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Research Report

Front-of-pack nutrition labelling: Testing effectiveness of different nutrition labelling formats front-of-pack in four European countries

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Abstract

In two studies, the impact of eight front-of-pack nutrition labelling formats that differed in complexity was investigated across four European countries. In total 1630 men and women (18–55 yrs) were recruited from Internet panels in the United Kingdom, Germany, Italy and the Netherlands for study 1 and 776 in Italy and the United Kingdom for study 2. Participants evaluated several products (healthier and less healthy variants of the same product category) with a front-of-pack nutrition labelling format. The first study evaluated different labelling formats on consumer friendliness (comprehension, liking and credibility) and the second study measured the effect of the different labelling formats on decision-making (usage intention and process time). The results indicated minor differences in consumer friendliness and usage intention between simpler (such as *Healthier Choice Tick*, *Smileys* and *Stars*) and more complex front-of-pack nutrition labelling formats (such as *Multiple Traffic Light*, *Wheel of Health* and *GDA scores*). Endorsement by national and international health organisations strongly increased the labelling formats' credibility. Participants needed significantly less time to evaluate simpler front-of-pack labelling compared to the more complex labelling format. Thus simpler front-of-pack labelling formats seem more appropriate in a shopping environment where quick decisions are made.

Keywords: Labelling; Food choice; Public health; Behavioural change; Comprehension; Intention; Nutrition; Logo

Introduction

There is robust evidence that dietary factors are related to the development of chronic diseases such as heart disease, stroke, obesity and diabetes (Astrup, 2001; Joint FAO/WHO Expert Consultation, 2003; Kromhout, Menotti, Kesteloot, & Sans, 2002). The World Health Organization has recommended that food manufactures reduce levels of saturated fatty acids, trans fatty acids, sodium and sugar in their products in order to reduce the burden of chronic diseases on society (WHO, 2004). One way to help consumers reduce the intake of these nutrients is to improve the product composition; another is to motivate consumers to make healthier choices. Both should be done simultaneously. Therefore, in addition to enhancing the nutritional profile of products using the Unilever Nutrition Enhancement Programme score (Nijman et al., 2007), we investigated the effectiveness of front-of-pack nutrition labelling formats that would help consumers make healthier choices and that could be used across different countries.

In order to make healthier choices, consumers must be able to distinguish healthier products from less healthy ones. This can be done by making the nutritional composition of foods transparent in the form of nutrition labels, either in the form of front-of-pack or back-of-pack nutritional information. A front-of-pack logo in addition to the traditional numerical nutrition fact box on the back of the pack may be more effective in helping consumers make a healthy choice than back-of-pack nutritional information alone (Geiger, Wyse, Parent, & Hansen, 1991; Scott & Worsley, 1994). However, research on nutrition labelling formats is relatively scarce and the

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majority has investigated back-of-pack nutrition labelling formats and is qualitative in nature (see for example Cowburn & Stockley, 2005; Higginson, Rayner, Draper, & Kirk, 2002). Furthermore, only a small part of that research has investigated the effect of different formats on behavioural change (see Scott & Worsley, 1994, for an exception). Therefore, the objective of the research reported in this paper was to investigate how well a number of front-of-pack nutrition labelling formats were understood by consumers and how effective they could be in helping consumers make healthier choices.

Although back-of-pack nutrition labels were designed to help consumers make healthier choices (Jordan Lin, Lee, & Yen, 2004; Kurtzweil, 1993), research conducted in Europe, the US and Australia/New Zealand suggests that the majority of consumers find back-of pack nutrition labels confusing, especially the numerical information and the terminology used (Byrd-Bredbenner, Wong, & Cotte, 2000; Cowburn & Stockley, 2005; EUFIC, 2005; Sadler, 1999; Scott & Worsley, 1997; Shannon, 1994; Shine, O'Reilly, & O'Sullivan, 1997; Wandel, 1999). Cowburn and Stockley (2005) reviewed the literature on nutrition labelling formats and concluded that in particular vulnerable groups such as older consumers and consumers with lower levels of education and income are likely to have difficulties in understanding nutrition labels. Their review also showed that consumers had difficulty converting information from 'g per 100 g' to 'g per serving' and interpreting serving size information. Results from a study by Vijwanathan and Hastak (2002) suggested that adding some kind of benchmark (e.g., as a percentage of the recommended daily intake) can help consumers put nutritional information into context.

In order to make healthier choices consumers have to take into account several nutrients simultaneously. A study by Black and Rayner (1992) showed that consumers find it difficult to make these comparisons. To simplify their task, consumers tended to use a single nutrient (like fat) as a measure to compare products on overall health. This may lead consumers to make the wrong choice—products low in fat could well be high in other nutrients, such as sugar or salt. A simple front-of-pack label that summarises the whole nutritional profile and provides an overall interpretation of the healthiness of the product should therefore facilitate and improve consumers' decision-making with regard to healthy foods. Furthermore, such a label would not require detailed nutritional knowledge. Another advantage of simple labels is that these reduce the cognitive effort and the time needed to process the information compared to more detailed labels (Geiger et al., 1991; Scott & Worsley, 1994). In a supermarket environment, consumers generally have limited opportunity to process information and their motivation to do this is likely to be low when shopping for groceries, resulting in relatively superficial processing of information (cf. Eagly & Chaiken, 1993; Fiske & Neuberg, 1990; Petty, Cacioppo, & Schumann, 1983). Research by Hoyer (1984) showed that consumers take buying decisions in a supermarket in seconds rather than minutes. Other findings support the idea that consumers only glance at nutrition information and do not further process the information at the point of purchase (Higginson et al., 2002; Scott & Worsley, 1997). In conclusion, the available research suggests that a front-of-pack label would facilitate making healthier choices by incorporating benchmark information that enables consumers to interpret the information and/or by providing an advice that includes an interpretation of the nutritional information.

Ever since the introduction of the traditional numerical nutrition fact box, different parties (retailers, manufactures, governmental and non-governmental organisations) have tried to design front-of-pack nutrition information labels that complement it and are easier to understand and use. These labels vary from complex detailed nutrition labels to simple symbols. Detailed nutrition labelling formats enable consumers to make an informed choice by providing information on key nutrients in a friendlier way compared to the traditional nutrition fact box. Simple symbols provide an *interpretation* of the healthiness of the overall product, thus reducing the processing load (Scott & Worsley, 1994).

Examples of more detailed labels are 'Guideline Daily Amounts (GDA)' and 'Wheel of Health'. GDA shows the amount in grams and percentages for calories, sugar, fat, saturates and salt per serving (Tesco, 2006). The 'Wheel of Health' is similar to the 'Multiple Traffic Light' label, which is recommended by the UK Food Standards Agency (FSA, 2005). It shows the amount of the five key nutrients energy, total fat, saturated fatty acids, sugar and salt in each serving. The nutrients can score green, amber or red, respectively, indicating "Go", "Ok" and "Think before you eat too much of this … although a little bit will never hurt"(Sainsbury, 2006). Note that neither the 'GDA' nor the 'Wheel of Health' provides an overall interpretation of the information.

Examples of simple symbols are the 'Green Keyhole' (Sweden; Kinnunen, 2000; Larsson, Lissner, & Wilhelmsen, 1999; Weinehall, Hellsten, Boman, & Hallmans, 2001), 'Shop Smart With Heart' (Canada; Kinnunen, 2000), 'Pick The Tick' (Australia and New Zealand; Kinnunen, 2000; Scott & Worsley, 1994; Young & Swinburn, 2002) and 'Smart Spot' (PepsiCo, 2006).

There is thus a multitude of front-of-pack labels that aim to help consumers make a healthier choice. The verdict is still out as to which of these labelling formats is best understood by consumers and which makes it easiest for consumers to make a healthier choice.

The aim of the first study was to evaluate the different front-of-pack nutrition labelling formats on their consumer friendliness and their ability to help consumers differentiate between healthier and less healthy variants of the same product category, to see whether the different labelling formats met the basic requirements. The aim of the second study was to investigate the effect of the labelling formats

on decision-making when taking into account the shopping environment.

In addition to our main research question, we investigated whether there were any significant differences in comprehension and intention to change behaviour across different countries. Furthermore, as research in the USA and New Zealand had shown that consumers with lower levels of overall education are less likely to read nutrition and ingredient information (Bender & Derby, 1992; Cowburn & Stockley, 2005; Scott & Worsley, 1994), we investigated differences in comprehension of the labels for consumers with different levels of education. The impact of endorsement on the credibility of a labelling format was also explored. Finally, we investigated whether participants thought the labelling formats indicated a comparison within one product category or across food groups.

Study one

Method

Participants

In total, 1630 participants from four European countries participated in this study, 316 participants from the United Kingdom, 447 participants from Germany, 430 participants from Italy and 437 participants from the Netherlands. These countries were selected on the basis of geographical distribution, size of the country and spread in food cultures. Consumer samples of each country were drawn from Internet panels of a market research agency (Survey Sampling International). To create representative samples, participants were selected by means of quota sampling (based on census figures) on gender, education and age (for the age range of 18–55 yrs) (Table 1). To correct for slight differences from the census figures, data were weighted for age, education and gender for each country.

Table 1
Socio-demographic characteristics of participants by country (study 1)

Demographics	%			
	UK ($n = 316$)	Germany ($n = 447$)	Italy ($n = 430$)	NL ($n = 437$)
Gender				
Male	48.6	48.2	48.1	49.7
Female	51.4	51.8	51.9	50.3
Education level				
Low[a]	39.9	18.9	51.8	36.3
Middle[b]	35.6	58.9	41.0	35.8
High[c]	24.5	22.1	7.3	27.9
Age				
18–24 years	19.5	18.7	19.2	14.8
25–34 years	26.2	24.8	27.6	25.2
35–44 years	28.9	30.3	28.3	31.6
45–55 years	25.4	26.2	24.9	28.4

[a]Up to primary school.
[b]Up to secondary school.
[c]Higher education/university.

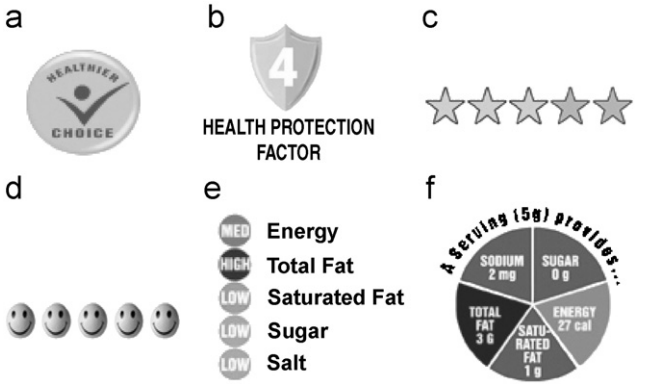

Fig. 1. The nutrition labelling formats used in study 1: (a) Healthier choice tick; (b) Health protection factor; (c) Stars; (d) Smileys; (e) Multiple traffic light; (f) Wheel of health.

Materials

Type of nutrition labelling format. The different nutrition labelling formats varied in complexity from the simple 'Healthier Choice Tick' to the more complex 'Wheel of Health' (Fig. 1a–1f). The simple formats provide a judgement about the total product and the more detailed formats provide a judgement per nutrient. The Healthier Choice Tick is a single tick used only on the healthier product variants, i.e., in contrast to the other labelling formats this labelling format is absent or present on a product. Three graded nutrition-labelling formats (Stars, Smileys and the Health Protection Factor) were included because it was hypothesised that familiarity with these systems from non-food categories might increase comprehension, credibility and liking. Stars is a well-known rating system awarded to restaurants and hotels. Smileys is a similar format with "smileys" instead of stars. The Health Protection Factor was derived from the system that is used on sunscreen lotions. Products could receive a number from 1 to 7, with higher numbers indicating a healthier product. The Multiple Traffic Light showed the five key nutrients (energy, total fat, saturated fatty acids, sugar and salt). Each nutrient can score low (green), medium (amber) or high (red) and this was indicated by colour and in text. The Wheel of Health, used by retailer Sainsbury (UK), provides the exact amount of the five key nutrients per serving in a pie-chart format, with each slice of the pie coloured green (low), amber (medium) or red (high), depending on the nutrient score.

Products. For three product categories a healthier variant and a less healthy variant of the same product category was selected by using the Unilever Nutrition Enhancement Programme score which is based on International Dietary Guidelines (Nijman et al., 2007). For dairy drinks, the healthier variant was 'low-fat milk' and the

less healthy variant 'low-fat fruit flavoured yoghurt drink'. For ice-cream, the healthier variant was 'real fruit covered ice-cream' and the less healthy variant 'chocolate covered ice-cream' and for spreads, the healthier variant was 'vegetable oil-based margarine' and the less healthy variant 'butter'. All products were presented unbranded.

Endorsements. Each endorsement was shown together with the Smileys format. The following endorsements were included: (a) a national nutrition organisation, (b) the World Health Organization, (c) the European Union and (d) European Food Manufacturers. Depending on the country the following national nutrition organisations were used, the 'British Dietetic Association', the German 'Deutsche Gesellschaft für Ernährungsforschung', the Italian 'Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione' and the Dutch 'Voedingscentrum'.

Procedure

The study was conducted on-line. Participants were randomly assigned to three out of the six nutrition labelling formats and each of these was presented for all three product categories. Each product category consisted of two products, a healthier and less healthy variant. The order of presentation of the nutrition labelling formats and product categories was randomised over participants, as was the presentation of the products on the left versus the right side of the screen.

Participants were exposed to nine pairs of pictures of products with a front-of-pack labelling format. An enlarged version of the nutrition labelling format was shown below the product. Note that the Healthier Choice Tick was only placed on the healthier variant within each pair. All labelling formats in this test were accompanied with the text that it was endorsed by the World Health Organization. A click button was located below each product enabling participants to see the standard back-of-pack nutrition fact box in a pop-up window. They then rated the front-of-pack nutrition labelling format on liking, comprehension, credibility and perceived healthiness for both products. When participants finished rating all nine product pairs they were asked to complete questions on demographics, health behaviours and attitudes, nutritional knowledge and the endorsements. Finally, participants were asked whether they thought the label indicated a comparison within one product category or across all food groups.

Measures

All questions employed 5-point Likert-type rating scales, unless otherwise indicated.

Consumer friendliness measures. Comprehension was measured by the question, 'How difficult or easy is it for you to understand this health indicator', with extremes 1 (*very difficult to understand*) and 5 (*very easy to understand*). Credibility was measured by the question, 'How credible is this health indicator to you', with extremes 1 (*not at all credible*) and 5 (*extremely credible*). Liking was measured by the question, 'How much do you like the health indicator on this product', with extremes 1 (*do not like it at all*) and 5 (*like it extremely*).

Perceived healthiness measure. Perceived healthiness of the product was measured by the question, 'How healthy is this product to you?' with extremes 1 (*not healthy at all*) and 5 (*very healthy*). The mean difference in perceived healthiness between the healthier and less healthy variants of the same product category for each labelling format was calculated. The size of this difference indicated to what extent the labelling formats helped consumers to differentiate between healthier and less healthy product variants.

Background variables. The background variables consisted of demographic variables, knowledge, behaviour and attitudinal variables regarding health and nutrition.

Demographics: Participants were asked about their age, gender, education level, income level, profession, marital status and household composition.

Nutritional knowledge: Perceived nutritional knowledge was measured with the item 'I am knowledgeable about health and nutrition issues', with extremes 1 (*strongly disagree*) and 5 (*strongly agree*). For the analyses scores 1 and 2 were recoded as *low*, score 3 as *middle* and scores 4 and 5 as *high*.

Perceived healthiness of diet: Perceived healthiness of diet was measured with the question, 'How would you describe your overall diet?', with extremes 1 (*excellent*) and 5 (*poor*). For the analyses scores 1 and 2 were recoded as *excellent*, score 3 as *average* and scores 4 and 5 as *poor*.

Label reading: Label reading was measured with the question, 'Do you read labels on food packages?', with extremes 1 (*always*) and 5 (*never*). For the analyses scores 1 and 2 were recoded as *always*, score 3 as *sometimes* and scores 4 and 5 as *never*.

Attitude towards healthy eating: Personal attitude towards healthy eating was measured with the question, 'Which one of the following statements do you think best describes your personal attitude towards healthy eating?'. Participants answered this question by choosing one of the following statements: 'Have to follow a special diet because of a specific health need', 'Eat a healthy diet because it helps keep me fit and well', 'Try to eat a healthy diet but find it hard to stick to' or 'Eat what I like and do not worry about how healthy it is'.

Participants were also asked: 'When comparing these products what were your assumptions?' and could tick one of the following options: 'I assumed the health indicators help me to compare ice-cream with ice-cream, spreads with spreads, and drinks with drinks', '(…) help me to make choices across all foods' or 'I did not think about it really'.

Design and statistical analyses

A 6 (Labelling Format: Healthier Choice Tick, Health Protection Factor, Smileys, Stars, Multiple Traffic Light, Wheel of Health) × 3 (Product category: Dairy drink, Ice-cream, Spreads) × 2 (Healthiness of product: Healthier product, Less healthy product) within subject factorial design was used with Countries as a between subjects variable (UK, Germany, Italy, The Netherlands). Each cell contained approximately 160 participants. These mixed model ANOVAs were performed as not all participants saw all nutrition labelling formats. The alpha level was set at 0.01. Differences between groups were analysed using Tukey–Kramer pair-wise comparisons. Significance was assessed with alpha set at 0.01. Pre-analyses revealed normal distribution of each variable. All background variables were included as independent variables in the analyses for comprehension and perceived healthiness.

Results

Impact of nutrition labelling format on perceived consumer friendliness (study 1)

Comprehension of formats. On average, participants found all nutrition labelling formats easy to understand, with means ranging from 3.4 to 4.0 on a 5-point scale (Table 2). Main effects were found for Format and for Country. Overall, the differences, although significant, were small. The Health Protection Factor scored significantly lower than the other five formats. The Multiple Traffic Light, followed by Stars and Smileys scored highest on comprehension, $p<0.01$. Furthermore, Dutch participants reported a slightly better understanding of the formats compared to participants from the UK, Germany and Italy, $p<0.01$. The interaction between Country and Format was also significant. In contrast to the other countries, in the Netherlands and Italy the Health Protection Factor did not score significantly lower than the other formats (Table 2).

Credibility of formats. On average, participants found the formats reasonably credible, with means ranging from 2.9 to 3.5 on a 5-point scale (Table 2). Main effects were found for Format and for Country. The Wheel of Health and Multiple Traffic Light were perceived as most credible and the Health Protection Factor as least credible, $p<0.01$. Participants from the UK and Italy found the formats somewhat more credible compared to Dutch and German participants, $p<0.01$. The interaction between Format and Country was also significant. In the Netherlands and Italy, the Health Protection Factor was perceived to be as credible as the Healthier Choice Tick, Smileys and Stars, but this was not the case in the UK and Germany.

Liking of formats. On average, participants reasonably liked the formats, with means ranging from 2.8 to 3.4 on a 5-point scale (Table 2). Main effects were found for Format and for Country. Participants liked the Multiple Traffic Light and Wheel of Health the most, $p<0.01$. The Health Protection Factor, followed by Stars and Smileys were liked the least, $p<0.01$. Participants from the UK and Italy liked the formats the most and Dutch participants liked the formats the least, $p<0.01$. Furthermore, the interaction between Format and Country was also significant. Participants from the UK liked the Multiple Traffic Light more than the Wheel of Health, $p<0.01$, but this difference was not found in other countries.

Impact of background variables on comprehension of the labels. The interaction between Format and Perceived nutritional knowledge was significant (Table 3). Participants who perceived themselves as least knowledgeable about health and nutrition found the Wheel of Health more difficult to understand than Smileys, $p<0.01$.

The interaction between Format and Label reading was also significant. Participants who never read labels found the Wheel of Health more difficult to understand compared to Stars and Smileys, $p<0.01$ (Table 3).

No significant differences on comprehension were found for Education level (Table 3).

For the other background variables, some small differences were found for Comprehension on Age, Gender, Perceived healthiness of diet and Attitude towards healthy eating, but these did not provide a consistent and interpretable pattern (data not shown, available from authors).

Impact nutrition labelling format on perceived healthiness (study 1)

On average, participants rated the healthier products as slightly healthy ($M = 3.2$) and the less healthy products as slightly unhealthy ($M = 2.3$). We calculated the mean difference in perceived healthiness between the healthier and less healthy products for each labelling format and used this as the dependent measure. Mean difference scores ranged from 0.6 to 1.0 (Table 2). Main effects were found for Format and for Country. Smileys and Stars were significantly the best differentiators between healthier and less healthy product variants and the Health Protection Factor differentiated the least, $p<0.01$. For the UK and The Netherlands, the difference in perceived healthiness between the healthier and less healthy products was greater than the difference in perceived healthiness for Italy and Germany, $p<0.01$. Furthermore the interaction between Format and Country was also significant (Table 2). In Italy and the UK the Healthier Choice Tick scored as well as Smileys and Stars, $p<0.01$.

No substantial differences were detected for Perceived healthiness on all background variables (data not shown, available from authors).

Difference in perceived healthiness per product category. We also analysed the differences in perceived healthiness between healthier and less healthy products per product category. The main effect for product category was

Table 2
Mean scores and ANOVAs for comprehension, credibility, liking and mean difference in perceived healthiness by format and country across products (study 1)

Variables	Format							ANOVAs		
	Healthier choice tick ($n = 670$)	Health protection factor ($n = 645$)	Smileys[1] ($n = 1630$)	Stars ($n = 645$)	Multiple traffic light ($n = 656$)	Wheel of health ($n = 644$)	Overall mean	Format (df = 5)	Country (df = 3)	Format × Country (df = 15)
	M	*M*	*M*	*M*	*M*	*M*	*M*	*F (p)*	*F (p)*	*F (p)*
Comprehension								35.7 (*)	19.0 (*)	5.7 (*)
UK	3.6^{cd}	3.1^{d}	3.9^{bc}	4.0^{abc}	4.3^{a}	3.7^{bc}	3.8			
Germany	3.7^{a}	3.2^{b}	4.0^{a}	4.0^{a}	3.9^{a}	4.0^{a}	3.8			
Italy	3.7^{a}	3.4^{a}	3.7^{a}	3.8^{a}	3.7^{a}	3.7^{a}	3.7			
NL	4.1^{a}	4.0^{a}	4.2^{a}	4.1^{a}	4.3^{a}	4.0^{a}	4.1			
Overall mean	3.8^{c}	3.4^{d}	3.9^{ab}	4.0^{ab}	4.0^{a}	3.8^{bc}	3.9			
Credibility								61.2 (*)	9.8 (*)	2.6 (**)
UK	3.1^{cd}	2.9^{d}	3.2^{bc}	3.3^{bc}	3.8^{a}	3.5^{ab}	3.3			
Germany	2.9^{c}	2.7^{d}	2.9^{c}	3.0^{bc}	3.2^{ab}	3.4^{a}	3.0			
Italy	3.2^{bc}	3.1^{c}	3.1^{c}	3.2^{bc}	3.4^{ab}	3.6^{a}	3.3			
NL	2.9^{b}	2.9^{b}	2.9^{b}	3.0^{b}	3.4^{a}	3.4^{a}	3.1			
Overall mean	3.0^{b}	2.9^{c}	3.0^{b}	3.1^{b}	3.4^{a}	3.5^{a}	3.1			
Liking								36.2 (*)	34.3 (*)	2.8 (**)
UK	3.3^{b}	2.8^{c}	3.2^{b}	3.1^{bc}	3.9^{a}	3.3^{b}	3.3			
Germany	3.2^{ab}	2.6^{c}	3.1^{b}	3.0^{b}	3.3^{ab}	3.5^{a}	3.1			
Italy	3.5^{ab}	3.1^{c}	3.2^{bc}	3.1^{c}	3.6^{a}	3.6^{a}	3.3			
NL	2.8^{ab}	2.5^{c}	2.7^{bc}	2.7^{bc}	2.9^{a}	3.0^{a}	2.8			
Overall mean	3.2^{b}	2.8^{cd}	3.1^{c}	3.0^{c}	3.4^{a}	3.4^{ab}	3.1			
Mean difference perceived healthiness[2]								46.5 (*)	35.3 (*)	3.2 (*)
UK	1.1^{ab}	0.8^{c}	1.3^{a}	1.2^{a}	1.1^{ab}	1.0^{bc}	1.1			
Germany	0.6^{b}	0.6^{b}	0.8^{a}	0.8^{a}	0.7^{ab}	0.8^{ab}	0.7			
Italy	0.8^{a}	0.4^{c}	0.8^{a}	0.7^{a}	0.7^{ab}	0.5^{bc}	0.6			
NL	0.9^{bc}	0.8^{c}	1.1^{a}	1.1^{ab}	1.0^{abc}	0.9^{bc}	1.0			
Overall mean	0.8^{c}	0.6^{d}	1.0^{a}	1.0^{ab}	0.9^{bc}	0.8^{c}	0.9			

Note: Means in the same row that do not share superscripts differ at $p < 0.01$ (Tukey–Kramer). *$p < 0.0001$; **$p < 0.001$.

[1]Every participant received Smileys.

[2]Mean differences are the difference between healthier and less healthy products for each format.

Table 3
Mean scores and ANOVAs for comprehension by format, perceived nutritional knowledge and label reading across countries and across products (study 1)

Intervening variables	Format							ANOVAs	
	Healthier choice tick ($n = 670$)	Health protection factor ($n = 645$)	Smileys ($n = 1630$)	Stars ($n = 645$)	Multiple traffic light ($n = 656$)	Wheel of health ($n = 644$)	Overall mean	Intervening variable (df = 2)	Intervening variable × format (df = 10)
	M	*M*	*M*	*M*	*M*	*M*	*M*	*F* (*p*)	*F* (*p*)
Perceived nutritional knowledge								11.8 (*)	2.3 (*)
Low ($n = 236$)	3.7^{ab}	3.4^{b}	3.9^{a}	3.9^{ab}	3.9^{ab}	3.4^{b}	3.7		
Middle ($n = 522$)	3.7^{ab}	3.4^{b}	3.8^{a}	3.9^{a}	3.9^{a}	3.7^{ab}	3.8		
High ($n = 872$)	3.9^{a}	3.5^{b}	4.1^{a}	4.0^{a}	4.1^{a}	4.1^{a}	4.0		
Label reading								6.9 (**)	4.7 (*)
Never ($n = 323$)	3.7^{bc}	3.5^{c}	4.0^{ab}	4.2^{a}	3.8^{abc}	3.6^{c}	3.8		
Sometimes ($n = 373$)	3.7^{a}	3.4^{b}	3.8^{a}	3.9^{a}	3.9^{a}	3.7^{ab}	3.7		
Always ($n = 934$)	3.9^{b}	3.5^{c}	4.0^{ab}	4.0^{ab}	4.2^{a}	4.1^{ab}	3.9		
Education level								0.6 (ns)	2.1 (ns)

Note: Means in the same row that do not share superscripts differ at $p<0.01$ (Tukey–Kramer).*$p<0.0001$; **$p<0.01$.

Table 4
Mean difference scores and ANOVAs for perceived healthiness by format and product category across countries (study 1)

Variables	Format							ANOVAs	
	Healthier choice tick ($n = 670$)	Health protection factor ($n = 645$)	Smileys ($n = 1630$)	Stars ($n = 645$)	Multiple traffic light ($n = 656$)	Wheel of health ($n = 644$)	Overall mean	Product category (df = 3)	Format × product category (df = 15)
	M	*M*	*M*	*M*	*M*	*M*	*M*	*F* (*p*)	*F* (*p*)
Mean difference								205.5 (*)	17.8 (*)
Dairy drink	0.9^{b}	0.9^{b}	1.2^{a}	1.1^{a}	1.2^{a}	1.0^{ab}	1.1		
Ice-cream	0.9^{a}	0.3^{b}	0.9^{a}	0.9^{a}	0.9^{a}	0.8^{a}	0.8		
Spreads	0.7^{bcd}	0.7^{abc}	0.9^{a}	0.8^{ab}	0.5^{d}	0.6^{cd}	0.7		

Note: The mean difference is the difference between healthier and less healthy products for each format. Means in the same row that do not share superscripts differ at $p<0.01$ (Tukey–Kramer). *$p<0.0001$.

significant (Table 4). Overall the labelling formats differentiated most for dairy drinks and least for spreads, $p<0.01$. The interaction between Format and Product category was also significant. In contrast to the other product categories, for spreads the Multiple Traffic Light differentiated significantly less between the healthier and less healthy product compared to Smileys and Stars, $p<0.01$.

Furthermore, we were interested in defining the most consistent format in differentiating between healthier and less healthy products across product categories. Therefore, we calculated the difference between the highest mean difference score in perceived healthiness and the lowest mean difference score in perceived healthiness for each labelling format and used this as the dependent measure. Main effects were found for Format $F(5,\ 3239) = 15.4$, $p<0.0001$ and for Country $F(3,\ 1627) = 6.8$, $p<0.001$. The Healthier Choice Tick ($M_{diff} = 0.2$), followed by Smileys ($M_{diff} = 0.3$) and Stars ($M_{diff} = 0.3$), was the most consistent differentiator across product categories, $p<0.01$. The most inconsistent differentiator was the Multiple Traffic Light ($M_{diff} = 0.7$), followed by the Health Protection Factor ($M_{diff} = 0.5$) and Wheel of Health ($M_{diff} = 0.5$), $p<0.01$. In Germany ($M_{diff} = 0.6$), the labelling formats were slightly less consistent across product categories than in Italy ($M_{diff} = 0.3$), $p<0.01$. The interaction between Format and Country was also significant $F(15,\ 3239) = 3.4$, $p<0.0001$. The interaction seemed to be mainly caused by the Wheel of Health, which was a significantly more consistent differentiator in Italy ($M_{diff} = 0.1$) compared to Germany ($M_{diff} = 0.8$).

Credibility of endorsers

Main effects were found for Endorsement type and for Country (Table 5). The nutrition labelling format (Smileys) was perceived to be far more credible when it was endorsed by an international or national organisation in the area of

Table 5
Mean scores and ANOVAs for credibility of labelling format (Smileys) by type of endorsement (study 1)

Countries	Endorsement						ANOVAs		
	No endorsement ($n = 136$)	National Nutrition Organisation ($n = 136$)	World Health Organization ($n = 136$)	European Union ($n = 136$)	European food manufactures ($n = 136$)	Overall mean	Type (df = 4)	Country (df = 3)	Type × Country (df = 12)
	M	*M*	*M*	*M*	*M*	*M*	*F* (*p*)	*F* (*p*)	*F* (*p*)
							664.2 (*)	5.9 (*)	35.4 (*)
UK	2.2[c]	3.3[a]	3.5[a]	2.7[b]	2.6[b]	2.9			
Germany	1.9[d]	3.4[a]	3.1[b]	2.5[c]	2.3[c]	2.6			
Italy	2.0[d]	2.9[c]	3.5[a]	3.2[b]	2.7[c]	2.9			
NL	2.1[c]	3.2[a]	3.0[a]	2.8[b]	2.7[b]	2.7			
Overall mean	2.0[e]	3.2[b]	3.3[a]	2.8[c]	2.6[d]				

Note: Means in the same row that do not share superscripts differ at $p<0.01$ (Tukey–Kramer). *$p<0.0001$.

health and nutrition, $p<0.01$. Furthermore, endorsements by the European Union and European Food Manufactures were perceived as less credible compared to the national nutrition organisation and the World Health Organization, $p<0.01$. The interaction between Endorsement type and Country was also significant. German participants found the format slightly more credible when endorsed by the national nutrition organisation compared to World Health Organization and Italian participants found the format more credible when endorsed by the World Health Organization compared to the national nutrition organisation, $p<0.01$.

Interpretation of labelling formats as comparison across or within product category. More than half of the participants (58%) indicated that they thought the nutrition labelling formats compared products across all food products compared to 27% of the participants who thought the format only compared products within one category and 15% who indicated that they had not thought about it.

Discussion study 1

Overall, the findings suggest that all labelling formats were understood, liked and were seen as credible, except for the Health Protection Factor. Furthermore, all labelling formats were able to help consumers to differentiate between healthier and less healthy variants of the same product category. Although there were several significant differences between countries, the overall effects were quite similar. There is thus an opportunity to introduce one front-of-pack label across European countries. Furthermore, the results indicate that an official endorsement strongly increases the credibility of the labelling format.

The Health Protection Factor was clearly the least consumer friendly format. It scored lowest on comprehension, credibility and liking. The low score of the Health Protection Factor may be due to the way the labelling formats were presented to participants, in that no further explanation about the formats was given to participants. Participants did not know what the maximum score was so they may not have been able to interpret the score as high or low. Furthermore, the term 'Health Protection Factor' might have been perceived as strange in relation to food.

Within the small differences that were found, the Multiple Traffic Light scored best with respect to the indicators used to assess consumer friendliness. However, it is also the most inconsistent differentiator between healthier and less healthy products. Given that a format should be effective for all product categories, the Multiple Traffic Light seems less ideal.

The results also indicated that providing more information is not necessarily better for everyone. Participants with low perceived nutritional knowledge found the detailed Wheel of Health more difficult to understand than participants with high perceived nutritional knowledge. A similar finding appeared for people who never or hardly ever read labels versus people who always read labels. However, we found no support indicating that people with lower levels of education had more difficulty in understanding the labels.

Measuring the effectiveness of different labelling formats is quite complex as there is a difference between evaluating several labels in an experimental setting where participants have time to process all the information, compared to a shopping situation where nutrition labels have to compete with many other stimuli. In a second study, we addressed this, and focussed on the impact of the labelling formats on behavioural intention. We introduced another method (shopping basket) to better mimic a shopping context.

Study two

Method

Participants

In total, 776 participants from two European countries participated in this study, 371 participants from Italy and

Table 6
Socio-demographic characteristics of participants by country (study 2)

Demographics	%	
	Italy ($n = 371$)	UK ($n = 405$)
Gender		
Male	46.6	48.6
Female	53.4	51.4
Education level		
Low[a]	30.6	33.2
Middle[b]	67.5	28.5
High[c]	19.0	38.5
Age		
18–24 years	18.6	14.1
25–34 years	26.7	31.6
35–44 years	30.8	28.9
45–55 years	23.9	25.4

[a]Up to primary school.
[b]Up to secondary school.
[c]Higher education/university.

405 participants from the United Kingdom. As the results of the first study showed that there were minimal differences between countries, we limited it to a southern and northern European country. Consumer samples of each country were drawn from Internet panels of a market research agency (Survey Sampling International). To create representative samples, participants were selected by means of quota sampling (based on census figures) on gender, education and age (for the age range of 18–55 yrs) (Table 6). To correct for slight differences from the census figures, data were weighted for age, education and gender for each country. Participants from the first study were not contacted for the second study.

Materials

Type of nutrition labelling format. We included two labelling formats from the first study (i.e. the Healthier Choice Tick and Stars) (Fig. 1). Stars was included as it was the most promising simpler format together with Smileys. The Healthier Choice Tick was included because it was the simplest format. In addition to these two labelling formats, we introduced two new labelling formats, i.e. the Multiple Choice Tick and GDA scores (Fig. 2). The Multiple Choice Tick was included as a more fine-grained alternative of the Healthier Choice Tick. A product was given 0, 1, 2 or 3 ticks, with 3 ticks being the healthiest product. The Multiple Traffic Light and Wheel of Health were replaced by GDA scores. The latter came up as an interesting example of another detailed format when it was launched by Tesco's in 2005.

Products. This study employed two methods. In the first method (product pair) two product categories were included, ice-cream and spreads. For each category a healthier variant and a less healthy variant was selected by

Fig. 2. The additional nutrition labelling formats used in study 2: (a) Multiple choice tick; (b) GDA scores.

using the Unilever Nutrition Enhancement Programme score (Nijman et al., 2007). For ice-cream, the healthier variant was 'real fruit covered ice-cream' and the less healthy variant 'chocolate covered ice-cream'. For spreads, the healthier variant was 'vegetable oil-based margarine' and the less healthy variant 'butter'. In the second method (shopping basket) five product categories that could be consumed as a snack and two filler products (i.e. soup and an apple) were selected. For each category a healthier and less healthy variant was included: 'real fruit covered' and 'chocolate covered ice-cream'; 'cola light' and 'regular cola'; 'unsalted peanuts' and 'salted peanuts'; 'tea biscuit' and 'muffin'; 'popcorn' and 'chocolate bar'.

Procedure

To obtain baseline measurements, participants were first exposed to the 12 products used in the study without a front-of-pack nutrition labelling format, enabling current usage and perceived healthiness of products to be assessed. Subsequently, participants were asked to complete a number of questions regarding demographics, health behaviours, health attitudes and nutritional knowledge. Participants then did the first test (product pair) using the same procedure as in the first study. Participants answered questions on liking, perceived healthiness and intended usage frequency. When participants finished this part of the test they were exposed to two collages of pictures of products that contained healthier and less healthy product variants (shopping basket). Participants answered questions on comprehension and liking of the labelling format. Subsequently participants would see the less healthy product variants that they used more than once a month, together with their healthier variant. Participants answered questions after each pair on perceived healthiness and intended usage frequency for both products.

Measures

Baseline measures. Current usage of the products without a front-of-pack nutrition labelling format was measured by the question 'How often do you usually eat or drink this product?', with answers ranging from 1 (*less than once a month*), 2 (*once a month*), 3 (*two or three times a month*), 4 (*once a week*), 5 (*two or four times a week*), 6 (*almost daily*) to 7 (*several times a day*). For the analyses the scale was converted to number of times per year. Current perceived healthiness of the products without a labelling format was measured by the question 'How healthy is this product for you?', with answers ranging from 1 (*not healthy at all*) to 5 (*very healthy*).

Consumer friendliness and perceived healthiness of product. Comprehension and liking of the labelling format were measured as in study 1. Change in perceived healthiness was measured by calculating the difference between baseline measure of perceived healthiness and perceived healthiness of the product after exposure to the labelling format.

Behavioural intention. Intended usage frequency of the product after exposure to labelling format was measured by the question 'Having seen this product with the health indicator, how often do you intend to use this product?', with answers ranging from 1 (*less than once a month*), 2 (*once a month*), 3 (*two or three times a month*), 4 (*once a week*), 5 (*two or four times a week*), 6 (*almost daily*) to 7 (*several times a day*). For the analyses the scale was converted to number of times per year. Intended change in usage frequency was measured by calculating the difference between baseline usage frequency and intended usage frequency after exposure to the labelling format. For the Healthier Choice Tick, less healthy products were followed by the question, 'Having seen this product without the health indicator, how often do you intend to use this product?'.

Time. The time (in seconds) participants took to look at and to evaluate each labelling format during the product pair test was measured.

Background variables. The questions were the same as in study 1.

Design and statistical analyses

Two different methods were used to test the nutrition labelling formats. The first method was similar to the one employed in the first study: front-of-pack nutrition labelling formats were presented per product pair (comparison of a healthier and less healthy product variant). A 4 (Labelling Format: Healthier Choice Tick, Multiple Choice Tick, Stars, GDA scores) × 2 (Product Category: Ice-cream, Spreads) × 2 (Healthiness of Product: Healthier product, Less healthy product) within subject factorial design was used with Countries as a between subject variable (UK, Italy).

The second method (shopping basket) used a single factor design. The factor was type of nutrition labelling format (the 4 different formats). The nutrition labelling formats were presented on a collage of 12 products to imitate a shopping situation. Depending on the labelling format (Healthier Choice Tick, Multiple Choice Tick or Stars) the 12 products were clustered on screen into, respectively, 2, 4 or 5 categories according to their healthiness. GDA scores were shown on each product separately. Each participant was shown two of the labelling formats. Products and labelling formats were all randomised across participants.

All data were analysed using the same analyses as mentioned in study 1. To facilitate interpretation of the results, all data were analysed separately for the product pair method and shopping basket method. Furthermore, the influence of labelling formats on Perceived healthiness and Intended change in usage frequency was analysed separately for healthier and less healthy products. The alpha was set at 0.01 for ANOVAs and 0.01 for post hoc analyses. Pre-analyses revealed normal distribution of each variable.

The same background variables as mentioned in study 1 were included in the analyses for Comprehension, Perceived difference in healthiness and Intended change in usage frequency.

Results

Impact nutrition labelling format on consumer friendliness (study 2)

Comprehension of formats. *Shopping basket*: On average, participants found all nutrition labelling formats easy to understand, with means ranging from 3.8 to 4.4 on a 5-point scale (Table 7). A main effect was found for Format. Stars scored highest on comprehension and GDA scores lowest, $p<0.01$. There was no main effect for Country and the interaction between Format and Country was also not significant.

For the background variables, no significant differences were found for Comprehension (data not shown, available from authors).

Liking of formats. *Product pair*: On average, participants reasonably liked the formats, with means ranging from 3.1 to 3.5 on a 5-point scale (Table 7). A main effect was found for Format. GDA scores was slightly more liked compared to the other formats, $p<0.01$. There was no main effect for Country and the interaction between Format and Country was also non-significant (Table 7).

Shopping basket: Also in the shopping basket, participants reasonably liked the formats, with means ranging from 3.2 to 3.6 on a 5-point scale (Table 7). A main effect was found for Format. Stars was most liked, followed by the GDA scores and Multiple Choice Tick, $p<0.01$. There was no main effect for Country and the interaction between Format and Country was also not significant (Table 7).

As the different methods showed different results we also conducted an ANOVA on liking of the formats with Format as between subjects factor and Test type (product pair vs. shopping basket) as within subjects factor. This yielded the main effect for Format, $F(3, 2288) = 7.9$, $p<0.0001$. We also found a main effect for Test type, $F(1, 2288) = 23.8$, $p<0.0001$. Participants liked the nutrition labelling formats slightly more when tested with the second method (shopping basket) compared to the first method (product pair), $p<0.01$ (Table 7). The interaction between Format and Test type was also significant, $F(3, 2288) = 11.1$, $p<0.0001$. The more complex GDA scores was liked most in the first method (product pair) ($p<0.01$).

Table 7
Mean scores and ANOVAs for liking and comprehension by format and method across countries (study 2)

Variables	Format					ANOVAs		
	Healthier choice tick ($n = 392$)	Multiple choice tick ($n = 376$)	Stars ($n = 356$)	GDA scores ($n = 406$)	Overall mean	Format (df = 5)	Country (df = 3)	Format × country (df = 15)
	M	*M*	*M*	*M*	*M*	*F* (*p*)	*F* (*p*)	*F* (*p*)
Comprehension								
Shopping basket	4.1^{b}	4.0^{b}	4.4^{a}	3.8^{c}	4.1	19.6 (*)	5.1 (ns)	1.4 (ns)
Liking								
Product pair	3.1^{b}	3.2^{b}	3.1^{b}	3.5^{a}	3.2	14.3 (*)	0.4 (ns)	0.2 (ns)
Shopping basket	3.2^{b}	3.3^{ab}	3.6^{a}	3.4^{ab}	3.4	6.9 (**)	6.5 (ns)	2.7 (ns)

Note: Means in the same row that do not share superscripts differ at $p<0.01$ (Tukey–Kramer). *$p<0.0001$; **$p<0.001$.

In the second method (shopping basket), the simpler Stars was liked most, $p<0.01$ (Table 7). These results indicate that the way formats are tested influences the liking of the labelling formats.

Impact nutrition labelling format on change in perceived healthiness (study 2)

Differences in perceived healthiness between baseline and post measure was used as the dependent measure. Overall, the labelling formats increased the perceived healthiness of the healthier products and slightly decreased the healthiness of the less healthy products. Although significant differences were found between the different labelling formats, these did not provide a consistent and interpretable pattern across the two methods and across healthier and less healthy products (Fig. 3).

For the background variables, some small differences were found for Difference in perceived healthiness but these did not provide a consistent and interpretable pattern (data not shown, available from authors).

Impact nutrition labelling format on behavioural intention

Intended change in usage frequency. Differences in frequency between baseline and post measure were used as the dependent measure. Overall, participants intended to slightly increase their consumption of healthier products and intended to decrease their consumption of less healthy products (Fig. 4). No significant differences between the formats were found (data not shown, available from authors).

For the background variables, no significant differences were found for Intended change in usage frequency (data not shown, available from authors).

Time to evaluate

Product pair. Twenty participants spent more than 350 s (i.e., 5.8 min) compared to an average of 80 s to evaluate a labelling format and were excluded as outliers. Analyses for the time needed by participants revealed significant main effects for Format and Product category (Table 8).

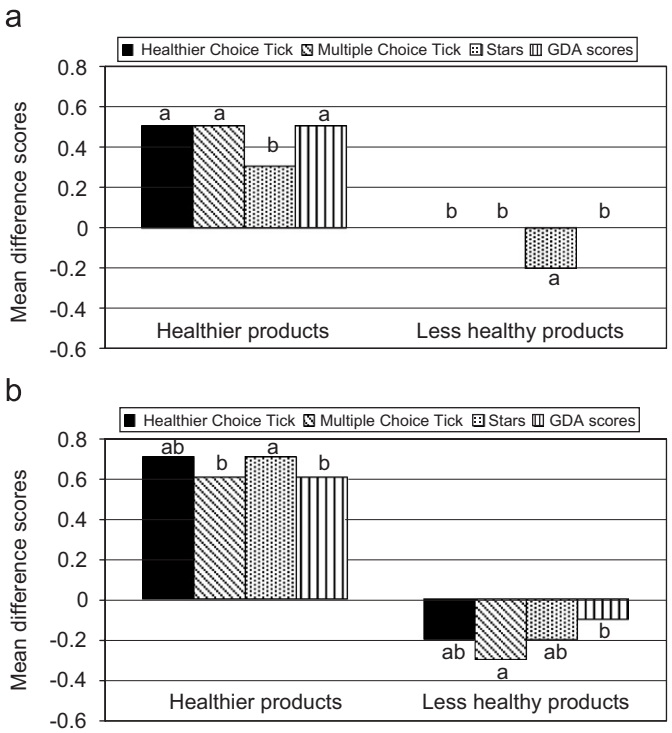

Fig. 3. Differences in mean scores for perceived healthiness per method by format, healthier and less healthy products and across countries (study 2): (a) product pair; (b) shopping basket. *Note*: Means that do not share letters in the same category differ at $p<0.01$ (Tukey–Kramer).

Participants needed significantly more time to evaluate GDA scores than the Healthier Choice Tick and Stars, $p<0.01$. Furthermore, participants needed significantly more time to evaluate the labelling formats when tested on Ice-creams than when tested on Spreads, $p<0.01$. No other significant effects were found (Table 8).

Discussion study 2

The results indicated that simpler front-of-pack labelling formats (Healthier Choice Tick and Stars) may be more effective in helping consumers to make healthier choices in

a supermarket environment than a more detailed complex front-of-pack labelling format (GDA scores), when considering the time participants needed to process the information and the ease of comprehension.

In addition, the study showed that all formats were more likely to increase the perceived healthiness of the healthier products than to decrease the perceived healthiness of the less healthy products. The nutrition labelling formats may have confirmed participants existing knowledge about less healthy products, and may have provided new information in that healthier products were initially seen as less healthy.

Contrary to what might be expected when taken into account the above results, participants' intention to use less healthy products decreased, whereas participants' intention to use healthier products hardly increased. This suggests that the labelling formats do not encourage overconsumption of particular products as was suggested in a study by Scott and Worsley (1994).

The results of this study suggest that the way a format is tested impacts on how participants judge products with a nutrition labelling format. For example, the labelling formats were slightly more liked when tested with the second method (shopping basket) than when tested with the first method (product pair). This shows that it is necessary to further improve the methodology to test nutrition labelling formats.

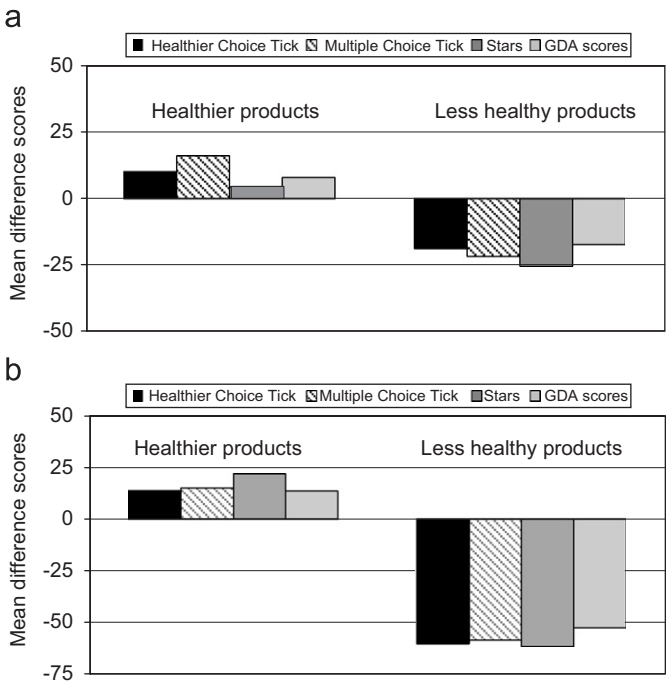

Fig. 4. Difference in mean scores for intended usage frequency (times per year) per method by format, healthier and less healthy products and across countries (study 2): (a) product pair; (b) shopping basket. *Note*: Means do not differ in the same category at $p<0.01$ (Tukey–Kramer).

General discussion

A series of front-of-pack nutrition labelling formats were evaluated on their consumer friendliness (comprehension, liking and perceived credibility), on their ability to differentiate between healthier and less healthy products, and on their impact on intention to change behaviour. In the first study, the focus was on comprehension, liking and credibility of the labelling formats and additionally the impact of the labelling formats on perceived healthiness of the products. In the second study, the focus was on decision-making and we consequently included behavioural intention measures and measured the amount of time people took to process a nutrition labelling format. As far as we know, this latter measure has not been taken into account before in research on the effectiveness of labelling formats, although this is an important dependent variable if it is our aim to facilitate making a healthy choice.

The results of both studies suggest that front-of-pack labelling formats are effective in helping consumers make healthier choices, e.g., participants intended to decrease the number of times per year they consumed less healthy products. The results also suggest that from the perspective of consumer friendliness there are no large differences between the different formats, with the exception of the Health Protection Factor, which scored lowest on consumer friendliness. In addition, front-of-pack nutrition labelling formats in general seem to work for everybody and across

Table 8
Mean scores and ANOVAs for time to evaluate each format by product category across countries (study 2)

Variables	Format					ANOVAs		
	Healthier choice tick ($n=762$)	Multiple choice tick ($n=767$)	Stars ($n=757$)	GDA scores ($n=776$)	Mean scores	Format (df = 3)	Product category (df = 1)	Format × product category (df = 3)
	M	*M*	*M*	*M*	*M*	*F* (*p*)	*F* (*p*)	*F* (*p*)
Time (s)						9.5 (*)	123.9 (*)	3.7 (ns)
Ice-cream	66.7[ab]	71.1[ab]	57.9[a]	76.1[b]	68.0			
Spreads	44.5[a]	45.5[a]	48.4[a]	51.9[a]	47.6			
Overall mean	55.6[a]	58.3[ab]	53.2[a]	64.0[b]	59.7			

Note: Means in the same row that do not share superscripts differ at $p<0.01$ (Tukey–Kramer). *$p<0.001$.

all countries, although there were some slight differences between subgroups and countries. Results from study 1 showed that participants who scored lowest on perceived nutritional knowledge and label reading understood the more detailed Wheel of Health less well than participants who perceived themselves as highly knowledgeable and always read labels. This suggests that too much detailed information might be less suitable for 'vulnerable' groups. Furthermore, some differences between countries were found, but these were not large enough to warrant different labels between countries. A caveat with respect to these latter findings is that differences between countries may have been attenuated by the different demographics in each country. However, given that we did not find any big differences between the demographic groups within each country, any confounding influences will be quite limited.

We also found clear evidence that official endorsements strongly increase the credibility of the labelling format, indicating that endorsement by an international or national organisation in the area of health and nutrition is important. Furthermore, most participants indicated that they thought a nutrition labelling format compares products across food products rather than between products within one category. Consumers thus clearly expect one nutrition labelling format across food products.

The results from study 2 showed that healthy choices can be made faster with the simpler front-of-pack formats Healthier Choice Tick or Stars than with the more detailed GDA scores. Participants needed almost 10 s more to evaluate products with GDA scores than products with a Healthier Choice Tick or Stars. This seems especially relevant in a shopping environment where consumers often spend little time to decide what to buy (Hoyer, 1984). In line with findings by Williams (2005), we recommend to present simple labelling formats front-of-pack and more detailed nutritional information (such as GDAs) on the back of the package. This will allow consumers to make a quick decision, whilst also providing detailed information if consumers desire this. Although consumers like the idea of a simplified front-of-pack nutrition label, there are individual differences with respect to the preferred level of detail of nutrition information (Grunert & Wills, 2007).

In addition to the findings from our study, there are also other considerations that need to be taken into account when choosing a labelling format. A front-of-pack labelling format (complementing detailed nutritional back-of-pack information) is more cost effective, as only products that meet a certain standard will be labelled. In contrast, complex front-of-pack labelling formats involve a specific label reflecting the nutrient profile on each product. This will significantly increase the costs of implementing such a labelling format, making adoption of a front-of-pack label by manufacturers less likely. Furthermore, research by Young and Swinburn (2002) showed that receiving a tick is a strong incentive for food companies to make their products healthier.

These studies also showed that measuring the effectiveness of front-of-pack labelling formats is a complex issue, as many different factors have to be taken into consideration. A caveat of this study is that processing information in an experimental setting is different from processing information in real life. In a supermarket situation consumers face many distracting factors (such as time, noise and large number of products) that will hinder detailed information processing. In our second study, we tried to create a task that better simulated the shopping environment and included a time measurement in the second study. Future research could explore this further by mimicking the shopping environment even better, e.g., by including distracters while consumers evaluate different front-of-pack nutrition labelling formats and by including actual choice. Furthermore, future studies should aim to measure actual behaviour (e.g., by creating a virtual shopping task where participants will be asked to buy products from a shopping list when they have to make a healthy meal). This may also allow us to better assess whether participants really understood the labelling formats. Participants may not really have understood a labelling format although they thought they did. Alternatively, participants may not have wanted to admit that they did not understand a nutrition labelling format.

In conclusion, our results indicated that front-of-pack labelling formats help consumers make healthier choices and that there are no major differences in consumer friendliness between simpler and more detailed labelling formats. However, when taking into account the shopping environment, we suggest a simple tick logo on the front-of-pack (e.g., the Healthier Choice Tick) to complement the detailed back-of-pack nutritional information fact box. Backed up by a detailed and science-based nutritional profile, such as Unilever's Nutrition Enhancement Programme score, such a front-of-pack labelling format could have a substantial positive impact on public health. However, a multitude of different front-of-pack labelling formats would only confuse consumers, thus decreasing the effectiveness of all front-of-pack labelling formats. The current challenge is therefore to come up with a harmonised European or even global front-of-pack labelling format across all foods.

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