantic differential scale and three items: "I was not–was familiar with the Nutri-Score," "I didn't recognize–recognized the Nutri-Score," and "I hadn't heard—had heard of the Nutri-Score" (α = 0.88) (Kumar, 2005).

3.2. Results

3.2.1. Perceived healthiness

Because the data comprise information about multiple stimuli, viewed by each participant, we need a multilevel analysis to account for the hierarchical data structure (Bryk & Raudenbush, 1992; Snijders & Bosker, 1999). Perceived healthiness is the dependent variable, and NS presence (present vs. not present) and NS category (A, B, C, D and E) serve as the independent variables. Subjective nutritional knowledge, importance of healthy food, dieting behavior, familiarity with the NS, and age are included as covariates. To account for participant-level effects, we randomly estimated the intercept. In the intercept-only model, the intraclass correlation coefficient (ICC) was 0.05, and it yielded a −2 restricted log-likelihood value (−2LL) of 34404.66. However, model fit improved significantly for a fixed-effects multilevel model with a random intercept estimation for each participant (–2LL = 29570.63; $\Delta\chi^2 = 4834.03$, $\Delta df = 14$, $p < .001$). This model indicated a significant difference in perceived healthiness across the NS presence ($F(1, 408) = 4.75$, $p = .030$) and NS category ($F(4, 7877) = 1674.37$, $p < .001$) conditions, after controlling for the effects of subjective nutritional knowledge, importance of healthy food, dieting behavior, familiarity with the NS, and age. Both importance of healthy food ($F(1, 408) = 6.51$, $p = .011$) and age ($F(1, 408) = 24.75$, $p < .001$) related significantly to perceived healthiness, whereas familiarity with the NS ($F(1, 409) = 0.39$, $p = .534$), subjective nutritional knowledge ($F(1, 409) = 0.06$, $p = .805$), and dieting behavior ($F(1, 409) = 0.29$, $p = .588$) did not. In Fig. 5, we also note the significant interaction between NS presence and NS category ($F(4, 7877) = 15.51$, $p < .001$).

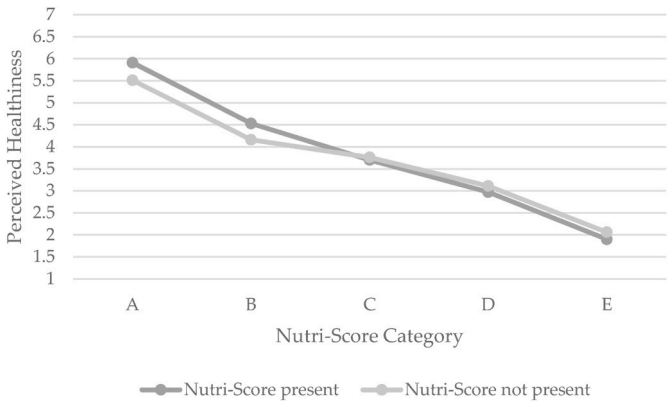

Fig. 5. Interaction effect of NS presence and NS category on perceived healthiness.

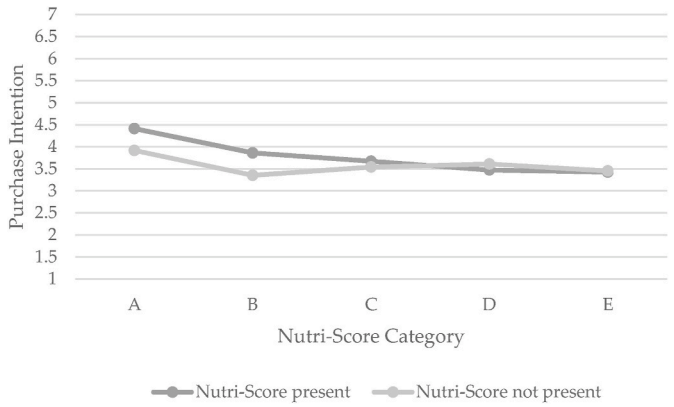

Fig. 6. Interaction effect of NS presence and NS category on purchase intention.

When the NS was present, products in categories A ($M_{A\text{-}NS} = 5.91$, $SD = 1.48$; $p < .001$) and B ($M_{B\text{-}NS} = 4.53$, $SD = 1.66$; $p < .001$) evoked higher perceived healthiness than in the NS not present condition ($M_{A\text{-}NNS} = 5.51$, $SD = 1.39$; $M_{B\text{-}NNS} = 4.16$, $SD = 1.78$); we found no significant differences for products in categories C ($M_{C\text{-}NS} = 3.76$, $SD = 1.21$; $M_{C\text{-}NNS} = 3.70$, $SD = 1.48$; $p = .353$) or D ($M_{D\text{-}NS} = 2.97$, $SD = 1.42$; $M_{D\text{-}NNS} = 3.11$, $SD = 1.40$; $p = .136$) though. A marginally significant difference in perceived healthiness arose between products in category E, depending on whether the NS was present ($M_{E\text{-}NS} = 1.90$, $SD = 1.53$; $M_{E\text{-}NNS} = 2.06$, $SD = 1.33$; $p = .085$). As expected, all NS categories differed significantly from one another, with p-values less than 0.001, when a NS was present as well as when it was not.

Regarding the type of brands, we check these effects for manufacturer brands and private labels. In a multilevel analysis, we found no significant three-way interaction among NS presence, NS category, and brand type (F (4, 7885) = 1.70, $p = .148$). That is, the effects of NS presence and NS category on perceived healthiness were the same for manufacturer brands and private labels.

3.2.2. Purchase intentions

We again use a multilevel analysis to account for the hierarchical data structure (Bryk & Raudenbush, 1992; Snijders & Bosker, 1999). In this analysis, purchase intention is the dependent variable, NS (present vs. not present) and NS category (A, B, C, D and E), are independent variables, and the five covariates remain the same. To account for participant-level effects, we again randomly estimated the intercept. The intercept-only model indicated an ICC of 0.22, so about one-fifth of the variance occurs at the individual level. The –2LL was 31484.64, and model fit improved significantly when we ran a fixed-effects multilevel model with a random intercept estimation for each participant (−2LL = 31239.01; $\Delta\chi^2 = 245.63$, $\Delta df = 14$, $p < .001$). Thus, we found a significant difference in purchase intentions across the NS presence (F (1, 408) = 5.44, $p = .020$) and NS category (F (4, 7877) = 58.55, $p < .001$) conditions, after controlling for the effects of the covariates. The importance of healthy food (F (1, 408) = 4.94, $p = .027$) and familiarity with the NS (F (1, 408) = 9.43, $p = .002$) covariates related significantly to perceived healthiness, whereas subjective nutritional knowledge (F (1, 408) = 1.77, $p = .185$) and dieting behavior (F (1, 408) = 1.46, $p = .228$) did not, and age (F (1, 408) = 3.82, $p = .051$) was marginally significantly related to it. We depict the significant interaction between NS presence and NS category (F (4, 7877) = 15.91, $p < .001$) in Fig. 6.

When a NS was present, respondents indicated significantly higher purchase intentions for products in categories A ($M_{A\text{-}NS} = 4.41$, $SD = 1.55$, $p < .001$) and B ($M_{B\text{-}NS} = 3.86$, $SD = 1.66$, $p < .001$) than if no NS were present ($M_{A\text{-}NNS} = 3.92$, $SD = 1.61$; $M_{B\text{-}NNS} = 3.35$, $SD = 1.71$). However, regardless of the presence of NS, no significant differences in purchase intentions emerged for products in categories C ($M_{C\text{-}NS} = 3.67$, $SD = 1.55$; $M_{C\text{-}NNS} = 3.54$, $SD = 1.70$, $p = .203$), D ($M_{D\text{-}NS} = 3.47$, $SD = 1.73$; $M_{D\text{-}NNS} = 3.61$, $SD = 1.78$, $p = .235$), and E ($M_{E\text{-}NS} = 3.43$, $SD = 1.93$; $M_{E\text{-}NNS} = 3.45$, $SD = 1.89$, $p = .873$). Without an NS, we identified (marginally) significant differences between NS categories A and B ($p < .001$), A and C ($p < .001$), A and D ($p < .001$), A and E ($p < .001$), B and C ($p = .095$), and B and D ($p = .004$). In addition, with a NS, categories A and B ($p < .001$), A and C ($p < .001$), A and D ($p < .001$), A and E ($p < .001$), B and D ($p < .001$), B and E ($p < .001$), C and D ($p = .091$), and C and E ($p = .013$) differed significantly from each other (Appendix B).

We further check whether these effects differ between manufacturer brands and private labels. With a multilevel analysis, we found that in general and as expected, products of a manufacturer brand evoked stronger purchase intentions than products of a private label ($M_{manufacturerbrand} = 4.06$, $SD = 1.76$; $M_{privatelabel} = 3.23$, $SD = 1.61$; F (1, 415) = 116.02, $p < .001$). However, there was no significant three-way interaction among NS presence, NS category, and brand type (F (4, 7885) = 0.24, $p = .915$). The effects of NS presence and NS category on purchase intentions were the same for manufacturer brands and private labels.

3.3. Mediation analyses

With a multilevel mediation model with a random intercept that accounts for the hierarchical data structure (Bryk & Raudenbush, 1992; Hayes, 2017; Snijders & Bosker, 1999), we sought to determine whether perceived healthiness mediates the relationship between the NS category and purchase intention. For the five NS category conditions, we created four dummy variables to compare categories A and C (Dummy A; NS A = 1, all other NS = 0), B and C (Dummy B; NS B = 1, all other NS = 0), D and C (Dummy D; NS D = 1, all other NS = 0), and E and C (Dummy E; NS E = 1, all other NS = 0).

In a first mediation analysis, purchase intention is the dependent variable, Dummy A serves as the independent variable, and Dummies B, D, and E are covariates; in addition, perceived healthiness is a mediator. We found a significant positive effect of NS category on purchase intentions ($B = 0.74$, $SE = 0.08$, t (3739) = 9.82, $p < .001$). To test the underlying process, we used Monte Carlo methods to generate a 95% CI around the indirect effect of perceived healthiness, such that mediation exists if the CI excludes 0 (Hayes & Rockwood, 2019). The analysis (10, 000 simulations; Monte Carlo CI) revealed a significant indirect mediation effect ($ab = 0.59$, $SE = 0.04$; 95% LLCI = 0.513, 95% ULCI = 0.674). As predicted, NS A (vs. NS C) increased perceived healthiness, which then increased purchase intentions (Fig. 7).

A similar mediation analysis includes purchase intentions as the dependent variable, perceived healthiness as a mediator, Dummy B as the independent variable, and Dummies A, D, and E as covariates. It revealed a significant positive effect of NS category on purchase intentions ($B = 0.19$, $SE = 0.08$, t (3739) = 2.50, $p = .012$), and the Monte

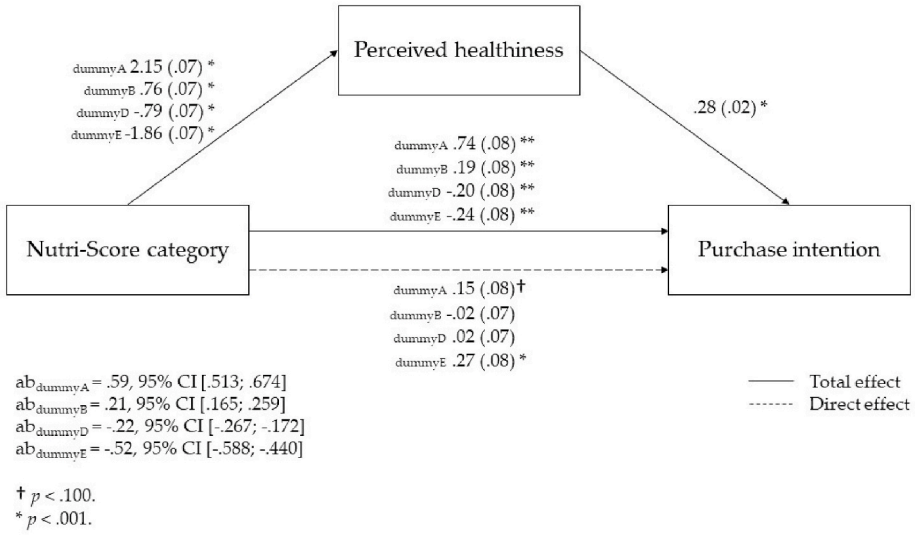

Fig. 7. Effect of NS A, B, D, and E on purchase intentions via perceived healthiness.

Carlo analysis indicated a significant indirect mediation effect (ab = 0.21, SE = 0.02; 95% LLCI = 0.165, 95% ULCI = 0.259). As predicted, NS B (vs. NS C) increased perceived healthiness, which increased purchase intentions (Fig. 7).

A third mediation analysis includes Dummy D as the independent variable and Dummies A, B, and E as covariates, and it indicated a significant negative effect of NS category on purchase intentions (B = −0.20, SE = 0.08, t (3739) = −2.63, p = .009). The Monte Carlo CI affirmed a significant indirect mediation effect (ab = −0.22, SE = 0.02; 95% LLCI = −0.267, 95% ULCI = −0.172). As predicted, NS D (vs. NS C) decreased perceived healthiness, which made respondents less willing to purchase the product (Fig. 7).

Finally, when we use Dummy E as the independent variable and Dummies A, B, and D as covariates, we found a significant negative effect of NS category on purchase intentions (B = −0.24, SE = 0.08, t (3739) = −3.25, p = .001). The Monte Carlo CIs confirmed a significant indirect mediation effect (ab = −0.52, SE = 0.04; 95% LLCI = −0.588, 95% ULCI = −0.440). As predicted, NS E (vs. NS C) decreased perceived healthiness, so respondents expressed lower purchase intentions (Fig. 7).

4. General discussion

The presence of the NS helped the respondents in these studies assess the healthiness of products more easily. Thus, the first objective of the NS—to make respondents more aware of product healthiness—has been achieved; respondents identified healthy products as healthier when the NS is present. In addition, they regarded the healthiness of products ranked in five categories significantly differently. We did not find evidence that respondents thought in extreme values or further simplified the NS. Rather, and in contrast with prior findings (Crosetto et al., 2018), they could distinguish dark green (NS A) from light green (NS B) labeled products and orange (NS D) from red (NS E) ones, in terms of their perceived healthiness. In this respect, our findings are promising regarding the effectiveness of the NS, which was designed explicitly to support more nuanced, accurate assessments of products' healthiness and to avoid dichotomous thinking (Julia & Hercberg, 2017a).

Our studies also indicate that respondents expressed higher purchase intentions for products with a positive NS (A and B) than for products with a negative NS (D and E), as well as for healthy products that feature the NS rather than those without it. However, average purchase intentions for unhealthy products were identical, whether the NS was present or not. These findings resonate with previous research that shows that respondents are inclined to choose more products with a green NS and fewer with a red NS (Crosetto et al., 2018; Ducrot et al., 2015a). Thus, we showed that the NS has the potential to boost sales of healthy products, while not affecting sales of unhealthy products. This interesting finding may mitigate fears among food industry actors that the NS would have negative impacts on the sales of red-labeled (NS E) products (Julia & Hercberg, 2018). For example, the federation of the Belgian food industry has argued that the NS is too stigmatizing for some unhealthy export products (e.g., chocolate in Belgium), which the country instead should be proud of (Fevia, 2018). Our results suggest the food industry does not need to worry about sales of such products, even if they feature the NS.

Yet perceived healthiness did mediate the relationship between NS category and purchase intentions. Because NS A and B increased the perceived healthiness of food products, respondents in our study were more willing to purchase them than products with a less good NS. Because NS D and E decreased their perceived healthiness, respondents were less willing to purchase these food products than products with a better NS. In this sense, the NS appears to be achieving another of its objectives, namely, to steer consumers toward healthier purchases.

Noting evidence that consumers have more confidence in manufacturer brands than in private labels (Underwood & Klein, 2002), we also sought to determine if such trust in manufacturer brands prevents the NS from functioning properly, but we did not find any evidence of an effect of the type of brand on the relationships of the NS with either perceived healthiness or purchase intentions. In contrast, prior research shows that, in addition to their trust in its quality, consumers are less likely to find alternatives to a manufacturer branded product (Goldsmith et al., 2010; Quelch and Harding, 1996), which is why we predicted that the NS might have less impact on manufacturer brands than on private labels (Elliott & Yannopoulou, 2007; Goldsmith et al., 2010; Quelch and Harding, 1996). The lack of difference that we found instead might imply that due to their rising quality, consumers largely accept and trust in private labels, so they remain more loyal to them (Ailawadi & Keller, 2004; Calvo Porral & Levy-Mangin, 2016; Nielsen, 2018), regardless of the presence of the NS.

4.1. Theoretical contributions

In addition to these findings, this investigation contributes specifically to academic research into packaging. We extend prior research on packaging labels by clarifying their impact on critical consumer responses, including product perceptions and purchase intentions. Our findings affirm that the NS has substantial implications for healthy food

choices, in support of prior calls for easier-to-understand product information on packaging (Silayoi & Speece, 2007). With our detailed analysis, focused solely on the NS instead of comparisons across FOP labels (Egnell et al., 2018; Julia et al., 2017; Talati et al., 2019), we provide a better understanding of how the NS in particular affects perceived healthiness and purchase intentions. As we show, consumers evaluate the healthiness of products according to the different NS categories, not different FOP nutrition labels. Our study results also offer a new perspective, in that we link the impact of the NS to the type of brand and thus can demonstrate that identifying product healthiness can lead to a competitive advantage, for both manufacturer brands and private labels. With these insights, we respond to calls for more research and a better understanding of how product manufacturers and public policy makers can encourage healthy food choices through packaging.

4.2. Consumer, public policy, and managerial implications

To date, the NS label has been implemented only on a voluntary basis in France, Belgium, and Spain, and its adoption mainly has involved a few, important actors in the food retail market (e.g., Danone, Alpro). The limited spread of the NS prevents consumers from making accurate comparisons across products, but considering our findings that respondents make healthier food choices when it is present, its mandatory implementation for all food products in Europe seems appropriate and could have beneficial consequences for retailers, manufacturers, consumers, nutritionists, other stakeholders, and public policy makers.

The NS and its associated transparency could help retailers and manufacturers attract consumers. Including it on their product packaging would signal that they care about the health of their customers and increase customer trust. Acknowledging product healthiness with a rating, even if the products are relatively unhealthy, establishes a competitive advantage for manufacturer and retailer private-label brands. Therefore, the findings should encourage both retailers and manufacturers to place the NS on all their products. This recommendation may be particularly relevant for manufacturers of unhealthy brands, which might hesitate to use it, for fear that consumers will switch to healthier alternatives (Julia & Hercberg, 2018). However, our research showed that the presence of the NS does not reduce purchase intentions of unhealthy products, a benefit that should be communicated clearly to manufacturers. The mandatory introduction of the NS would offer them a viable solution to meet demands for simple FOP labels for food (Talati et al., 2019). Sales of healthy foods grow when FOP labels are applied to all products within a category, rather than just a selection of healthy options (Rahkovsky, Lin, Lin, & Lee, 2013; Sacks, Rayner, & Swinburn, 2009; Sutherland, Kaley, & Fischer, 2010). If manufacturers must display the NS on their product packaging, they also might seek to improve product compositions to achieve the best possible NS for their product, compared with direct competitors. In this way, this research highlights the viability of another important objective of the NS, namely, to motivate manufacturers to maximize the nutritional quality of their products (Vyth et al., 2010).

Consumers also benefit. They often feel overwhelmed by the vast product options in a supermarket or confused by various FOP labels (Draper et al., 2013). If the NS became compulsory on all packaging, consumers could easily compare food products, regardless of brand type, and make healthier choices. Such an implementation also would grant consumers more confidence in the NS, such that they may be more inclined to follow its advice.

Finally, this research offers further evidence for public policy makers to use to encourage or mandate the implementation of the NS. With such incentives to introduce the NS on a larger scale, they could improve their efforts to tackle the obesity epidemic and associated chronic diseases. Although the NS is a worthy candidate to be the sole, mandatory European food label, some nuance also is appropriate here. It has some limitations, such as ignoring the extent to which products have been processed, their preparation method, or the use of additives (Monteiro et al., 2016; Diet Sensor, 2018). Comparing the NS across different product categories also might lead to incorrect interpretations. These points for consideration do not outweigh the many benefits of the NS, yet governments still have the crucial task of informing stakeholders about these limitations and guiding them with regard to how to make optimal use of the NS, through information campaigns.

4.3. Limitations and further research

A few limitations of this research suggest avenues for continued studies. First, we focused on five product categories, so our findings arguably may have limited generalizability to other product categories. The product categories we tested were relatively diverse, but further research could expand the analysis to an even greater scale, and with more or other product categories, to increase the generalizability of the findings.

Second, all the studies were conducted online, whereas product evaluations tend to be more informed when consumers can touch the product (Peck & Childers, 2003). Studies of the impact of the NS in an offline environment with real products would help consumers better imagine buying the product; studies in a real supermarket environment also might determine actual purchases instead of gathering self-reported measures.

Third, our online studies also rely on data gathered from a single moment in time, so we can only assess one-time evaluations. Additional research might consider more long-term effects and investigate whether they persist after consumers become used to the NS.

Fourth, both studies involved a single, European country. Healthiness perceptions, purchase intentions, subjective nutritional knowledge, importance of healthy food, dieting behavior, and familiarity with the NS all vary across countries, as do obesity rates and the relative prices of healthy and unhealthy food. Therefore, the impact of NS categories on perceived healthiness and purchase intentions likely differs in other countries, and research that seeks to replicate our findings across countries is necessary. The impact of the NS has been demonstrated in France (Julia & Hercberg, 2017b); we anticipate that our findings will hold in other European countries and Western nations as well.

Fifth, our convenience sample of mainly younger adults is not necessarily representative of the general population; middle-aged and younger adults are more likely to use nutrition labels than older adults (Campos, Doxey, & Hammond, 2011). To address this issue, researchers should seek representative samples of general populations, with representation of mature families and older adults of both sexes. Such efforts could offer further, more nuanced insights into the impact of the NS on product perceptions and purchase intentions.

5. Conclusions

In summary, respondents better assessed the healthiness of products when they saw the NS, and they did not simplify it further, according to findings showing that respondents perceived the healthiness of products in each of the five NS categories significantly differently. In turn, respondents indicated significantly higher purchase intentions for healthy products when the NS was present (vs. not present), yet no differences in purchase intentions for unhealthy products when it was present. Finally, perceived healthiness mediated the relationship between the presence of the NS and purchase intentions. We hope these findings contribute to greater conviction among all stakeholders, to introduce the NS as the only European FOP nutrition label and an effective option for addressing the growing obesity epidemic.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Declaration of competing interest

This study obtained ethics approval from the Ethics Committee of the Faculty of Economics and Business Administration of Ghent University.

Acknowledgments

The authors thank Tilien Vanhooren for help with the data collection for Study 1.

Appendices. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.appet.2020.104995.

Appendix A. Mean differences for the products in the pretest using a Bonferroni correction

Product	*M*	*SD*	A – 1	A – 2	A – 3	B – 1	B – 2	B – 3	C – 1	C – 2	C – 3
A – 1	5.29	1.30	1	1.77*	2.21*	2.15*	2.35*	2.46*	2.67*	1.15*	2.06*
A – 2	3.52	1.41		1	.44	.39	.58	.69	.90*	-.62	.29
A – 3	3.08	1.57			1	-.06	.14	.25	.46	-1.06*	-.15
B – 1	3.13	1.56				1	.19	.31	.52	-1.00*	-.10
B – 2	2.94	1.46					1	.12	.33	-1.19*	-.29
B – 3	2.83	1.34						1	.21	-1.31*	-.40
C – 1	2.62	1.51							1	-1.52*	-.62
C – 2	4.13	1.37								1	.90
C – 3	3.23	1.49									1

* $p < .050$.

Appendix B. Mean differences in purchase intentions for different NS categories using a Bonferroni correction

	M	*SD*	A	B	C	D	E
NS present							
A	4.41	1.55	1	.55**	.74**	.94**	.99**
B	3.86	1.66		1	.19	.39**	.43**
C	3.67	1.55			1	.20†	.25*
D	3.47	1.73				1	.05
E	3.43	1.93					1
NS not present							
A	3.92	1.61	1	.57**	.38**	.31**	.47**
B	3.35	1.71		1	-.19†	-.26*	-.01
C	3.54	1.70			1	-.07	.09
D	3.61	1.78				1	.16
E	3.45	1.89					1

† $p < .100$; * $p < .050$; ** $p < .001$.

Appendix C. Characteristics of the respondents in Study 1 and Study 2

	Study 1 (N = 292)	Study 2 (N = 415)
Age categories		
<25 years	N = 162	N = 114
25–35 years	N = 51	N = 97
36–50 years	N = 44	N = 106
>50 years	N = 35	N = 98
Education		
Student	N = 143	*Not measured in this study.*
Blue collar worker	N = 24	
White collar worker	N = 110	
Retired	N = 4	
Unemployed	N = 11	
Employment		
Primary education or no education	N = 7	*Not measured in this study.*
Secondary education	N = 105	
Bachelor	N = 108	
Master	N = 72	

References

Adams, L., & Geuens, M. (2007). Healthy or unhealthy slogans: That's the question. *Journal of Health Communication, 12*(2), 173–185. https://doi.org/10.1080/10810730601152755

Ailawadi, K. L., & Keller, K. L. (2004). Understanding retail branding: Conceptual insights and research priorities. *Journal of Retailing, 80*, 331–342. https://doi.org/10.1016/j.jretai.2004.10.008

Baker, M. J., & Churchill, G. A. (1977). The impact of physically attractive models on advertising evaluations. *Journal of Marketing Research, 14*(4), 538–555.

Bartels, M., Tillack, K., & Jordan Lin, C. T. (2018). Communicating nutrition information at the point of purchase: An eye-tracking study of shoppers at two grocery stores in the United States. *International Journal of Consumer Studies, 42*(5), 557–565. https://doi.org/10.1111/ijcs.12474

Becker, M. W., Bello, N. M., Sundar, R. P., Peltier, C., & Bix, L. (2015). Front of pack labels enhance attention to nutrition information in novel and commercial brands. *Food Policy, 56*, 76–86. https://doi.org/10.1016/j.foodpol.2015.08.001

Bialkova, S., Sasse, L., & Fenko, A. (2016). The role of nutrition labels and advertising claims in altering consumers' evaluation and choice. *Appetite, 96*, 38–46. https://doi.org/10.1016/j.appet.2015.08.030

Bialkova, S., & Trijp, H. Van (2010). What determines consumer attention to nutrition labels? *Food Quality and Preference, 21*(8), 1042–1051. https://doi.org/10.1016/j.foodqual.2010.07.001

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park, CA: Sage Publications.

Calvo Porral, C., & Levy-Mangin, J. P. (2016). Food private label brands: The role of consumer trust on loyalty and purchase intention. *British Food Journal, 118*(3), 679–696. https://doi.org/10.1108/BFJ-08-2015-0299

Campos, S., Doxey, J., & Hammond, D. (2011). Nutrition labels on pre-packaged foods: A systematic review. *Public Health Nutrition, 14*(8), 1496–1506. https://doi.org/10.1017/S1368980010003290

Canada Parliament. (2007). House of commons. Standing committee on health, & Merrifield, R. *Healthy weights for healthy kids: Report of the Standing Committee on Health*. https://www.ourcommons.ca/Content/Committee/391/HESA/Reports/RP2795145/hesarp07/hesarp07-e.pdf.

Clement, J., Kristensen, T., & Grønhaug, K. (2013). Understanding consumers' in-store visual perception: The influence of package design features on visual attention. *Journal of Retailing and Consumer Services, 20*(2), 234–239. https://doi.org/10.1016/j.jretconser.2013.01.003

Coulson, N. S. (2006). An application of the stages of change model to consumer use of food labels. *British Food Journal, 102*(9), 661–668.

Crosetto, P., Lacroix, A., Muller, L., & Ruffieux, B. (2018). Nutritional and economic impact of 5 alternative front-of-pack nutritional labels: Experimental evidence. https://hal.archives-ouvertes.fr/hal-01805431/document.

De Pelsmacker, P., Geuens, M., & Van den Bergh, J. (2017). *Marketing communications: A European perspective*. London: Pearson Education.

Desai, K. K., & Ratneshwar, S. (2003). Consumer perceptions of product variants positioned on atypical attributes. *Journal of the Academy of Marketing Science, 31*(1), 22–35. https://doi.org/10.1177/0092070302238600

Diet Sensor. (2018). Guide to understanding the Nutri-Score and NOVA classification. https://www.dietsensor.com/guide-to-understanding-the-Nutri-Score-and-nova-classification/?v=d3dcf429c679.

Draper, A. K., Adamson, A. J., Clegg, S., Malam, S., Rigg, M., & Duncan, S. (2013). Front-of-pack nutrition labelling: Are multiple formats a problem for consumers? *The European Journal of Public Health, 23*(3), 517–521. https://doi.org/10.1093/eurpub/ckr144

Drichoutis, A. C., Lazaridis, P., & Nayga, R. M. (2005). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics, 32*(1), 93–118. https://doi.org/10.1093/erae/jbi003

Ducrot, P., Julia, C., Méjean, C., Kesse-guyot, E., Touvier, M., Fezeu, L. K., et al. (2016). Impact of different front-of-pack nutrition labels on consumer purchasing intentions. *American Journal of Preventive Medicine, 50*(5), 627–636. https://doi.org/10.1016/j.amepre.2015.10.020

Ducrot, P., Méjean, C., Julia, C., Kesse-Guyot, E., Touvier, M., Fezeu, L., et al. (2015a). Effectiveness of front-of-pack nutrition labels in French adults: Results from the NutriNet-Santé cohort study. *PLoS One, 10*(10), 1–15. https://doi.org/10.1371/journal.pone.0140898

Ducrot, P., Méjean, C., Julia, C., Kesse-Guyot, E., Touvier, M., Fezeu, L., et al. (2015b). Objective understanding of front-of-package nutrition labels among nutritionally at-risk individuals. *Nutrients, 7*, 7106–7125. https://doi.org/10.3390/nu7085325

Egnell, M., Talati, Z., Hercberg, S., Pettigrew, S., & Julia, C. (2018). Objective understanding of front-of-package nutrition labels: An international comparative experimental study across 12 countries. *Nutrients, 10*(10). https://doi.org/10.3390/nu10101542

Elliott, R., & Yannopoulou, N. (2007). The nature of trust in brands: A psychosocial model. *European Journal of Marketing, 41*(9/10), 988–998. https://doi.org/10.1108/03090560710773309

European Commission. Food information to consumers–legislation. n.d. https://ec.europa.eu/food/safety/labelling_nutrition/labelling_legislation_en. (Accessed 24 October 2019)

European Heart Network. (2006). Review of 'front of pack' nutrition schemes. Retrieved from http://www.ehnheart.org/publications-and-papers/publications/112:review-of-front-of-pack-nutrition-schemes.html.

Fevia. (2018). Voedingsetiketten: Frankrijk achterna of europese aanpak?. https://www.fevia.be/nl/nieuws/voedingsetiketten-frankrijk-achterna-of-europese-aanpak.

Flemish Institute for Healthy Living. (2018). Vlaams Instituut gezond leven juicht invoeding gezondheidslabel "nutri-score" toe. https://www.gezondleven.be/nieuws/vlaams-instituut-gezond-leven-juicht-invoering-gezondheidslabel-nutri-score-toe. (Accessed 24 October 2019).

Flemish Institute for Healthy Living. Nutri-score. n.d., Retrieved https://www.gezondleven.be/themas/voeding/beleid/voedingslabels/nutri-score-label. (Accessed 24 October 2019).

Flynn, L. R., & Goldsmith, R. E. (1999). A short, reliable measure of subjective knowledge. *Journal of Business Research, 46*(1), 57–66. https://doi.org/10.1016/S0148-2963(98)00057-5

Food and Agriculture Organization of the United Nation. (2016). Handbook on food labelling to protect consumers. http://www.fao.org/3/a-i6575e.pdf.

Foodwatch. (2018). Unilever & Co schorten voedsellogo op: 'geen draagvlak. https://www.foodwatch.org/nl/current-nieuws/2018/unilever-co-schorten-voedsellogo-op-geen-draagvlak/?L=0.

Goldsmith, R. E., Flynn, L. R., Goldsmith, E., & Stacey, E. C. (2010). Consumer attitudes and loyalty towards private brands. *International Journal of Consumer Studies, 34*, 339–348. https://doi.org/10.1111/j.1470-6431.2009.00863.x

Gomez, P., Werle, C. O. C., & Corneille, O. (2017). The pitfall of nutrition facts label fluency: Easier-to-process nutrition information enhances purchase intentions for unhealthy food products. *Marketing Letters, 28*(1), 15–27. https://doi.org/10.1007/s11002-015-9397-3

Graham, D. J., Orquin, J. L., & Visschers, V. H. M. (2012). Eye tracking and nutrition label use: A review of the literature and recommendations for label enhancement. *Food Policy, 37*(4), 378–382. https://doi.org/10.1016/j.foodpol.2012.03.004

Grunert, K. G., & Wills, J. M. (2007). A review of European research on consumer response to nutrition information on food labels. *Journal of Public Health, 15*(5), 385–399. https://doi.org/10.1007/s10389-007-0101-9

Grunert, K. G., Wills, J. M., & Fernandez-Celemin, L. (2010). Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite, 55*, 177–189. https://doi.org/10.1016/j.appet.2010.05.045

Gutjar, S., Graaf, C. de, Palascha, A., & Jager, G. (2014). Food choice: The battle between package, taste and consumption situation. *Appetite, 80*, 109–113. https://doi.org/10.1016/j.appet.2014.05.006

Hallez, L., Qutteina, Y., Raedschelders, M., Boen, F., & Smits, T. (2020). That's my cue to eat: A systematic review of the persuasiveness of front-of-pack cues on food packages for children vs. adults. *Nutrients, 12*(4), 1062.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: Guilford Publications.

Hayes, A. F., & Rockwood, N. J. (2019). *Conditional process analysis: Concepts, computation, and advances in the modeling of the contingencies of mechanisms*. American Behavioral Scientist. https://doi.org/10.1177/0002764219859633

Hersey, J. C., Wohlgenant, K. C., Arsenault, J. E., Kosa, K. M., & Muth, M. K. (2013). Effects of front-of-package and shelf nutrition labeling systems on consumers. *Nutrition Reviews, 71*(1), 1–14. https://doi.org/10.1111/nure.12000

Hess, R., Visschers, V. H. M., & Siegrist, M. (2012). The role of health-related, motivational and sociodemographic aspects in predicting food label use: A comprehensive study. *Public Health Nutrition, 15*(3), 407–414. https://doi.org/10.1017/S136898001100156X

Ikonen, I., Sotgiu, F., Aydinli, A., & Verlegh, P. W. J. (2019). Consumer effects of front-of-package nutrition labeling: An interdisciplinary meta-analysis. *Journal of the Academy of Marketing Science*, 1–24.

Institute of Medicine of the National Academies. (2010). Examination of front-of-package nutrition rating systems and symbols. https://pdfs.semanticscholar.org/7320/ef3ce4d183b3dcbcf579132ce3a47f6d5b76.pdf.

Julia, C., & Hercberg, S. (2017a). Development of a new front-of-pack nutrition label in France: The five-colour Nutri-Score. *Public Health Panorama, 3*(4), 712–725.

Julia, C., & Hercberg, S. (2017b). Nutri-Score: Evidence of the effectiveness of the French front-of-pack nutrition label. *Ernährungs Umschau, 64*(12), 181–187. https://doi.org/10.4455/eu.2017.048

Julia, C., & Hercberg, S. (2018). Big food's opposition to the French Nutri-Score front-of-pack labeling warrants a global reaction. *American Journal of Public Health, 108*(3), 318–321. https://doi.org/10.2105/AJPH.2017.304284

Julia, C., Péneau, S., Buscail, C., Gonzalez, R., Touvier, M., Hercberg, S., et al. (2017). 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, 7*(6), 1–11. https://doi.org/10.1136/bmjopen-2017-016108

Kivets, R., & Simonson, I. (2000). The effects of incomplete information on consumer choice. *Journal of Marketing Research, 37*(4), 427–448.

Kumar, P. (2005). The impact of cobranding on customer evaluation of brand counterextensions. *Journal of Marketing, 69*(3), 1–18. https://doi.org/10.1509/jmkg.69.3.1.66358

Kung, F. Y. H., Kwok, N., & Brown, D. J. (2018). Are attention check questions a threat to scale validity? *Applied Psychology, 67*(2), 264–283. https://doi.org/10.1111/apps.12108

Lowe, M. R. (1993). The effects of dieting on eating behavior: A three-factor model. *Psychological Bulletin, 114*(1), 100–121. https://doi.org/10.1037/0033-2909.114.1.100

L'Abbé, M. R. L., McHenry, E. W., & Emrich, T. (2012). What is front-of-pack labelling? Codex committee on food labelling, FAO/WHO information meeting on front-of-pack nutrition labelling. https://www.who.int/nutrition/events/2013_FAO_WHO_workshop_frontofpack_nutritionlabelling_presentation_L%27Abbe.pdf.

Mackinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science, 1*(4), 173–181.

Mai, R., & Hoffmann, S. (2015). How to combat the unhealthy = tasty intuition: The influencing role of health consciousness. *Journal of Public Policy and Marketing, 34*(1), 63–83. https://doi.org/10.1509/jppm.14.006

Monteiro, C. A., Cannon, G., Levy, R., Moubarac, J. C., Jaime, P., Martins, A. P., et al. (2016). NOVA. The star shines bright. *World Nutrition, 7*(1–3), 28–38.

Nestle, M., & Jacobsen, M. F. (2000). Halting the obesity epidemic: A public health policy approach. *Public Health Reports, 115*(1), 12–24.

Nielsen. (2016). It's not about the shelf: Creating the ideal in-store experience. https://www.nielsen.com/us/en/insights/article/2016/its-not-just-about-the-shelf-creating-the-ideal-in-store-experience/.

Nielsen. (2018). The rise and shine again of private label. https://www.nielsen.com/cn/en/insights/report/2018/the-rise-and-rise-again-of-private-label/#.

Nishida, C., Uauy, R., Kumanyika, S., & Shetty, P. (2004). The Joint WHO/FAO Expert Consultation on diet, nutrition and the prevention of chronic diseases: Process, product and policy implications. *Public Health Nutrition, 7*(1a), 245–250. https://doi.org/10.1079/PHN2003592

Ollberding, N. J., Wolf, R. L., & Contento, I. (2011). Food label use and its relation to dietary intake among US adults. *Journal of the American Dietetic Association, 111*(5), S47–S51. https://doi.org/10.1016/j.jada.2011.03.009

Peck, J., & Childers, T. L. (2003). To have and to hold: The influence of haptic information on product judgments. *Journal of Marketing, 67*(2), 35–48. https://doi.org/10.1509/jmkg.67.2.35.18612

Petrovici, D. A., & Ritson, C. (2006). Factors influencing consumer dietary health preventative behaviours. *BMC Public Health, 6*, 1–12. https://doi.org/10.1186/1471-2458-6-222

Point-Of-Purchase Advertising International. (2014). POPAI's 2014 mass merchang shopper engagement study. http://cdn2.hubspot.net/hub/73834/file-1640923392-pdf/docs/popai_-_2014_mass_merchant_shopper_engagement_study.pdf.

Poquet, D., Ginon, E., Goubel, B., Chabanet, C., Marette, S., Issanchou, S., et al. (2019). Impact of a front-of-pack nutritional traffic-light label on the nutritional quality and the hedonic value of mid-afternoon snacks chosen by mother-child dyads. *Appetite, 143*(August). https://doi.org/10.1016/j.appet.2019.104425, 104425.

Quelch, J. A., & Harding, D. (1996). Brands versus private labels: Fight to win. *Harvard Business Review, 74*(1), 99–109.

Rahkovsky, I., Lin, B., Lin, C. J., & Lee, J. (2013). Effects of the Guiding Stars Program on purchases of ready-to-eat cereals with different nutritional attributes. *Food Policy, 43*, 100–107. https://doi.org/10.1016/j.foodpol.2013.08.013

Sacks, G., Rayner, M., & Swinburn, B. (2009). Impact of front-of-pack 'traffic-light' nutrition labelling on consumer food purchases in the UK. *Health Promotion International, 24*(4), 344–352. https://doi.org/10.1093/heapro/dap032

Santé Publique France. (2018). Nutri-Score: C'est plus facile de manger mieux. https://sites.uclouvain.be/reso/opac_css/doc_num.php?explnum_id=14083.

Sharf, M., Sela, R., Zentner, G., Shoob, H., Shai, I., & Stein-Zamir, C. (2012). Figuring out food labels. Young adults' understanding of nutritional information presented on food labels is inadequate. *Appetite, 58*(2), 531–534. https://doi.org/10.1016/j.appet.2011.12.010

Silayoi, P., & Speece, M. (2007). The importance of packaging attributes: A conjoint analysis approach. *European Journal of Marketing, 41*(11), 1495–1517. https://doi.org/10.1108/03090560710821279

Snijders, T. A., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage Publications.

Soederberg Miller, L. M., Cassady, D. L., Applegate, E. A., Beckett, L. A., Wilson, M. D., Gibson, T. N., et al. (2015). Relationships among food label use, motivation, and dietary quality. *Nutrients, 7*(2), 1068–1080. https://doi.org/10.3390/nu7021068

Sutherland, L. A., Kaley, L. A., & Fischer, L. (2010). Guiding Stars: The effect of a nutrition navigation program on consumer purchases at the supermarket. *American Journal of Clinical Nutrition, 91*(3), 1090S–1094S. https://doi.org/10.3945/ajcn.2010.28450C.INTRODUCTION

Talati, Z., Egnell, M., Hercberg, S., Julia, C., & Pettigrew, S. (2019). Consumers' perceptions of five front-of-package nutrition labels: An experimental study across 12 countries. *Nutrients, 11*(8), 1934.

Temple, N. J. (2020). Front-of-package food labels: A narrative review. *Appetite, 144*. https://doi.org/10.1016/j.appet.2019.104485, 104485.

Test Aankoop. (2020). Peiling test Aankoop: Meerderheid consumenten gewonnen voor een verplichte nutri-score. Retrieved from https://www.test-aankoop.be/action/pers informatie/persberichten/2020/peiling-nutri-score.

The European Consumer Organisation (BEUC). (2020). Joint letter to the European commission re: Mandatory nutri-score. Retrieved April 30, 2020, from http://www.beuc.eu/publications/beuc-x-2020-029_joint_letter_to_the_european_commission_re_mandatory_nutri-score.pdf.

Today, F. (2018). Nutri-score label to appear on supermarket products. http://www.flanderstoday.eu/nutri-score-label-appear-supermarket-products.

Turner, M. M., Skubisz, C., Pandya, S. P., Silverman, M., & Austin, L. L. (2014). Predicting visual attention to nutrition information on food products: The influence of motivation and ability. *Journal of Health Communication, 19*(9), 1017–1029. https://doi.org/10.1080/10810730.2013.864726

Underwood, R. L., & Klein, N. M. (2002). Packaging as brand communication: Effects of product pictures on consumer responses to the package and brand. *Journal of Marketing Theory and Practice, 10*(4), 58–68.

Van Herpen, E., Seiss, E., & Van Trijp, H. C. M. (2012). The role of familiarity in front-of-pack label evaluation and use: A comparison between the United Kingdom and The Netherlands. *Food Quality and Preference, 26*(1), 22–34. https://doi.org/10.1016/j.foodqual.2012.03.003

Van Kleef, E., & Dagevos, H. (2015). The growing role of front-of-pack nutrition profile labeling: A consumer perspective on key issues and controversies. *Critical Reviews in Food Science and Nutrition, 55*(3). https://doi.org/10.1080/10408398.2011.653018

Vlaams Instituut Gezond Leven. (2018). Zijn kant-en-klare maaltijden gezond?. https://www.gezondleven.be/nieuws/zijn-kant-en-klare-maaltijden-gezond.

Vyth, E. L., Steenhuis, I. H. M., Roodenburg, A. J. C., Brug, J., & Seidell, J. C. (2010). Front-of-pack nutrition label stimulates healthier product development: A quantitative analysis. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), 65. https://doi.org/10.1186/1479-5868-7-65

Wardle, J., Parmenter, K., & Waller, J. (2000). Nutrition knowledge and food intake. *Appetite, 34*(3), 269–275. https://doi.org/10.1006/appe.2000.0314

World Health Organization. (2004). Global strategy on diet, physical activity and health. https://www.who.int/dietphysicalactivity/strategy/eb11344/strategy_english_web.pdf.

World Health Organization. (2017a). 10 facts on obesity. Retrieved from https://www.who.int/features/factfiles/obesity/en/.

World Health Organization. (2017b). France becomes one of the first countries in Region to recommend colour-coded front-of-pack nutrition labelling system. Retrieved from http://www.euro.who.int/en/countries/france/news/news/2017/03/france-becomes-one-of-the-first-countries-in-region-to-recommend-colour-coded-front-of-pack-nutrition-labelling-system.

World Health Organization. (2018). New report on front-of-pack nutrition labelling identifies what works better for consumers. Retrieved from http://www.euro.who.int/en/data-and-evidence/news/news/2018/10/new-report-on-front-of-pack-nutrition-labelling-identifies-what-works-better-for-consumers.

Zhao, X., Lynch, J. G., Jr., & Chen, Q. (2010). Reconsidering baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research, 37*(2), 197–206. https://doi.org/10.1086/651257