A front-of-pack nutrition logo: A quantitative and qualitative process evaluation in the Netherlands

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Abstract

Introduction: This study aimed to perform a quantitative and qualitative process evaluation of the introduction of the Choices logo, a front-of-pack nutrition logo on products with a favorable product composition, adopted by many food producers, retail and food service organizations, conditionally endorsed by the Dutch government, validated by scientists, and in the process of international dissemination.

Methods: An online questionnaire was sent to adult consumers four months after the introduction of the logo (n=1032) and one year later (n=1127). Additionally, seven consumer focus groups (n=41) were conducted to provide more insight into the questionnaire responses.

Results: Quantitative analyses showed that exposure to the logo had significantly increased. Elderly and obese reported to be more in need of a logo than younger and normal-weight respondents. Women perceived the logo more attractive and credible than men did. Further qualitative analyses indicated that the logo’s credibility would improve if it became known that governmental and scientific authorities support it. Elderly indicated to need a logo due to health concerns. Consumers interested in health reported that they used the logo.

Conclusions: Further research focusing on specific target groups, forming healthful diets and health outcomes is needed to investigate the effectiveness of the Choices logo.
Introduction

The prevalence of chronic diseases related to diet, such as cardiovascular disease, cancer, obesity and diabetes, is increasing (1). In order to diminish this prevalence, the World Health Organization has recommended that consumers reduce their intake of sodium, sugar, saturated fatty acids and trans fatty acids (2). A front-of-pack nutrition logo on products that contain lower levels of these nutrients as compared to similar products within the same product category could help consumers to make healthy choices, thereby possibly reducing the intake of these nutrients. In addition, such a logo might stimulate food manufacturers to improve their product composition (3-6).

The traditional Nutrient Facts Panel on the back of packaged food products provides extensive information about product composition, expressed in relative and absolute quantification of nutrients. However, many studies show that consumers have difficulties interpreting these food labels, especially older consumers and consumers with lower levels of education and income (7-9). Therefore, a simple front-of-pack nutrition logo that provides an overall representation of the key nutrient composition of a product could help consumers to choose products with a more favorable product composition (3, 10). Interpreting such a logo does not require detailed nutritional knowledge and thus could be useful for all consumer groups.

In order to help consumers to interpret the traditional nutrient fact box, many countries have developed their own front-of-pack nutrition labels. These labels differ in design and complexity. Complex labels can be found in the United Kingdom, such as the Guideline Daily Amount (GDA) and the Multiple Traffic Light system (11, 12). Both labels provide extensive information per nutrient relatively to the average recommended daily intake, and do not provide an integrative assessment of a combination of nutrients. Additionally, simpler logos exist, that serve as a “health quality mark” and are only present on products with a relatively favorable nutrient composition. The European Heart Network has published an overview of current “health quality marks” that are available globally (5). It shows that the product criteria and the authorities responsible for the introduction of different nutrition logos differ per country and even within an individual country, which may be confusing for consumers. In Sweden, the Swedish National Food Administration introduced the Green Keyhole in 1989, a nutrition logo on low-fat and high-fiber products. Research showed that the majority of the respondents understood its message. However, certain sub-groups had difficulties linking the meaning of the symbol to a healthy diet (13). In Finland, the Finnish Heart Foundation developed the Heart Symbol, a nutrition logo for products with low levels of fat and salt (14). Five years after its introduction, 82% of the adult population recognized the logo, and 42% of the adult population indicated that the logo had influenced their purchases (5). In Denmark, a logo on low fat products has been introduced. They intend to extend this logo with other nutrient criteria. In Canada, the Heart and Stroke Foundation developed the Health Check Symbol, based on their national nutrient criteria. In Australia and New Zealand, the respective Heart Foundations created the Pick the Tick logo, based on national criteria for fat, salt, energy, fiber and added sugar. Research showed that the Pick the Tick logo seemed to act both as a “nutrient signpost” for consumers, and to significantly influence product formulation (5, 6, 15). In the United States, a group of the largest food companies recently introduced the Smart Choices logo. The cri-
teria are derived from the national dietary guidelines. In the Netherlands, there are currently two of such nutrient sign post logos in use. One logo, the Healthy Choice Clover, is the initiative of the largest national supermarket chain and can only be found on the own brands in that chain’s stores. The other logo is the Choices logo ("Ik Kies Bewust" logo, see Figure 1), introduced by a collaboration of different stakeholders, which can be found on a variety of brands in many supermarket chains and in many food service locations. The criteria of the Choices logo are based on international recommendations by the World Health Organization regarding saturated fatty acids, trans fatty acids, sodium and added sugar (16). The Choices nutrition logo has distinguished itself from other nutrition logos. One reason for this is that the logo is not supported by a single authority, but by a foundation of food manufacturers, retail and food service organizations, the Netherlands Nutrition Center, nutrition scientists, and conditionally endorsed by the Dutch Government. The other reason is that it is the only nutrition logo for which criteria were developed and are continuously monitored by an independent scientific committee of nutrition and food scientists. The logo is assigned to products that have a more favorable nutrient composition than alternatives within the same product category. Thereby the logo should stimulate consumers to make well considered food choices. However, no evaluation research among consumers has been published since the introduction of the Choices logo in the Netherlands. Therefore, the aim of this study was to perform a quantitative and qualitative process evaluation of the introduction of the Choices logo in the Netherlands.

**Methods**

**Design**

Primarily, a quantitative process evaluation was performed via an online questionnaire that was completed four months after the introduction of the Choices logo, just before the first public advertisement campaign, and again one year later. To provide more in-depth insight into the perception of the Choices logo among consumers, an additional qualitative study was performed by means of seven focus group interviews after the second online questionnaire using different participants.

**The Choices logo**

The Choices logo is assigned to products with relatively low levels of saturated fatty acids, trans fatty acids, sodium and added sugar within their product category. Additionally, fibers and calories are taken into consideration. The Choices logo should facilitate consumers to make a favorable choice within each product category and should stimulate product innovation towards healthier products. Six main product categories have been defined that substantially contribute to the daily intake of es-
essential nutrients: vegetables and fruits, sources of carbohydrates, sources of proteins (meat, fish, eggs and meat substitutes), dairy products, oils and fats, and ready-to-eat dishes. Additionally, four categories were identified which provide fewer essential nutrients but are consumed regularly and are consequently of interest for product innovation: soups, sauces, snacks and beverages. Although the logo is open for all food manufacturers, not all producers have joined the foundation. In June 2008, over 100 food manufacturers have joined the foundation, and the logo has been assigned to around 2100 packaged products and 600 fresh fruits and vegetables. Mass media was developed to communicate the meaning of the Choices logo to consumers. Currently, the Choices International Foundation has secured the endorsement of local authorities, scientists, non-governmental organizations and industry to support the logo in 9 countries.

**Participants**

Participants were recruited via existing adult consumer panels, from a pool of 20,000 Dutch consumers willing to participate in market research. An online questionnaire was sent to a random sample of around 1400 consumers at two periods of time: four months after the introduction of the Choices logo (T0) and again one year later (T1). For T1, another sample of participants was recruited than for T0. At both times, participants consisted of representative samples of Dutch shoppers by age, region, size of household and size of residence. Inclusion criteria were age (>18 years old) and buying products in a supermarket at least once a week. Within a household, the person visiting a supermarket most often per week was asked to fill in the questionnaire. A total of 1032 respondents completed the questionnaire at T0 (response rate 61%) and 1127 respondents completed it at T1 (response rate 78%). Participants received some credits which could be exchanged for a gift coupon. Additionally, seven focus group interviews (n=41) were conducted at T1. Participants were recruited through community centers, cultural centers, sports clubs, and supermarkets. Inclusion criteria were age (>18 years old) and buying products in a supermarket at least once a week. All focus groups included both men and women.

**Conceptual framework**

The Choices nutrition logo aims to help consumers to make healthy choices and change their food selection behavior. McGuire's Communication Persuasion Model is frequently used to describe behavioral change (17). This model describes successive steps that have to be followed before successful communication and the consequent behavioral change can occur: exposure, attention, liking, comprehension, cognitive elaboration, skill, acquisition, agreement, memory storage, retrieval, decision making, acting on a decision, cognitive consolidation and proselytizing. In the current process evaluation, the first steps of successful communication were included: exposure, attention, liking and comprehension. Additionally, other relevant concepts were examined, in agreement with other process evaluation studies (18-21). Concepts included were whether consumers felt they needed a logo, the credibility of the logo, and self-reported effects on purchasing behavior.

**Questionnaire / Focus groups**

All respondents provided information about background variables, such as age, gen-
der, body weight, height and level of education. Further, exposure to the Choices logo was measured by asking whether respondents were familiar with the logo or not (response categories 0= “no” or 1= “yes”) and the perceived need for a logo (response categories ranging from 1= “totally not needed” to 5= “strongly needed”) was measured both at T0 and T1. On basis of reported body weight and height data, the Body Mass Index (BMI) was calculated (kg/m²). Educational level was divided into three categories: a low educational level (primary school or basic vocational education), a medium level (secondary vocational education or high-school degree) or a high educational level (higher vocational education or university degree). Only at T1, further questions about the logo were asked to respondents who indicated being exposed to the logo at that time (n=996), all measured with a five-point Likert scale. Attention and purchasing behavior were measured by asking how often respondents paid attention to or bought products with the logo (response categories ranging from 1= “never” to 5= “always”). Further, respondents were asked to what extent they agreed that the logo is attractive, eye-catching and useful (liking), and credible (credibility) (response categories ranging from 1= “totally disagree” to 5= “totally agree”).

For the analyses at T1, BMI was divided into three categories: BMI<25 (healthy body weight), BMI 25-30 (overweight) and BMI>30 (obese). Age was divided into two categories: <50 years old and >50 years old.

Table 1 shows the main interview topics discussed in the focus groups. The same concepts that were measured in the quantitative study were discussed, with the addition of comprehension, because qualitative research was supposed to provide the most accurate insight into how the logo was understood. The seven focus groups were conducted by a three-member project team (EV, SM, ZM). The moderators (EV, SM) used moderation techniques developed by Morgan and Krueger (22).

<table>
<thead>
<tr>
<th>Interview topic</th>
<th>Main aspects to discuss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td>Familiarity with the Choices logo</td>
</tr>
<tr>
<td></td>
<td>Places where the logo has been seen</td>
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<tr>
<td>Need</td>
<td>Feeling a need for a nutrition logo</td>
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<tr>
<td>Attention</td>
<td>Attention to nutrition logos in the supermarket</td>
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<tr>
<td></td>
<td>Attention to the Choices logo in the supermarket</td>
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<tr>
<td>Liking</td>
<td>Attractiveness of the Choices logo</td>
</tr>
<tr>
<td></td>
<td>Design of the Choices logo: colors, size, and format</td>
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<tr>
<td></td>
<td>Eye-catchingness of the Choices logo</td>
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<tr>
<td>Comprehension</td>
<td>Meaning of the Choices logo</td>
</tr>
<tr>
<td></td>
<td>Criteria of the Choices logo</td>
</tr>
<tr>
<td>Credibility</td>
<td>Credibility of the Choices logo</td>
</tr>
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<td></td>
<td>Supporting authority for the Choices logo</td>
</tr>
<tr>
<td></td>
<td>Importance of support by an independent authority</td>
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<tr>
<td>Purchasing behavior</td>
<td>Buying products with the Choices logo due to the logo</td>
</tr>
<tr>
<td></td>
<td>Intention to buy (more) products with the Choices logo</td>
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</table>

Table 1. Main interview topics discussed during focus group discussions.
moderator per focus group guided the interview, and two independent observers asked participants to explain any unclear statements, in order to acquire more complete data. Participants completed a brief demographic questionnaire at the beginning of the interview. At first, participants were asked to briefly discuss their opinions about nutrition information in the supermarket in general. Next, the Choices nutrition logo was introduced and the concepts mentioned before were discussed. Products from different product categories with the nutrition logo were used to illustrate the discussion topics. After the interview, participants received a small gift for participation.

Analyses
Descriptive analyses were used to report the demographic variables of the participants. The χ² test and t test were used to test for differences in exposure and need between T0 and T1. For the next analyses at T1, associations between demographic variables (gender, educational level, BMI and age) and exposure to the logo were analyzed using multiple logistic regression analyses (exposure to the logo dichotomous). The results are presented as odds ratios (OR) with 95% confidence intervals (CI). Univariate analysis tests (t tests, ANOVA) were used to examine significant differences in need, attention, liking, credibility and reported purchasing behavior between subgroups, based on gender, educational level, BMI and age. Bonferroni adjustment for multiple comparisons was applied. Statistical analyses were performed by the SPSS 15.0 statistical package (SPSS, 2006), using a significance level of 0.05.

Responses from each focus group were recorded and transcribed verbatim. Transcripts were analyzed deductively using the “Framework approach” (23). Codes were based on the concepts mentioned before. Data analyses were conducted by the three project members. The different analyses were systematically compared, and combined into one analysis. Data were analyzed using Atlas.ti 5.2.

Results
The quantitative research population consisted of 1032 participants at T0 and 1127 at T1, the majority of whom were women (80.8 % and 86.5 %, respectively). At T0, mean age (±SD) was 46.4 (±13.2) years old and mean BMI (± SD) was 25.6 (± 5.1) kg/m2. At T1, mean age (±SD) was 49.1 (±15.0) years old and mean BMI (± SD) was 25.4 (± 4.5) kg/m2. At both T0 en T1, men were significantly higher educated than women (P < 0.01). Also, men were significantly higher educated at T1 than at T0 (P < 0.01). Further, no significant differences were detected.

A total of 41 consumers (16 men, 25 women) participated in the focus group interviews. The mean age was 46 years old (range 20-83). The mean BMI was 23.0 kg/m² (range 17.7-27.7). Participants reported that they visit a supermarket three times a week on average. Seven participants had a low educational level, 12 participants had a medium educational level and 22 participants had a high educational level.

The exposure to the logo had significantly increased in one year: at T0, 33.4% of the population was familiar with the logo, compared to 88.4% at T1 (P<0.01). The mean score for need for a logo (±SD) was 3.67 (± 3.94) at T0 and 3.44 (± 0.90) at T1, a significant decrease (diff. = 0.23, 95% CI: 0.15; 0.30, P<0.01). Table 2 shows the associations between demographic variables and exposure for all respondents at T1 (n=1127). Men were less exposed than women, both before and after adjustment for
2. Process evaluation

Further, logistic regression analyses showed that respondents more than 50 years old were less exposed to the logo than younger respondents, both before and after adjustment for gender, educational level and BMI (P<0.01). In general, participants of the focus groups stated to be familiar with the Choices logo at T1. The logo had been noticed on food products in supermarkets and in a television commercial. Other communication promoting the Choices logo, such as posters or flyers, seemed to be unknown among the participants. Older participants, especially men, indicated that they were not familiar with the logo. The reasons they mentioned for this were that they were not interested in on-package nutrition information, or that the logo had not yet attracted their attention.

The older age group was the group that reported to be in greater need of a logo than respondents less than 50 years old in the quantitative study at T1 (diff. = 0.20; 95% CI: 0.09; 0.30, P<0.01). Obese respondents reported to be in greater need of a logo than those with a healthy body weight (diff. = 0.23; 95% CI: 0.03; 0.44; P<0.05) at T1. The reason why some participants of the focus groups mentioned to feel a need for a nutrition logo was because of diet-related health problems, such as diabetes or cardiovascular disease. Older participants especially indicated that they were suffering from these types of diseases. A comprehensible nutrition logo could help them to make the right food choices regarding their health:

*A good, visible nutrition logo makes it easy to make the right food choice for my heart.*

The explanation given why participants felt they did not need a nutrition logo was that they did not understand the advantages of a new logo in addition to the overwhelming number of quality logo’s currently in use, such as health, safety, organic and ecological logos.

Respondents of the focus groups came up with educational level, BMI and age (P<0.01).
many different explanations for the meaning of the Choices logo. The explanations frequently mentioned could be related to product quality, such as: healthy product, safe product, natural product or organic product. More detailed explanations mentioned could be linked to a healthy product composition: less fat, less sugar, good mix of ingredients or fewer calories. However, not all respondents were able to explain the meaning of the logo completely. The diversity of product categories carrying the logo appeared to be somewhat confusing: fresh vegetables, snacks, dressings, soups, dairy products.

How do they put the same logo on fresh vegetables and snacks?

Table 3 shows mean scores (±SD) for respondents of the quantitative study who

Table 3. Mean scores (± SD) (range 1-5) of subgroups exposed to the logo at T1. Only significant differences are listed.

Note: BMI not significant, thus not shown.

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<th></th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>Age&lt;50</th>
<th>Age&gt;50</th>
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<tbody>
<tr>
<td></td>
<td>(n=996)</td>
<td>(n=124)</td>
<td>(n=872)</td>
<td>(n=312)</td>
<td>(n=407)</td>
<td>(n=277)</td>
<td>(n=577)</td>
<td>(n=419)</td>
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<tr>
<td>Attention (1-5)</td>
<td>2.60</td>
<td>2.71</td>
<td>2.45**</td>
<td>2.53</td>
<td>2.71**</td>
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<td>(±1.02)</td>
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<td>(±1.06)</td>
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<tr>
<td>Attractiveness (1-5)</td>
<td>3.80</td>
<td>3.60</td>
<td>3.83**</td>
<td>3.88**</td>
<td>3.84**</td>
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<td></td>
<td>(±0.99)</td>
<td>(±1.01)</td>
<td>(±0.88)</td>
<td>(±0.85)</td>
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<tr>
<td>Eye-catchingness (1-5)</td>
<td>3.72</td>
<td>3.54</td>
<td>3.74*</td>
<td>3.81</td>
<td>3.62**</td>
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<td></td>
<td>(±0.96)</td>
<td>(±0.95)</td>
<td>(±0.96)</td>
<td>(±0.92)</td>
<td>(±0.95)</td>
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<tr>
<td>Usefulness (1-5)</td>
<td>3.42</td>
<td>3.49</td>
<td>3.79**</td>
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<td></td>
<td>(±1.06)</td>
<td>(±1.06)</td>
<td>(±0.97)</td>
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<tr>
<td>Credibility (1-5)</td>
<td>3.75</td>
<td>3.49</td>
<td>3.79**</td>
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<td></td>
<td>(±0.99)</td>
<td>(±1.06)</td>
<td>(±0.97)</td>
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<tr>
<td>Reported purchasing behavior (1-5)</td>
<td>2.75</td>
<td>2.53</td>
<td>2.79**</td>
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<td></td>
<td>(±0.98)</td>
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*P < 0.05       **P < 0.01
were exposed to the logo at T1 (n=996). The table lists significant relationships only. The mean score for **attention** was 2.60 (±1.02), with respondents with a low educational level paying more attention to the logo than respondents with a high educational level (diff. = 0.25, 95% CI: 0.05; 0.45, P<0.01). Also, respondents who were more than 50 years old reported that they paid more attention to the logo than younger respondents (diff. = 0.18, 95% CI: 0.06; 0.31, P<0.01). In the qualitative study, it appeared that especially female participants who were interested in health paid attention to the Choices logo. They indicated that they compared the composition of the products with and without a logo in order to make a healthy choice. Possible explanations for not paying attention to the logo were unfamiliarity, habitual behavior or lack of time:

*I run through the supermarket like a race car and buy what I see at first sight.*

The quantitative analyses showed that women liked the logo more than men: they perceived the logo as being more attractive (diff. = 0.23, 95% CI: 0.06; 0.40, P<0.01) and eye-catching (diff. = 0.20, 95% CI: 0.02; 0.38, P<0.05) than men did. Respondents with a medium and high educational level perceived the logo as being more attractive than respondents with a low educational level (diff. = 0.23, 95% CI: 0.07; 0.39, P<0.01 and diff. = 0.18, 95% CI: 0.01; 0.36, P<0.05, respectively). Further, respondents with a medium educational level perceived the logo to be more eye-catching than highly educated respondents (diff. = 0.18, 95% CI: 0.00; 0.36, P<0.05). Female respondents of the focus groups especially indicated to like the logo:

*It is fresh and sparkling, and because of the orange, it looks fruity.*

Men appeared to be somewhat indifferent to it. The criticisms mentioned were related to the design of the logo: its colors, size and location differ among products, and some respondents considered the logo to be far too small, and dominated by the other colors on the package.

The mean score for **credibility** was 3.75 (±0.99), with women perceiving the logo as being more credible than men (diff. = 0.30, 95% CI: 0.11; 0.48, P<0.01). Factors that may contribute to the logo’s credibility, according to the focus groups, were that the logo is perceived to be supported by independent authorities, such as the Netherlands Nutrition Center, the Dutch government, the Food and Consumer Product Safety Authority, or the European Union. Factors that might negatively influence the logo’s credibility were that participants had the impression that the logo is only present on high-quality brands of processed foods and the perception that the food industry had developed the logo only for its own benefit:

*It seems to be one of those marketing stunts!*
cated that they do not intentionally buy products with a logo, because their purchasing decisions appeared to be generally guided by a familiar brand or a low price.

**Discussion**

This study aimed to perform a quantitative and qualitative process evaluation of the introduction of the Choices logo, a front-of-pack nutrition logo on products with a favorable product composition. The exposure to the Choices logo had increased significantly after one year. This could partly be explained by communication campaigns which started during the year and by the increased visibility of the logo in supermarkets and in other public places, due to an increasing number of participating organizations. However, the qualitative study indicated that the logo’s meaning appeared to be not totally clear to some consumers. These findings are in agreement with a review of the Pick the Tick logo used in Australia and New Zealand (15), that shows that it takes some years of communication before a real understanding of the meaning of a nutrition logo can be created. Nevertheless, the finding that the majority of consumers was familiar with the Choices logo only 1.5 year after its introduction can be considered as a major achievement for the introduction of a new brand.

We found several significant differences in need, attention, liking, credibility and reported purchasing behavior between subgroups. Although these were rather minor differences, they indicate interesting trends which require further investigation.

We found that especially elderly and obese people expressed the need for a logo. The older adults generally have a higher chance of suffering from diet-related health problems, such as diabetes or cardiovascular disease, and therefore demonstrate a higher need for a health related logo (4, 11, 24), which has been supported by our findings as well. The older age group was also the same group that appeared to be less familiar with the Choices nutrition logo than younger respondents, although a large majority of the elderly still appeared to be familiar with the logo. Nevertheless, on-package nutrition information, such as a nutrition logo, might be too small to be noticed by the elderly (25). This factor stresses the importance of a good, visible design, a logo that is uniform in terms of size, location and colors, as previously recommended in the literature (3, 9, 25, 26). Further, obese people might be particularly sensitive to nutrition information that could help them to lose body weight (13), explaining their increased need and substantial familiarity with the Choices logo. To our knowledge, there are hardly studies that focus on the perception of nutrition logos by specific target groups, such as the elderly or obese people, thus forming a challenge for further research and communication campaigns.

Respondents with a low educational level reported paying more attention to the logo than more highly educated respondents. As many studies have indicated the difficulty of communicating nutrition education to people with lower levels of education (27, 28), this finding could be valuable and should be investigated in further research. The qualitative findings that habitual purchasing behavior and time pressure play a role in whether or not consumers are paying attention to the logo are in agreement with other studies (4, 24, 26, 29) and could also be of interest for further research regarding the Choices logo.

The mean score for the credibility of the logo was rather high. Nevertheless, our qualitative study indicated that the authority supporting the logo was not totally clear
to consumers, resulting in mixed feelings regarding the logo’s trustworthiness. The literature shows that consumers’ trust in nutrition information on food labels would increase if there is “a clear trustworthy sender” (4, 9, 26, 30). Health professionals, scientists and independent (consumer) organizations are the most trusted information sources for nutrition information, whereas industry is usually perceived as less trustworthy (21, 31). This emphasizes the importance of correcting the potential misconception that the Choices nutrition logo is supported only by industry.

Women liked the logo more than men, and women also reported to buy more products with the Choices logo than men. These findings are not surprising: women are generally more interested in health, food and nutrition information than men (4, 8, 11, 24, 30). Currently, the Choices logo seems to mainly play a role in the reported purchasing behavior among people who are interested in health. It is important to realize this, as the Choices logo aims to stimulate a favorable eating pattern among all consumers. However, one should realize that behavior change is a complex process, and a nutrition logo could be one of the factors that might influence behavior change. Further, one could question whether reported purchasing behavior correctly reflects actual label use, as discussed in earlier research (32). Yet there is a lack of studies investigating the role of nutrition logos in guiding buying decisions in real-life settings, such as supermarkets or other places outside the home (4, 9, 15, 29, 33), offering challenges for further research on the actual label use of the Choices logo. Additionally, the possible stimulating effect of the logo on product development towards healthier products could be interesting to investigate. The increased availability of healthy products could be favorable for the dietary pattern of all consumers, including those consumers not interested in health.

A limitation of this study could be the possibility that people who are interested in nutrition research were more willing to participate in both the quantitative and the qualitative study. Also, one could question whether participants were inclined to give socially desirable answers (34). Therefore, one should be careful when extrapolating the results to the general population. Nevertheless, this unique combination of quantitative and qualitative analyses provides initial insights into the perception of the Choices nutrition logo among consumers, which are used to formulate useful recommendations for further research and communication regarding the logo.

Conclusions
Consumers’ exposure to the Choices logo has increased significantly in one year. To further increase consumer’s comprehension and use of the logo, product criteria and the support provided by independent authorities should be clarified more extensively. Further research focusing on specific target groups, on actual food choice and on health outcomes of consumption of Choices products is needed to investigate the effectiveness of the Choices logo in real-life settings.

Conflicts of interest and authors’ affiliations
Gerda Feunekes works at the Unilever Food and Health Research Institute, one of the participating food companies in the Choices programme. Léon Jansen is secretary of the International Scientific Committee of the Choices International Foundation and works at Schuttelaar & Partners, a consultancy firm that operates as the Foundation’s Secretariat.
Hans Verhagen works at the RIVM and was requested by the Dutch Ministry of Health, Welfare and Sports (MinVWS) to actively participate in the project group in order to assure agreement on the quality, however leaving the responsibility for the project with the Choices Foundation; the RIVM is an agency of the MinVWS. The other authors have no conflicts of interest. Marcel Temminghoff is employed by GfK Panel Services Benelux B.V., the Netherlands. Johannes Brug is employed by the Department of Epidemiology and Biostatistics, EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, the Netherlands. The other authors are employed by the Department of Health Sciences and the EMGO Institute for Health and Care Research, VU University Amsterdam, the Netherlands.

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