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Research report

Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK

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ABSTRACT

Based on in-store observations in three major UK retailers, in-store interviews (2019) and questionnaires filled out at home and returned (921), use of nutrition information on food labels and its understanding were investigated. Respondents' nutrition knowledge was also measured, using a comprehensive instrument covering knowledge of expert recommendations, nutrient content in different food products, and calorie content in different food products. Across six product categories, 27% of shoppers were found to have looked at nutrition information on the label, with guideline daily amount (GDA) labels and the nutrition grid/table as the main sources consulted. Respondents' understanding of major front-of-pack nutrition labels was measured using a variety of tasks dealing with conceptual understanding, substantial understanding and health inferences. Understanding was high, with up to 87.5% of respondents being able to identify the healthiest product in a set of three. Differences between level of understanding and level of usage are explained by different causal mechanisms. Regression analysis showed that usage is mainly related to interest in healthy eating, whereas understanding of nutrition information on food labels is mainly related to nutrition knowledge. Both are in turn affected by demographic variables, but in different ways.

Background

Nutrition information on food labels is regarded as a major means for encouraging consumers to make healthier choices when shopping for food (Baltas, 2001; Cheftel, 2005). In recent years, the traditional nutrition information in table or grid form, usually found on the back of the food package, has been supplemented by a variety of simplified nutrition labels that appear on the front of the pack, often called front-of-pack (FOP) signposting information. Various formats of FOP labels have been promoted, of which the most well known are labels based on the guideline daily amount (GDA) concept and labels based on a traffic light (TL) scheme. Both formats are typically based on four key nutrients and energy, i.e., contain information on fat, saturated fat, sugar, salt and calories.

Do consumers notice such labels, do they read and understand them, and do they make use of them in their purchasing decisions? A range of consumer research studies (reviewed recently by Cowburn & Stockley, 2005; Drichoutis, Lazaridis, & Nayga, 2006; Grunert & Wills, 2007) have tried to shed light on these questions. However, existing research on the issue has a number of deficiencies, as pointed out in these reviews. Most notably, most of the studies conducted are based on self-reported retrospective behaviour, which can lead to considerable overreporting with regard to behaviours that are regarded as socially desirable (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Also, when analysing determinants of use of nutrition information, most studies have been restricted to an analysis of demographic determinants (e.g., Guthrie, Fox, Cleveland, & Welsh, 1995; Nayga, 1996; see also Drichoutis, Lazaridis, & Nayga, 2005). Demographic determinants are important, not least because the incidence of unhealthy eating habits is known to be unequally distributed across social classes (e.g., Hulshof, Brussard, Kruizinga, Telman, & Löwik, 2003; Lien, Jacobs, & Klepp, 2002; Shelton, 2005), but leave open the question whether for example a lower use of nutrition information in the lower classes is due to lower nutrition knowledge, lower interest in healthy eating, or other factors. Finally, it is only in the past few years that front-of-pack signposting systems have found wider penetration, and therefore studies addressing their role in consumers' use of nutrition information have started to appear only recently (Borgmeier & Westenhoefer, 2009; Kelly et al., 2009; Sacks, Rayner, & Swinburn, 2009; Van Kleef, van Trijp, Paeps, & Fernandez-Celemin, 2007; Vyth, Steenhuis, Mallant, & Mol, 2009).

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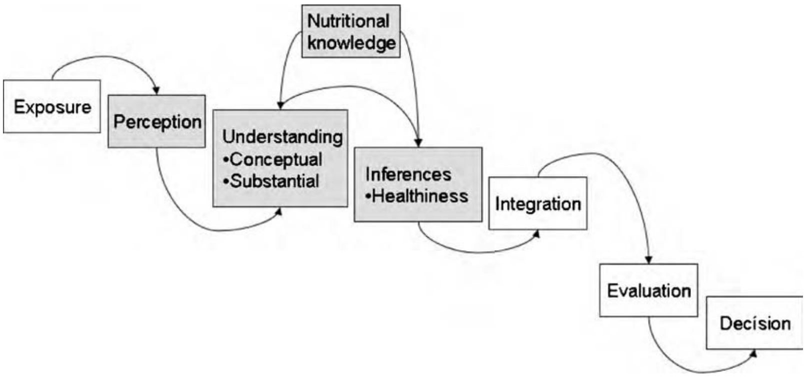

Fig. 1. Conceptual framework.

The present study contributes to fill some of these deficits. It has been conducted in the UK, which is the European country where the penetration of FOP nutrition information is highest (Wills, Grunert, Fernández Celemín, & Storcksdieck genannt Bonsmann, 2009). The study has a threefold objective:

- To get a realistic estimate of the level of usage of nutrition information on food labels by combining observation in the store with an in-store interview concerning the observed choice.
- To provide evidence on the extent to which UK consumers are able to understand and apply information about the major FOP nutrition label formats.
- To measure UK consumers' level of nutrition knowledge and see how this, together with demographic factors and interest in healthy eating, affect use and understanding of nutrition information on food labels.

The conceptual model guiding the study is shown in Fig. 1. It is an adaptation of the hierarchy of effects model proposed by Grunert and Wills (2007) for studying effects of nutrition labels on consumers (and follows the tradition of streams of research in consumer decision-making and attitude formation and change, see, e.g., Eagly & Chaiken, 1993; McGuire, 1985; Peter, Olson, & Grunert, 1999; Solomon, Bamossy, Askegaard, & Hogg, 2006). In order for nutrition labels to have any effect, consumers must be exposed to them and must be aware of them. The effect will then be mediated by consumer understanding, which in turn will be affected by consumers' nutrition knowledge. Based on their understanding, consumers may then use the label information to make inferences about the healthiness of the product, which, together with other information (for example, about the taste of the product) may affect the evaluation and eventually the purchase decision with regard to the product. Only the shaded parts of the model are dealt with in the present study.

Overall design, sampling and data collection

The study comprises three elements: an in-store observation, an in-store interview, and an in-home questionnaire. The overall study design is depicted in Fig. 2. The overall design was discussed with a range of stakeholders in the food sector before being finalized, and two pilot studies were conducted before the instruments were finalized.

Shoppers were observed at six selected aisles in the supermarket that corresponded to six product categories: breakfast cereals, carbonated soft drinks, confectionary, ready meals, salty snacks, yoghurts. When they had selected at least one product for purchase, they were approached for an interview about that particular purchase. At the end of the interview, they were asked if they would complete a further questionnaire at home and then return it. Respondents received an incentive (£5) for participating in the in-store interview and were offered an additional incentive

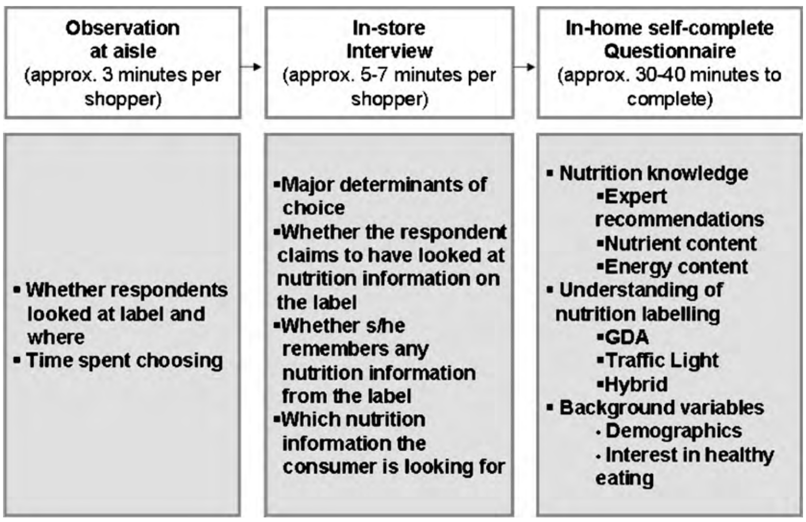

Fig. 2. Study design.

(£10) if they completed a longer questionnaire at home and returned it.

Observation and recruitment of participants occurred in three major UK retailers selected for differences in the nutrition labelling schemes they use on their own products: Retailer A, employing a GDA-based FOP system, retailer B, employing a FOP traffic light (TL) scheme with GDAs on back of pack (BOP), and retailer C, who uses a FOP hybrid TL colour-coded GDA system with the words *high, medium* or *low*. Field work was spread over three geographic locations in England—Birmingham, London and Manchester. Six product categories were selected for the observational and in-store components of the study: breakfast cereals, carbonated soft drinks, confectionery, ready meals, salty snacks, yoghurts. These categories were selected based on three criteria: they should cover products where nutrition information, both front-of-pack and back-of-pack, is usually available on the food label (this rules out all non-packaged foods, like fruits and vegetables), they should cover both products where the retailer's own nutrition label and/or branded goods manufacturers' nutrition labels are prevalent, and they should cover products that differ in degree of overall perceived healthiness. Shoppers who were observed to have selected at least one product from one of these categories and put it into their trolley were then recruited for the interview part of the study by saying "*Good morning/afternoon/evening, my name is... and I am conducting a survey on behalf of... This survey is about the way people choose the products they buy when shopping at supermarkets*" The observations and interviews were carried out throughout a range of time segments on weekdays and at weekends. This results in a design with 3 retailers × 3 locations × 6 product categories = 54 cells. Target cell size for data collection was 40, with an overall target of 2160 in-store observations and interviews. Actual cell sizes varied between 31 and 44, and the overall number of usable in-store observations and interviews was 2019. Of these, 921 returned the in-home questionnaire, corresponding to a return rate of 46%, which is regarded as very satisfactory. Demographic characteristics of the overall sample can be seen in Table 1. The data indicate a prevalence of women in the sample, which corresponds to the fact that women still have the main responsibility for shopping of food in the majority of UK households (Grunert, Brunsø, Bredahl, & Bech, 2001). The spread with regard to social grade and age is very good. When comparing the demographic profile of those who did return the in-home questionnaire with those who did not, we find that the proportion of women was significantly higher in the part of the sample that did return the questionnaire compared to those who did not (81% vs. 69%, $\chi^2 = 36.0$, df = 1, $p = .00$), and there was also a significant difference in the age distribution ($\chi^2 = 10.0$, df = 4, $p = .04$), due mainly to a lower proportion of respondents in the lowest age bracket (34 and under) among those who did return the in-home questionnaire compared to those who did not (23% vs. 28%). There were no significant differences in the proportions of respondents having children under 16 and in the social grade distribution. As both gender and age are known to be related to interest in nutrition (Grunert & Wills, 2007), we cannot rule out that the subsample who did return the in-home questionnaire is affected by a self-selection bias. However, as the differences are relatively small, we do not regard this as a serious problem.

Table 1
Sample characteristics.

	% in-store interviews	% returned in-home questionnaires
Total *n*	2019	921
Gender		
Male	25.9	19.0
Female	74.1	81.0
Social grade[a]		
A	2.1	1.1
B	20.6	21.8
C1	36.5	36.7
C2	18.6	18.0
D	10.3	10.8
E	12.0	11.6
Parents with children <16 years		
Yes	36.7	37.1
No	63.3	62.0
Age		
–34	26.1	22.7
35–44	24.1	25.0
45–54	22.2	24.4
55–64	14.9	15.4
65+	12.7	12.4
Total	100.0	100.0

[a] Measured by NS-SEC, see Office for National Statistics (2002).

The rest of the paper is structured as follows. We first present the in-store part of the study, describing the methodology and the results on use of nutrition information in the store. We then present the in-home part of the study, again describing the methodology and then the results on nutrition knowledge and on understanding of nutrition information. Finally, we present the analysis drawing the two parts together, by estimating regression models where nutrition use and understanding is sought explained by demographics, interest in healthy eating, and nutrition knowledge.

In-store observation and in-store interview

Methodology

The purpose of the in-store observation was to record whether shoppers looked at the label of food products before choosing them, where on the label they looked, and for how long. Observations took place at the aisles of the 6 product categories mentioned previously. Observers were situated at the end of the aisle, with a good overview of the aisle. Observations were one at a time and started when a shopper arrived at the aisle with the obvious intention of selecting a product there. For each product handled in the aisle, it was recorded whether the shopper looked at the front of the product, looked elsewhere, or did not look at the product in detail before putting it into the trolley. For each product handled, it was also recorded whether the product was placed in the trolley finally or replaced on the shelf/in the cooling counter. The time from arrival at the aisle until the product to be bought is put into the trolley (if several products of the same category were bought: until the last product bought is put into the trolley) was recorded in seconds using a stopwatch. Records from shoppers leaving the aisle without having put at least one product into the trolley were discarded.

Observed shoppers who had put at least one product into their trolley were approached and asked whether they were willing to participate in a short interview. Observational data for shoppers who declined to take part in the interview were discarded. In the interview, respondents were first asked for permission to record details of the first product they had selected in this aisle. They were then asked whether they had bought this product before, and for the main reason for selecting this particular product (open question). They were then asked whether they had looked for any nutrition information on the package of this product. If a shopper answered 'yes', they were asked to indicate which nutrition information they had looked for (open question). For each of the nutrients the respondent mentioned, respondents were asked whether the product they just had placed into their trolley

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contained a lot, some or a little of it. Finally, respondents were asked to show on the package where they had found this information. Respondents were also asked how often they look for nutrition information in general when shopping for the product category in question.

The in-store interview also collected demographic information: age, gender, and whether respondents have children under 16. Social grade was measured according to the National Statistics Socio-economic Classification (NS-SEC) system for the respondent household's chief earner (Office for National Statistics, 2002).

Results: observation

The observational data showed that respondents bought on average 1.8 products in the aisle where they were observed, and spent, on average, 29 s per product bought. The average time was highest when buying ready meals (41 s) and lowest for carbonated soft drinks (23 s). The figures show that purchases were not completely habitual and people took time to look at products. This is supported by the finding that 65.6% of respondents were observed to have looked at the front of the package, 11.6% were observed to have looked at it elsewhere, and 31.8% were observed not to have looked at the product in detail (these figures refer to the first product put into the trolley, but figures for the subsequent products selected, if any, were very similar).

Results: in-store interview

When asked whether they had looked for nutrition information on the first product that they had put into the trolley in the aisle where they were observed, 27% of respondents answered yes. Of these 27%, all respondents could name at least one nutrient they had looked for, and could show on the package where they had found that information. Also, most of them (21%) had been observed having looked at the front or elsewhere on the product. Of those 6% who were observed not having looked at the product in detail, but who still claimed to have looked for nutrition information, most (5%) had bought the same product before and may have recalled the information from a previous purchase or just very briefly have confirmed the information they already knew.

Altogether, these results lead us to believe that the figure of 27% looking for nutrition information is valid and not inflated by social desirability considerations in answering. In this context, it is informative to compare this figure with the answers to the question whether respondents 'generally' look for nutrition information when buying this product category: for the whole sample, 47.4% answered 'always' or 'regularly'. Of those who credibly looked for nutrition information in the concrete purchase situation – the 27% referred to above – 86% answered that they 'always' or 'regularly' do this when shopping for this product category. However, of the 73% who did not look for nutrition information in the concrete purchase, it is still 38% claiming that they 'always' or 'regularly' do this when shopping for this product category. Together, these results suggest that self-reported frequency of using nutrition information leads to overreporting of about 50%.

Not surprisingly, whether shoppers looked for nutrition information differed between product categories. Frequencies were highest for yoghurt (38%) and breakfast cereals (34%), followed by ready meals (28%), carbonated soft drinks (23%), salty snacks (22%) and confectionery (16%). This indicates that nutrition information is more likely to be sought for products that at the outset are regarded as more healthy.

The first question respondents were asked on the selected product was an open question on the main reason for choosing this particular product. Across the six product categories, the most frequently mentioned answer was *taste* (31%), followed by *this is what my family wants* (20%), *health and nutrition* (18%) and *price/special offer* (14%). Results also showed, not surprisingly, that looking for nutrition information was much more likely when health and nutrition was mentioned as the main reason for choosing this particular product compared to when the main reason was something else (55% as compared to 22%, $\chi^2 = 156.2$, df = 1, $p = .00$).

Concerning which information the respondents had looked for, the most frequently mentioned was fat (49% of those who had looked for nutrition information) followed by sugar (35%), calories (33%), salt (20%), saturates (11%) and additives (10%). Everything else was below 10%.

The main sources of information mentioned by the respondents are the GDA label, the nutrition grid or list, and the traffic light label. GDA labels are more frequently mentioned at retailer A (who uses them on their own label) and for those product categories dominated by multinational brands who likewise have adopted GDA labels (breakfast cereals, carbonated soft drinks). Traffic light labels are mentioned mostly at retailer B, who has adopted traffic lights. For retailers, own label ready meals, consumers were most likely to use the FOP nutrition labelling system as a source of nutrition information. On the whole, the GDA label was the most frequently mentioned source of nutrition information. Details on where on the package respondents indicated that they had found the information, broken down by product category and by retail chain, can be found in the table in Appendix A (figures are aggregated for the five key nutrients).

Discussion

Our first aim in this study was to get a realistic estimate of the degree of usage of nutrition label information by combining observation in the store with an in-store interview concerning the observed purchase. We conclude from this part of the study that 27% of respondents had looked at nutrition information on the package before making a selection. As argued above, we regard this figure as valid. The sample is of course constrained by the choice of retail chains, cities, and product categories (aisles), but since we have considerable variation in these and in addition have a good spread of the sample on demographic characteristics, we believe that our figure is a realistic estimate for the UK population.

Is 27% a high or low figure? Previous studies on use of nutrition information, based on retrospective self-reported behaviour, have reported much higher figures, with 40–60% of respondents claiming that they use nutrition information when shopping either always or often (e.g., ACNielsen, 2005; IGD, 2004; Safefood, 2004; Tesco, 2006, for a range of results in other European countries see the review in Grunert & Wills, 2007, and for results beyond Europe see also the review of Cowburn & Stockley, 2005). These numbers are in line with the results when questioning respondents how often they 'generally' look for nutrition information when buying the focal product category. It is widely accepted that measures of self-reported behaviour are affected by a social desirability bias leading to overreporting, and qualitative studies involving observation and verbal protocols (e.g., Higginson, Rayner, Draper, & Kirk, 2002a, 2002b; Malam, Clegg, Kirwan, & McGinigal, 2009) indeed suggest a much lower degree of usage. It is also widely accepted that shopping for groceries is characterised by habitual behaviour, heuristics, and fast and simple decisions (Grunert, 2006), and in this respect the 27% may appear as rather high. Our results suggest that self-reported behaviour, when compared to measures based on observation and subsequent interviewing on the concrete purchase, lead to overreporting of about 50%.

In-home questionnaire

Methodology

All respondents who agreed to take home and complete a longer survey and return it received a self-administered questionnaire, together with a return-addressed and stamped envelope. This questionnaire consisted of three sections, containing measures on nutrition knowledge, understanding of FOP nutrition label formats, and background information.

Nutrition knowledge

Our instrument for measuring nutrition knowledge contains three parts. The first part measured respondents' knowledge on *dietary recommendations* and consisted of 12 items measuring awareness of whether health experts recommend that one should have more, about the same, less or try to avoid a series of nutrients, calories or ingredients (fat, polyunsaturated fats, calories, sodium, saturated fat, whole grains, salt, trans fat, sugar, omega-3 fatty acids, fibre, monounsaturated fat), and 7 items measuring awareness of whether health experts recommend that one should eat a lot, some, a little or try to avoid different food groups (fruits and vegetables, starchy foods [bread, rice, pasta, potatoes], protein sources [meat, fish, eggs, beans], milk and dairy products, foods and drinks that are high in fat, foods and drinks that are high in sugars, foods and drinks that are high in salt). The former was adapted from the similar list in Parmenter and Wardle (1999) and the latter from an earlier UK Food Standards Agency (FSA) study (FSA, 2007a) in accordance with UK food-based dietary guidelines (FSA, 2007b). This resulted in a total of 19 items for the first part. The second part, also adapted from Parmenter and Wardle (1999) measured respondents' knowledge on *sources of nutrients* and asked them, for 18 different products, to indicate whether they were high or low in fat, saturated fat, salt and sugar, resulting in a total of 72 items for the second part. The third part measured respondents' knowledge on the *calorie content of food and drink products,* to give an indication of their knowledge of the approximate energy (calorie) content of specific food and drinks. For indicated serving sizes of 8 different products, respondents were asked to choose the amount of calories in that serving from a scale consisting of 7 calorie ranges. For analysis, the answer for each item was coded as right or wrong, and an overall index of nutrition knowledge was constructed according to the following formula:

$$\text{Nutrindex} = \left(\frac{\text{number of correct answers dietary recommendations}}{19}\right) + \left(\frac{\text{number of correct answers sources of nutrients}}{72}\right) + \left(\frac{\text{number of correct answers about the calorie content of food and drink products}}{8}\right)$$

Our measure of nutrition knowledge lives up to the requirement voiced by Axelson and Brinberg (1992) that such a measure should tap knowledge that allows people to make healthy choices. Awareness of expert recommendations about nutrients together with knowledge about which food products contain how much of these nutrients allows people to make healthier choices. One could go one step further and consider our measures of understanding of nutrition label formats, described below, as an additional component of nutrition knowledge, since this is also knowledge that contributes to people's ability to make healthier food choices. We have chosen to keep nutrition knowledge and understanding of nutrition labels conceptually distinct, since we want to investigate causal relationships between the two constructs. Compared to the Parmenter and Wardle (1999) measure of nutrition knowledge, our measure of nutrition knowledge thus covers the first two of their four key constructs, namely *awareness of experts' dietary recommendations* and *knowledge of food sources of nutrients*, whereas our measures of understanding nutrition labels can be conceived as mapping part of their third key construct, namely *practical food choice*. In this study we do not cover their fourth key construct, *awareness of diet-disease associations*.

Understanding of FOP nutrition label formats

Understanding of nutrition labels was measured with regard to the two major FOP formats existing in the UK, notably guideline daily amount labels and traffic light labels, both based on energy and four key nutrients: fat, saturated fat, sugar and salt. We distinguish conceptual understanding and substantive understanding. In addition, we measure health inferences. Inferences go beyond understanding, but build on the understanding achieved (Kardes, Posavac, & Cronley, 2004). We also measured subjective understanding on a scale from 1 (do not understand at all) to 10 (understand completely) for both GDA and TL formats.

Conceptual understanding refers to whether respondents understand, at the general level, the meaning of the concept of GDAs or the meaning of the colours in the TL scheme. Conceptual understanding of GDAs was measured by multiple choice questions on the definition of GDA [(a) guide to the amount of different foods a person should be eating in a day; (b) guide to the minimum amount of energy (calories) and some nutrients (e.g., fat, saturated fat/saturates, salt, sugars) a person should be eating in a day; (c) exact amount of energy (calories) and some nutrients (e.g., fat, saturated fat/saturates, salt, sugars) a person should be eating every day; (d) guide to the amount of energy (calories) and maximum amount of some nutrients (e.g., fat, saturated fat/saturates, salt, sugars) a person should be eating in a day], on the interpretation of a GDA for fat of 70 g [(a) an average adult should eat at least 70 g fat a day; (b) an average adult should eat exactly 70 g fat a day; (c) an average adult should eat no more than 70 g fat a day], and on whether the reference for GDAs is per 100 g, per serving or both/none of these. Conceptual understanding of traffic lights was measured by multiple choice questions on the meaning of the three colours [(a) I should try not to eat this product; (b) it's fine to have this product occasionally or as a treat; (c) this is an ok choice most of the time; (d) this is an ok choice all of the time; (e) this is a healthier option], and on whether the reference for assigning a colour is per 100 g (or per 100 ml), per serving or both/none of these.

Substantive understanding refers to whether respondents interpret the information on the label correctly. It was measured by presenting respondents with pictures of packaging of three actual ready meals (both front and back of pack) and asking them which of these were lowest in saturated fat per serving, lowest in calories per 100 g, contains the highest GDA for sugar, provides you with more than half of the GDA of fat, and contains the most salt (this is comparable to tasks used in earlier studies by the FSA, 2005 and Which, 2006). Respondents recruited at retailers A and B

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Table 2
Health inferences based on complete package information (answers in % of questionnaires returned, correct answers for healthiest product in bold, all products were pasta-type chilled ready meals).

% is % GDA for that nutrient	Healthiest	2nd Healthiest	3rd Healthiest	Not answered
Retailer A – GDA label, nutrition table per pack/per 100 g on back				
Product 1: calories 559/28%, sugar 2 g/2%, fat 29.6 g/42%, saturates 15.6 g/78%, salt 2.4 g/39%	4.2	**83.7**	7.1	5.1
Product 2: calories 400/20%, sugar 4.4 g/5%, fat 8.8 g/13%, saturates 4.8 g/24%, salt 1.8 g/30%	**87.5**	5.9	2.4	4.2
Product 3: calories 615/31%, sugar 12.2 g/14%, fat 40.1 g/57%, saturates 16.4 g/82%, salt 2 g/33%	3.7	5.9	**85.4**	5.0
Retailer B – TL label, nutrition table per pack/per 100 g and GDAs on back				
Product 1: calories 376/green, total sugars 4.6 g/green, fat 7.3 g/green, sat fat 4.2 g/amber, salt 2.1 g/amber	**83.7**	5.6	6.1	4.6
Product 2: calories 618/amber, total sugars 11.4 g/green, fat 35.5 g/red, sat fat 16.1 g/red, salt 1.9 g/amber	7.1	18.8	**69.9**	4.3
Product 3: calories 569/amber, total sugars 9.2 g/green, fat 29.8 g/red, sat fat 16.0 g/red, salt 1.9 g/amber	4.5	**72.1**	19.1	4.3
Retailer C – GDA/TL hybrid label, nutrition list per 100 g on back				
Product 1: calories 585/29%/amber, sugar 7.9 g/9%/green, fat 27.4 g/39%/red, sat fat 17.3 g/87%/red, salt 2.1 g/35%/amber	2.4	7.4	**84.2**	6.1
Product 2: calories 536/27%/amber, sugar 6 g/7%/green, fat 24 g/34%/red, sat fat 9.2 g/46%/red, salt 2 g/33%/amber	8.1	**82.8**	3.0	6.1
Product 3: calories 323 g/16%/green, sugar 5.6 g/6%/green, fat 9.2 g/13%/green, sat fat 5.2 g/26%/amber, salt 1.2 g/20%/amber	**82.8**	6.4	5.7	5.1

completed this task twice, once with a set of retailer A's products bearing GDA labels, and once with a set of retailer B's products that included a TL label. Respondents recruited at retailer C completed the task only once with a set of retailer C's products bearing a FOP hybrid label, containing both GDAs and TLs and *high*, *medium* or *low*. The different sets (each containing three products) were selected from the three retailers' actual selection of ready meals, and therefore the three sets of products differed not only in the nutrition information provided on the pack, but also slightly in their actual nutritional composition. However, products were selected with the aim of making the three sets as uniform and comparable as possible, while keeping the realism resulting from using actually available products. The stimulus material is described in Table 2.

In addition, two other measures addressed specifically the question on whether people can distinguish and use correctly the percentage GDAs as distinguished from the nutrient content in absolute terms on a GDA label. Respondents received two multiple choice questions, one on the correct interpretation of a particular piece of information on the GDA label on a packet of crisps, and the other based on GDA labels on three different products (a breakfast cereal, a soft drink and a yoghurt). Respondents were asked whether consuming a serving of each of these on a particular day would lead to the amount of sugar consumed on that day being more than the GDA, equal to or less than the GDA for sugar.

Health inferences refers to the question whether respondents can use the label information to distinguish products in terms of their nutritional healthiness (previous studies measuring health inferences include Feunekes, Gortemakers, Willems, Lion, & van den Kommer, 2008; Malam et al., 2009; Which, 2006). Three tasks measured health inferences. The first two tasks involved presentation of FOP nutrition labels only, with no additional information about the product. In the first task, respondents were presented with two labels for a fictitious product and asked to indicate which one was healthier. One alternative dominated the other in that the labels were equal on sugar and salt and one was higher than the other on fat, saturated fat and calories, even though both labels had the same traffic light colours. In the second task, respondents were presented with three labels for a portion of a fictitious pasta ready meal and asked which product was healthiest and which was least healthy. None of the alternatives was clearly dominant in terms of nutritional healthiness; they varied by fat, saturated fat, salt or calorie content, representing real life. These tasks were administered with both GDA labels and TL labels for respondents recruited at retailers A and B. The figures differed slightly for the GDA and TL to avoid respondents thinking that the fictitious products shown for GDA and TL were the same products, which could result in the respondents not making the effort to judge them again and to copy their first answer. The hybrid label (TL colour-coded GDA with *high*, *medium* or *low*) was used for respondents recruited at retailer C. Finally, for the third task, respondents were asked to rank the three actual ready meals used in the substantive understanding task in terms of healthiness. Here, ranking the products in terms of healthiness was clear from objective nutritional considerations. The ranking was previously agreed by nutritionists at the European Food Information Council, and was based on the levels of fat, saturated fat, sugar and salt, and calories, in the products. The ranking task was supplemented by an open question asking the respondent to list up to three informational items on which they had based their ranking.

Background information

In addition to the demographic information already collected in the store, respondents were asked to indicate their weight and height, allowing the computation of BMI. Interest in healthy eating was measured using 7 items developed by Roininen, Lähteenmäki, and Tuorila (1999) (the 8th item in this scale – *I do not avoid foods even if they may raise my cholesterol* – was omitted as not all respondents may be familiar with cholesterol; this item also had the lowest item-total correlation in the original study by Roininen et al.). These items were converted into a mean score for further analysis (Cronbach's α = .85). The questionnaire also contained a few other measures not reported in this paper.

Results: in-home questionnaire

Nutrition knowledge

Expert recommendations. Most respondents answered correctly most questions on expert recommendations for nutrients, or, if they erred, they tended to choose the more extreme answer—notably the answer *try to avoid* instead of the correct *have less*. If *try to avoid* (extreme answer) is coded as correct in addition to the *have less* (correct answer), more than two thirds of respondents answered correctly the questions on fat, calories, sodium, whole grains, salt, trans fat, sugar, fibre and omega-3 fatty acids. The exception are the questions on polyunsaturated fat and monounsaturated fats, where not more than 25% could provide the correct answer. Regarding recommendations on food groups intake, almost all respondents knew that one should eat *a lot* of fruits and vegetables, and more than two thirds answered correctly that one should eat *some* protein sources and dairy products. As for foods and drinks high in fat, sugar or salt, most respondents answered that one should *try to avoid* these; this is in line with the FSA (2007a) omnibus survey, where over 50% of respondents answered *try to avoid*.

If one regards *try to avoid* as correct together with *eat a little* (correct answer), more than 90% answered correctly. The only exception is starchy foods, where 78% believed one should eat *some* instead of the correct answer *a lot*. The mean number of correct answers on expert recommendations was 14.4 out of 19.

Sources of nutrients. For the questions asking whether 18 different products were high or low in fat, saturated fat, salt and sugar, the average number of correct answers was 49.6 out of 64. Respondents got most of the fat and saturated fat items right, with smoked salmon (63% believe it is low in fat), margarine (65.9% believe it is high in saturated fat) and regular yoghurt (58% believe it is low in saturated fat) being the major exceptions. For sugar, the most common error was respondents believing that regular yoghurt is high in sugar.

Calorie content. As respondents had to find the right range of calories among 7 intervals (up to 40, 41–100, 101–200, 201–300, 301–400, 401–480, more than 480), this task was more difficult, with on average 3.3 correct answers out of 8 items. Most errors were in adjacent categories, though. The most common mistakes were with regard to a pint of beer and a 120 ml glass of wine, for which most respondents overestimated the calorie content.

As noted above, answers to these questions were converted to an index for nutrition knowledge where expert recommendations, sources of nutrients and energy contents of food and drink products entered with equal weight. This index, with a range from 0 to 3, had a mean of 1.6 and a standard deviation of .39.

Understanding of FOP nutrition label formats

Subjective understanding. Means of the subjective understanding scale were 7.0 for GDA labels and 6.9 for TL labels on a 10-point scale with 1 = *don't understand at all*, and 10 = *understand extremely well*.

Conceptual understanding. 61% of the respondents could correctly identify GDAs as guide to the amount of energy (calories) and maximum amount of some nutrients (e.g., fat, saturated fat/saturates, salt, sugars) a person should be eating in a day. 47% correctly answered that GDAs are per serving of the food, and 89% correctly answered that a GDA for fat of 70 g means that an average adult should eat no more than 70 g fat a day. 23% answered correctly that TLs can be both per 100 g and per serving. When measuring perception of colour meaning for TLs, respondents were asked to pick, for each colour, one – and only one – meaning out of the list provided. Even so, 67% of respondents ticked more than one answer for at least one of the colours, typically amber or red. This indicates that respondents had some difficulty in distinguishing meanings that differed in degree of severity. Respondents had a tendency to overinterpret the meaning of the amber and red colours—57% chose the answer it's fine to have this product occasionally as a treat for amber (whereas the FSA's definition of amber is this is an OK choice most of the time), and 73% chose the answer I should try not to eat this product for red (where the FSA's definition is it's fine to have this product occasionally as a treat).

Substantive understanding. Percentages of correct answers when respondents were asked to characterise three ready meals with regard to a number of nutrients varied between 72% and 92%, indicating a high level of proficiency in using label information independent of the format in which this information appears. Also, 74% of respondents interpreted the single GDA label on a packet of crisps correctly, and 76% answered correctly that when eating one recommended serving each of a breakfast cereal product, a 330 ml can of soft drink and a 125 g yoghurt, the total sugar intake would be less than the GDA for sugar.

Results on health inferences are in Table 2 and Fig. 3a and b. When ranking three ready meals on healthiness, based on pictures of the packages, including one of the three FOP formats, percentages of respondents correctly identifying the healthiest option varied between 83% and 88%, indicating high levels of proficiency in nutrition information use independent of the format used (Table 2). When coding the answers to the open question asking which information their judgement was based upon, the most frequent answer was fat content, followed by calories, salt, saturated fat and sugar. These results are specific for the ready-meal category and can be expected to look differently for, for example, products rich in sugar.

When asked to identify the healthier option out of two where only the FOP nutrition label information was present, and where one of the options was dominant, but the TLs were the same overall for the two products, between 78% and 88% of the respondents gave the correct answer (Fig. 3a).

Fig. 3b shows the results of having to identify the healthiest option based on three labels where none was dominant. Results indicate that fat and calorie levels drive health inferences more than levels of salt or saturated fats.

Discussion

Our results show that the majority of respondents had little difficulty in understanding FOP nutrition information, and in putting it to use in making inferences about the healthiness of products. Traffic lights are to some degree self-explanatory, though our results indicate that consumers may overinterpret the severity of the amber and especially red colours. Most respondents had a good understanding of the GDA concept and could apply the figures in the correct way. Misconceptions appeared for both systems mostly with regard to whether some of the information referred to portions or 100 g. Most importantly, when asked to use label information to make inferences about the healthiness of the products, most respondents had no difficulties doing this. And this was true for all three label formats tested—GDA, traffic lights, and TL colour-coded GDAs.

This result is in line with other recent research from the UK (Malam et al., 2009), where label formats varied systematically with regard to major components (including traffic light colours and GDA percentages), and which did not differ systematically in enabling respondents to make correct intra-category product comparisons with regard to their healthiness. It differs, however, from other pairwise comparison tasks conducted in laboratory settings in Australia (Kelly et al., 2009) and in Germany (Borgmeier & Westenhoefer, 2009), where traffic light labels led to higher rates of correct answers compared to GDA-type formats, even though the base rate of correct answers also here was high across all label formats.

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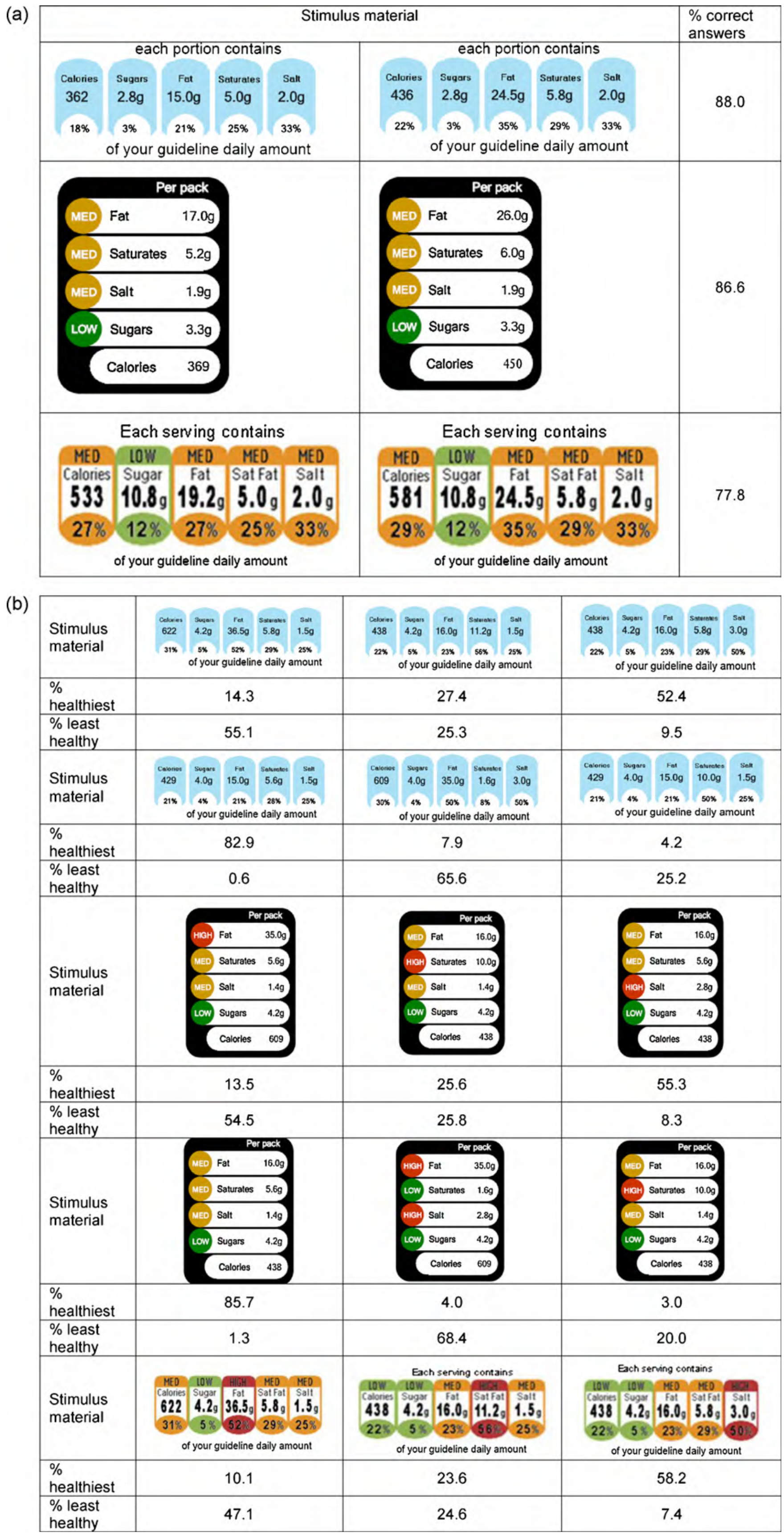

Fig. 3. (a) Health inferences based on FOP label only, one dominant alternative (Task 1) (answers in % of questionnaires returned, labels were presented as two labels showing the nutrient content in a 150 g portion of quiche for shoppers at retailers A and B, in a 350 g portion of a pasta ready meal for shoppers at retailer C, respondents should indicate which product was healthiest). (b) Health inferences based on FOP label only, no dominant alternative (Task 2). (answers in % of questionnaires returned, labels were presented as three labels showing the nutrient content in a 350 g pack (1 portion) of different pasta ready meals, respondents should indicate which product was healthiest and which product was least healthy).

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(c)

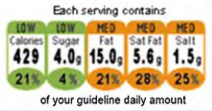
Stimulus material			
% healthiest	83.8	6.4	2.7
% least healthy	0.7	64.0	17.8

Fig. 3. (*Continued*).

Relationships between demographics, nutrition knowledge, interest in healthy eating, use of nutrition information when shopping and understanding of nutrition label formats

Previous research has suggested that use and understanding of nutrition information on food labels is related to demographic characteristics, notably social grade, age, gender, and having children in the household (see Drichoutis, Lazaridis, & Nayga, 2006, Grunert & Wills, 2007, for overviews). Our data allow us to test for presence of such relationships. More importantly, since we have a measure of nutrition knowledge and a measure of interest in healthy eating, we can also investigate how such factors may be at work in influencing use and understanding of nutrition information. Demographic factors are not usually causal predictors in themselves, but rather serve as proxies for something else. For example, higher social grade may lead to more interest in healthy eating and better nutrition knowledge, which in turn may affect use and understanding of nutrition information, or it may affect use of nutrition information in other ways, for example by better access to stores that have a broad selection of goods carrying that type of information. Our data allow us to see how demographic factors affect use and understanding of nutrition information both directly and indirectly, mediated by nutrition knowledge and interest in healthy eating.

In order to analyse such direct and indirect effects, we need to estimate a series of regressions in line with classical mediation analysis (Baron & Kenny, 1986). We try to explain use of nutrition information by logistic regression and understanding of nutrition information by linear regression. For all dependent variables, the analysis proceeds in two steps. First, we try to explain the dependent variable by the demographic predictors. Then, in a second step, we enter the nutrition knowledge index and interest in healthy eating into the equation. If the nutrition knowledge index and interest in healthy eating partly mediate the effects of the demographic variables, the effects of the demographic variables should decrease in the second step. In the effect of complete mediation, they should become insignificant. We then run an additional regression where we explain nutrition knowledge and interest in healthy eating by the demographic variables.

Three dependent variables were used, one for use of nutrition information when shopping and two for understanding of nutrition information formats. For use of nutrition information when shopping, the dichotomous variable from the in-store interview, specifying whether respondents had looked for nutrition information when selecting the product, was used. For understanding of nutrition information formats, an index was constructed that combined substantive understanding and health inferences from the most realistic of our tasks, where respondents had to assess three different ready-meal products. More specifically, we constructed the index by counting the number of correct answers related to the task where respondents evaluated and ranked three ready meals (described in Table 2), using both the task on substantive understanding of the label (correct answers about content of key nutrients in the ready meals) and on health inference (correct ranking of the three products in terms of overall healthiness, see Table 2). Three such indices were constructed, one for the set of products from retailer A carrying a FOP GDA label, one for the set of products from retailer B carrying the FOP TL label with GDAs BOP, and one for the set of products from retailer C carrying the hybrid TL colour-coded GDA label with *high*, *medium* and *low*. As demographic characteristics we use age, gender, social grade, having children under 16 in the household, and BMI. As potential mediators we use the nutrition knowledge index and the mean score from the interest in healthy eating scale. These variables are described in the methodology section and summarised in the table in Appendix B.

Table 3 shows the results of the logistic regression explaining whether respondents looked for nutrition information in the store. The major effect is the product category the choice was about:

Table 3
Determinants of use of nutrition information in store (logistic regression).

Dependent variable: NIUSE	*B*	Sig.[a]	Exp(*B*)
Step 1: Demographics only—Nagelkerke R Square = .07			
PROD (base: salty snacks)		.00	
Ready meals	−.01	.97	.99
Soft drinks	−.15	.65	.86
Yoghurts	.73	.01	2.07
Cereals	.35	.22	1.42
Confectionery	−.67	.05	.51
GENDER (base: female)	−.15	.22	.85
SOC (base: E)		.36	
A–B	.50	.12	1.69
C1	.31	.32	1.37
C2	.50	.14	1.66
D	.03	.94	1.03
CHILD (base: no)	−.09	.65	.91
AGE	.01	.22	1.01
BMI	.01	.42	1.01
Constant	−2.057	.00	.128
Step 2: Demographics + nutrition knowledge. Interest in healthy eating—Nagelkerke R Square = .12			
PROD (base: salty snacks)		.00	
Ready meals	−.15	.63	.86
Soft drinks	−.15	.66	.86
Yoghurts	.63	.03	1.88
Cereals	.23	.45	1.26
Confectionery	−.83	.02	.44
GENDER (base: female)	.03	.89	1.03
SOC (base: E)		.60	
A-B	.21	.56	1.23
C1	.07	.83	1.07
C2	.39	.29	1.48
D	−.11	.80	.90
CHILD (base: no)	.03	.90	1.03
AGE	.01	.49	1.05
BMI	.02	.40	1.01
HEALTHINT	.57	.00	1.77
NUTRINDEX	.46	.09	1.60
Constant	−4.79	.00	.01

[a] Based on Wald statistic.

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Table 4
Determinants of understanding of nutrition information on ready meal packages (regression).

	Dependent variable: AUND		Dependent variable: BUND		Dependent variable: CUND	
	B	Sig.	*B*	Sig.	*B*	Sig.
Step 1: Demographics only						
Intercept	6.73	.00	6.29	.00	7.07	.00
GENDER (base: female)	−.314	.11	−.26	.24	−.33	.37
SOC (base: E)						
A–B	1.54	.00	1.49	.00	1.45	.01
C1	1.48	.00	.77	.02	.54	.25
C2	1.47	.00	.72	.04	.79	.13
D	.84	.03	.34	.41	.51	.36
CHILD (base: no)	−.47	.01	−.15	.45	−.07	.84
AGE	−.03	.00	−.03	.00	−.02	.15
BMI	.02	.37	.03	.19	−.02	.53
R Square	.13		.09		.06	
Step 2: Demographics + nutrition knowledge, interest in healthy eating						
Intercept	4.18	.000	2.97	.000	5.02	.00
GENDER (base: female)	−.14	.47	−.17	.410	−.34	.32
SOC (base: E)						
A–B	.79	.01	.70	.044	1.26	.02
C1	.83	.00	.07	.820	.55	.24
C2	.92	.00	.11	.757	1.09	.03
D	.62	.08	.06	.881	.93	.09
CHILD (base: no)	−.44	.01	−.11	.567	−.03	.91
AGE	−.02	.00	−.02	.002	−.01	.34
BMI	.01	.54	.02	.189	−.02	.34
HEALTHINT	.18	.09	.29	.016	−.12	.46
NUTRINDEX	1.33	.00	1.54	.000	1.50	.00
R Square	.17		.16		.14	

Looking for nutrition information is most likely when the product category is yoghurt, i.e., a category with a healthy image, and least likely for the category confectionery, i.e., an indulgence product. It can be seen that none of the demographic factors has a direct significant effect on use of nutrition information. The only significant effect at the .01 level in addition to product category is obtained when entering interest in healthy eating into the equation. Nutrition knowledge has a weakly significant effect ($p = .09$).

As Table 5 shows, both interest in healthy eating and nutrition knowledge are, in turn, affected by demographic factors. Women are more interested in healthy eating than men. The age effect is opposite for the two variables: older respondents have more interest in healthy eating, but less nutrition knowledge. People with a higher BMI have less interest in healthy eating, as do people who have children under 16 at home. The Sobel test statistic for indirect effects in mediation analysis shows that gender, social grade, having children and age (but not BMI) have significant ($p < .05$) indirect effects on use of nutrition information via their effect on interest in healthy eating, but not via nutrition knowledge.

Table 4 shows the results of the regression explaining understanding of label information in the three ready-meal tasks. When using only the demographic variables as predictors, social grade has significant effects on all three dependent variables. Only for the set of products carrying the TL label (BUND) is the effect clearly linear, though, with respondents having more correct answers the higher their social grade. For the task involving products with the GDA label (AUND), number of correct answers also rises with social grade, but levels off when reaching grade C2. For the task involving products with the hybrid label level (CUND), social grade E respondents had clearly lowest and social grade A-B respondents clearly the highest number of correct answers, with the rest in between. Age is related to understanding for both the GDA and TL labelled products, with younger people giving more correct answers. Having children under 16 in the household has an effect only for the GDA label task. Gender and BMI have no effect.

Table 5
Determinants of nutrition knowledge and interest in healthy eating (regression).

	NUTRINDEX		HEALTHINT	
	B	Sig.	*B*	Sig.
Intercept	1.59	.00	3.78	.00
GENDER (base: female)	−.04	.26	−.36	.00
SOC (base: E)				
A–B	.30	.00	.27	.02
C1	.23	.00	.19	.07
C2	.16	.00	.09	.44
D	.04	.48	.09	.50
CHILD (base: no)	−.02	.62	.−21	.00
AGE	−.01	.00	.01	.00
BMI	.00	.34	−.01	.04
R Square	.10		.10	

When nutrition knowledge and interest in healthy eating are introduced into the equation, the effects of demographic variables largely remain, but diminish considerably in size (Table 5). More nutrition knowledge leads to more understanding of label information in all three tasks; this is the strongest predictor in the equation. More interest in healthy eating leads to higher levels of understanding only for the TL label task. Linking the results in Table 5 again to the results in Table 4 and applying the Sobel statistic shows that both social grade and age have significant ($p < .05$) indirect effects on understanding via their effect on nutrition knowledge, in addition to the direct effects shown in the lower part of Table 5.

General discussion and limitations

General discussion

We found in the first part of the study that 27% of shoppers looked for nutrition information on food labels. The most interesting perspective on this figure emerges from comparing it with that part of the study addressing the question whether UK consumers are able to understand and apply information of the major FOP nutrition label formats. In the public debate on nutrition labelling, there seems to be a widespread assumption that the major hurdle against more use of nutrition information is that this information is difficult to understand for many consumers, and that finding the optimal format for FOP nutrition information therefore will be a major step towards increasing the usage rate of this information. However, our results show that degrees of understanding of nutrition labels are much higher than degrees of usage. While 27% of respondents used a nutrition label when making a selection in the store, the percentage of respondents coming up with correct health inferences was in the range of 70–90%. If one wants to increase the degree of usage of nutrition information on food labels, one might therefore ask why the high degree of ability to understand and use this information does not translate into equally high degrees of usage.

In answering this question, two aspects of our results are useful. First, we could show that degree of use of nutrition information depends on product category. It is highest for yoghurt, i.e., a product category that already has a healthy image, and lowest for confectionery, i.e., indulgence-type products. This is in line with earlier research suggesting that consumers are less interested in nutrition information for indulgence-type products (Directorate General for Health & Consumer Protection, 2005; FSA, 2005); on the other hand, our UK data do not support results from other countries that showed that consumers are especially interested in nutrition information for products with a high degree of processing, like ready meals (Mannell et al., 2006; Nordic Council, 2004). Our results thus suggest that encouraging more healthy choices may require different instruments for different product categories.

Secondly, our analyses of demographic determinants of both use and understanding are helpful. We could show that while demographic characteristics have an effect on both use and understanding, the causal mechanisms are quite different. Younger people and people in the higher social grades have higher levels of understanding, with part of this effect being mediated by higher levels of nutrition knowledge, whereas the remaining part may be interpreted as effects of education and intellectual ability. Understanding of nutrition information on food labels can therefore be regarded mainly as a question of nutrition knowledge. For determinants of use, however, the effect of demographics is completely mediated by interest in healthy eating. Interest in healthy eating was the only variable having a direct effect on use of nutrition information in the store, and it is higher for people in the higher social grades, for women and for older people (it is also somewhat lower for people with a higher BMI, and, surprisingly, for people living with children under 16). While the effect of demographics on understanding replicates earlier findings (e.g., FSA, 2004; Which, 2006), our analysis of determinants of actual use is novel and adds an interesting dimension.

In a nutshell, therefore, usage is a question of interest in healthy eating, whereas understanding is a question of nutrition knowledge. Understanding is of course a prerequisite for meaningful use – use by itself does not ensure that the information is used in the correct way – but since the level of understanding is much higher than the level of usage, the construct with most leverage for increased use of nutrition information is interest in healthy eating. One can therefore raise the question whether the debate on the best form of FOP nutrition labelling has concentrated too much on the question of understanding, and too little on the question of motivation for healthy eating.

The most important implication for labelling policy resulting from our study is that, while the provision of front-of-pack nutrition information on food products clearly can help consumers in comparing products according to their healthiness, this does not mean that the provision of this information also will result in its use. Only when labelling policy is embedded in a broader nutrition policy that uses multiple instruments to increase interest in healthy eating can both understandability, and use of nutrition information on food labels be expected to increase. Two major challenges appear in this context. One is that health and nutrition is only one among several choice criteria, and as our study also shows, mostly not the dominant one. As long as consumers perceive trade-offs between especially taste and health, interest in healthy eating will be limited. Making these trade-offs disappear is mostly a question for product reformulation and product development, not just a question of providing nutrition information. The other challenge is that many food purchase decisions are habitual. While our data suggest that a certain amount of deliberation does take place, decisions are relatively fast and cast in the history of previous purchases. Also, one label format may not fit all products. Indulgence type of products may call for different types of labels than products that already have a healthy image.

Limitations

In interpreting the results of the study, one should note that self-selection biases may be at work. Potential respondents who did not agree to be interviewed in the store may differ from those who did agree. Such differences are most likely related to how time-pressured these people were in the store, and this suggests that the actual rate of people who looked for nutrition information in the store may even be somewhat lower than the one measured in this study. Also, as already noted, another self-selection bias may have been at work with regard to those of the respondents interviewed in the shop who returned the in-home questionnaire and those who did not. We cannot rule out that those who returned the questionnaire had a somewhat higher interest in nutrition and healthy eating than those who did not.

Another limitation of the study is that the amounts of explained variance in the estimated models are relatively small, even when supplementing the demographic predictors with the measure of nutrition knowledge and the measure of interest in healthy eating. This suggests that other attitudinal and – with regard to use of nutrition information – situational variables are at work that were not captured in this study.

Finally, we should note that the results do not prove that the label information actually did change consumers' choices, compared to a situation where such information is not available or is not read by the consumer. Consumers may read the label but then reject the information in a trade-off with other choice criteria, or just use the information as an assurance of a choice already made. A recent study by Sacks et al. (2009) is the first published study analysing whether the introduction of labels did change the distribution of sales in the supermarket into a more healthy direction, and found no effects. This study, while pioneering, was based on relatively few products and a relatively short time frame, and is in need of replication with larger databases.

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Appendix A. Sources of nutrition information on package indicated by respondents

	Guideline daily amounts	Traffic lights	Health logo[a]	Specific claim	Nutrition grid[b]	Ingredient list	TL colour-coded GDA	Other	*n*
Retailer A									
Ready meals	80.0	.0	3.3	.0	13.3	6.7	.0	.0	30
Carb. soft drinks	65.0	.0	.0	5.0	20.0	10.0	.0	.0	20
Yoghurts	32.3	.0	.0	12.9	38.7	12.9	.0	3.2	33
Breakfast cereals	63.2	.0	2.6	5.3	28.9	.0	.0	.0	38
Confectionery	40.0	.0	.0	.0	30.0	10.0	.0	20.0	11
Salty snacks	54.5	.0	.0	4.5	40.9	13.6	.0	4.5	22
Retailer B									
Ready meals	7.4	59.3	7.4	.0	25.9	3.7	.0	3.7	27
Carb. soft drinks	50.0	10.7	.0	21.4	10.7	3.6	.0	7.1	28
Yoghurts	28.9	18.4	5.3	10.5	36.8	10.5	.0	5.3	38
Breakfast cereals	50.0	20.6	2.9	8.8	23.5	.0	.0	2.9	34
Confectionery	25.0	6.2	6.2	6.2	37.5	6.2	.0	18.8	17
Salty snacks	54.2	12.5	.0	4.2	25.0	4.2	.0	4.2	24
Retailer C[c]									
Ready meals	12.5	.0	8.3	8.3	25.0	12.5	37.5	.0	24
Carb. soft drinks	30.0	.0	5.0	20.0	20.0	15.0	.0	10.0	20
Yoghurts	20.0	.0	10.0	13.3	46.7	10.0	.0	3.3	30
Breakfast cereals	42.3	.0	7.7	3.8	34.6	7.7	3.8	.0	26
Confectionery	28.6	.0	7.1	7.1	35.7	28.6	.0	7.1	14
Salty snacks	37.5	.0	.0	6.2	25.0	25.0	.0	12.5	18

Row indicates % based on number of respondents who indicated that they had looked for 1 of the 4 key nutrients or calories on the package. Overall *n* = 454, and since respondents could have looked for more than 1 nutrient, % do not sum up to 100.

[a] Symbol on front of pack indicating that this product lives up to criteria entitling it to bear the logo.

[b] Table or list with nutrition information, usually on the back of the product.

[c] In Retailer C, the hybrid system of TL colour-coded GDA with *high*, *medium* or *low* was only present on ready meals and breakfast cereals.

Appendix B. Variables used in investigating determinants of use and understanding of nutrition information on labels

Name	Description	Scale	Comments
PROD	Product category	Nominal (6 levels)	From in-store interview
GENDER	Gender (male, female)	Nominal (2 levels)	From in-store interview
AGE	Age (uncoded)	Metric	From in-store interview
CHILD	Whether there are children under 16 in respondent's household	Nominal (2 levels)	From in-store interview
SOC	Social grade according to NS-SEC system (with grades A_B collapsed due to small *n* in A)	Ordinal (5 levels)	From in-store interview
BMI	Body mass index	Metric	Computed based on answers in in-home questionnaire
NUTRINDEX	Index of nutrition knowledge, based on number of correct answers to questions in expert recommendations, sources of nutrients and calorie content of food and drink products	Metric (range 0–3), higher values indicate more knowledge	Computed based on answers in in-home questionnaire
HEALTHINT	Interest in healthy eating, Roininen et al. scale	Metric (range 1–5), higher values indicate more interest	Computed based on answers in in-home questionnaire
NIUSE	Whether respondent had looked for nutrition information when selecting product in store	Nominal (2 levels)	From in-store interview
AUND	Understanding of nutrition information on 3 ready meals from retailer A (including GDA label), computed as number of correct answers to 5 questions about key nutrient content and ranking in terms of overall healthiness	Metric (range 0–8), higher values indicate more understanding	Computed based on answers in in-home questionnaire; respondents from retailers A and B only
BUND	Dto. for retailer B (including TL label)	Metric (range 0–8), higher values indicate more understanding	Computed based on answers in in-home questionnaire; respondents from retailers A and B only
CUND	Dto. for retailer C (including TL colour-coded GDA label)	Metric (range 0–8), higher values indicate more understanding	Computed based on answers in in-home questionnaire; respondents from retailer C only

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