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**A systematic review**  
of the research on  
**consumer understanding of**  
**nutrition labelling**

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### **A systematic review of the research on consumer understanding of nutrition labelling**

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# The European Heart Network (EHN)

The European Heart Network is a Brussels-based alliance linking heart foundations and other non-governmental organisations committed to the prevention of cardiovascular disease in 25 countries across Europe. EHN's mission is to play a leading role through networking, collaboration and advocacy in the prevention and reduction of cardiovascular disease so that it will no longer be a major cause of premature death and disability throughout Europe.

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# Executive summary

## 1 Introduction

The purpose of this systematic review was to examine published and unpublished research into consumer understanding of nutrition labelling. It was undertaken in order to inform the European Heart Network's (EHN) policy position on nutrition labelling and to provide a solid foundation for proposals for nutrition labelling in Europe that have a consumer and public health dimension.

The objectives of the review were to assess:

- To what extent do consumers understand and make use of nutrition labelling as currently found on food packets in Europe?
- To what extent could consumer understanding of nutrition information be enhanced by i) improving the format of nutrition labelling or ii) educational initiatives?
- What gaps exist in current research in this area?
- What further research is suggested by the review and which methods would be most appropriate to address key outstanding research questions?

## 2 Method

The review searched international sources for published and unpublished research into consumer understanding of nutrition labelling which may be culturally applicable in Europe. A comprehensive search was carried out using criteria for including and excluding papers. Eligible studies were assessed for scientific quality. Further details of the methods used are given in the Appendix. The review looked at the provision of nutrition labelling for a range of population groups, in a variety of situations except catering outlets. Studies assessing whether consumers looked at nutrition labels and their knowledge, or attitudes, or beliefs, or perceptions, or understanding, or preferences for or ability to use nutrition labelling were all included, as were any interventions designed to enhance consumer understanding and use of nutrition labelling. Papers reporting any type of study design and any type of process or outcome measure were considered for inclusion in the review.

In this review, nutrition labelling refers to the nutrition information panel provided on the pack. The primary focus of the review was consumer understanding of nutrition labelling, particularly their understanding and use of different formats that have been used to present this information. Research into broader aspects of food labelling, such as brand naming and package design, was excluded.

Because one of the objectives of the review was to seek information about the enhancement of consumer understanding of nutrition information,

research about educational initiatives at point-of-purchase, such as shelf labelling schemes, was included. Research identified through the search strategy relating to nutrition claims was also included, although this was not the primary focus of the review. However, an assessment of consumer understanding of other types of nutrition information provision (such as ingredient listing, health claims and quality assurance schemes) was excluded.

## 3 Results

### 3.1 Overview

The search strategy resulted in the identification of 307 papers. Of these, 177 papers were screened and excluded from the review because they failed to meet the agreed inclusion criteria. A total of 130 studies were eligible for inclusion in the review. One of these studies was too costly to purchase and was also excluded from the review. 55% of the papers included reported studies from the USA and Canada. 53% of the studies used quantitative observational methods. Most studies included used adult population samples. Some studies specifically targeted primary food shoppers within households. These studies generally reported a gender bias, with a greater number of female participants compared with male subjects. The majority of studies used mainly white populations with only one study particularly exploring nutrition labelling issues with a minority population group. Four papers reported studies which focused on low income populations.

This review used a systematic approach to searching and assessing the existing worldwide evidence base on nutrition labelling. Although we attempted to be comprehensive, it is likely that some studies will have been missed in the reviewing process. However, this review is presented as the most thorough review of the evidence on nutrition labelling to date.

About half of the papers included in the review reported studies based in the USA. Although one third of papers looked at nutrition label use in countries in Europe, most of these studies were from the UK. The remaining European studies that were based outside the UK mostly took place in northern Europe (in the Scandinavian countries, Ireland, the Netherlands and Germany). We found no studies which met our inclusion criteria from southern European countries.

Of the 129 papers included in the review, only 10% (12) papers were judged to be of high or medium-high quality. Most papers were of moderate quality and others had significant methodological flaws. Of all the studies included in the review, only about one third took place in realistic settings, with people actually making food purchase decisions. Many studies also relied on subjective, self-reported measures of use and understanding and some studies used samples of volunteer participants whose views and use of nutrition labelling may not be typical of the general population. This makes it difficult to use the evidence base to build up a picture that



accurately reflects consumers' habitual understanding and use of nutrition labelling.

There are methodological challenges of assessing the value of a mixed evidence base such as was identified during this review. Our approach has been to assess each paper individually against a set of established criteria and to weight our conclusions towards the higher quality evidence. However, we acknowledge that a wider debate exists around these criteria and their use. Weighting the evidence in this way also means that our conclusions are largely based on a relatively few studies.

Recommendations drawn from the existing research need to be considered in the context of these limitations of the review.

Two broad types of nutrition labelling format were found in the literature. Single nutrient formats require consumers to consider each single nutrient in order to assess the nutritional composition of the product. Within this format, two types of labelling were found a) numerical information (including the standard nutrition labelling format in many countries) and b) non-numerical formats that aim to represent the nutritional composition of the product in a verbal or graphical way. Integrated nutrition labelling (for example, healthy logo schemes) aims to help consumers make a choice based on the overall nutritional composition of the product rather than based on an assessment of each single nutrient.

### **3.2 Do consumers look at nutrition labelling?**

This review has found that many consumers report looking at nutrition labels during food purchase.

- Most people claim to look at nutrition labels often or at least sometimes. Some claim that looking at labels influences their purchases, especially for unfamiliar foods.
- Label readers report using nutrition labels to avoid certain nutrients and to assess the specific nutrient content (particularly fat, calories and sugar) of different products.
- Men are less likely to report an interest in reading nutrition labels. Women, those on a higher income and people who have attained a higher level of educational achievement are most likely to report looking at labels. The label reading habits of older people is unclear.
- Those with a special interest or positive attitude to diet and health are more likely to report higher levels of label reading.
- There is some evidence that label reading is associated with some aspects of diet quality although the nature of this relationship remains unclear.

Although reported use of nutrition labels is high, more objective measures suggest that actual use of nutrition labelling during food purchase may be much lower. Reported reasons for non-use of nutrition labels include lack of time, the presentation of the information, lack of understanding of terms and concerns about the accuracy of the information.

### 3.3 Can consumers understand and use nutrition labelling?

It seems likely that, generally, consumers who look at nutrition labels can understand some of the terms used but are confused by other types of information. They can make simple comparisons between similar products using nutrient composition information similar to that provided on European food labels, but their ability to accurately interpret the nutrition label reduces as the complexity of the task increases.

Consumers particularly seem to find it difficult to use nutrition label information to place an individual product into the context of their overall diet. Adding some kind of benchmark, whether numerical (e.g. percentage of dietary reference values which is used in the USA, or guideline daily amounts used on a voluntary basis in the UK) or non-numerical seem to help consumers make this kind of judgement. Of the non-numerical labelling systems, people prefer bar charts but adjectival descriptors (words like high-medium-low) perform best in more objective tests of label usage. The use of 'healthy' logos on selected products has met with a mixed response.

There are indications in the literature that, not surprisingly, people both prefer and are better at using label formats with which they are familiar. It is not clear to what extent this is due to exposure to the format or due to educational initiatives which may have accompanied the introduction of a new format (as in the USA, where the label format was completely revised in 1994). Many studies consistently reported finding poor or moderate levels of general nutrition knowledge amongst their participants. However, we found very few reports of intervention studies which had attempted to address this nutrition knowledge deficit, so the impact of increasing knowledge on label usage is still unknown. Other interventions such as adding additional information at point-of-purchase (such as shelf tags) has prompted consumers to purchase 'tagged' products.

From the available evidence, labels with the following characteristics are most easily and effectively used by consumers:

### 3.4 Format/layout

- Using alignment lines (thinner rather than thicker)
- Using boxing and boldening information
- Using a standard format for all products
- Not having additional information panels and multiple columns
- Putting important information away from the 'dense' centre of a label
- Ensuring consistency amongst all of the information in the label, including the brand name, product name, any claims, or other information on the package

### **3.5 Order of nutrients/highlighting**

- The terms that appear to be best understood are fat and calories (or kilocalories), sugar, vitamins, and salt. Dietary fibre had an indeterminate position in this list.
- %DRV may be useful on the label, particularly to put the food item into the context of the overall diet. If it is provided, it is best if it is additional to information on absolute amounts as well as relative measurements (%DRV) for macronutrients. For micronutrients, relative information alone appears to be sufficient.

### **3.6 Language used to express terms**

- Non technical terms and language
- Not using terms such as percentage energy

### **3.7 Legibility/font size**

- Labels are easier to use if the printing is as large and clear as possible

### **3.8 Accuracy**

- Rounding decimals to the nearest whole number

### **3.9 Reference quantities – 100g/portion**

- People had difficulty converting information from grams per hundred grams to grams per serving. However, serving size information also proved difficult to interpret in some studies.

### **3.10 Reference to whole diets versus straight comparisons**

- Dietary reference values and guideline daily amounts have been shown to be useful in providing dietary context. Verbal descriptions (like high-medium-low) or graphical information (particularly bar charts) also help people in placing a food or nutrient in the context of their overall diet.

## **4 Conclusions**

Drawing firm conclusions and developing a framework for action to improve nutrition labelling in Europe is problematic when so little is known about consumer use and understanding of nutrition labelling in a European context. More work needs to be done to explore the needs of consumers in Europe, in particular those in southern Europe. Any research in this area should adopt robust methodologies, take place in realistic food

purchase settings and use objective measures of consumer use and understanding.

The complexities of the influences on food choice and behaviour change are well documented. It is essential to recognise the limited but important contribution that nutrition labelling can make to the promotion of healthy eating. Improvements in nutrition labelling can make a small contribution towards improving the currently hostile food choice environment. Such improvements must be set within a context of wider action to promote better nutrition across Europe.

There needs to be clarity about the purpose of nutrition labelling. Available evidence suggests that some consumers are able to use existing labelling to make comparisons between products. However, if nutrition labelling aims to enable consumers to assess a product in a wider dietary context, format changes may help more consumers with this task.

Little is known about how to motivate and encourage non-users to change their behaviour or about what types of interventions might improve consumers understanding and use of nutrition labelling. There is a need for further work in this area.

Any initiative aimed at helping consumers to understand and use nutrition labelling is likely to also require a concurrent consumer education and marketing strategy to be developed. The issues and terms about which there is most confusion are: the relationship between calories and energy; sodium and salt; sugar and carbohydrate; and the terms cholesterol and saturated fat, and fatty acids. If the label aims to put the food into the context of an overall diet, it is important that consumers understand the concept of dietary recommendations.

In summary, this review is the first systematic review of nutrition labelling which has been carried out. It presents the evidence on consumer preferences for different formats and explores whether they are able to use these formats for different types of tasks. The two main types of tasks are comparing the nutrient composition of different products, and assessing the contribution of a product to the overall diet. Formats similar to those currently used in Europe are adequate for the former, but the latter needs some dietary reference information similar to that provided in the USA.

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# Introduction

This review is a systematic examination of published and unpublished research into consumer understanding of nutrition labelling. It was undertaken in order to inform the European Heart Network's (EHN) policy position on nutrition labelling and to provide a solid foundation for proposals for nutrition labelling in Europe that have a consumer and public health dimension.

## 1 Review objectives

The objectives of the review were to assess:

- To what extent do consumers understand and make use of nutrition labelling as currently found on food packets in Europe?
- To what extent could consumer understanding of nutrition information be enhanced by i) improving the format of nutrition labelling or ii) educational initiatives?
- What gaps exist in current research in this area?
- What further research is suggested by the review and which methods would be most appropriate to address key outstanding research questions?

## 2 Background

Creating supportive environments that help people to make healthy choices is an important underlying principle of promoting health. Effective strategies strengthen the skills and capabilities of people to take action. The provision of nutritional information at point-of-purchase (for example, with on pack nutrition labelling) is one means of informing consumers about the composition of foods. Increasing such awareness may guide purchasing decisions by helping consumers assess the healthiness of a food and enabling them to make a healthy food choice if they so wish. However, the content and format of nutrition labelling on foods has primarily been a consequence of legislative requirements, rather than an aid to consumers in making choices. Several studies demonstrate the difficulty consumers face in understanding and using nutrition labelling in its current standard format.<sup>1,2</sup> Consumer and health groups and some governments have called for labelling that is comprehensive, clear and easier to use.<sup>3-6</sup> Because of this concern attempts have been made to develop voluntary formats that are more useful for consumers. Some of this work has been led by industry (for example, by the Institute of Grocery Distribution in the UK<sup>7</sup>) and some by consumer or pressure groups. In the USA, there has been a formal recognition that nutrition labelling should play a supportive role in nutrition education, resulting in a complete review of the legislation under the Nutrition Labelling and Education Act. This included several measures,

including mandatory labelling of all packaged products sold in the USA, intended for purchase by consumers.

Another approach, which goes beyond provision of nutrition labelling information, has been to develop educational initiatives on food composition, either in retail outlets alone, or in the wider community. Some of these have included a labelling component as an intrinsic part of the initiative. Examples of this include the 'Pick the Tick' scheme run by the National Heart Foundation in Australia,<sup>8</sup> the 'Green Keyhole' scheme in Sweden<sup>9</sup> and the 'Heart' symbol in Finland.<sup>10</sup> Other countries, including the Netherlands, have explored and rejected this approach.<sup>11</sup>

Some of the work describing consumer understanding of current nutrition labelling, alternative formats and educational initiatives has been published in the scientific literature. However, some information exists as limited circulation reports and unpublished information. The purpose of this review was to examine systematically all of the relevant literature in order to provide a solid foundation for proposals for nutrition labelling in Europe that have a consumer and public health dimension, in addition to the more traditional legal requirements.

## Methodology

The review searched international sources for published and unpublished research into consumer understanding of nutrition labelling which may be culturally applicable in Europe. A comprehensive search was carried out using criteria for including and excluding papers. Once this had been done, studies were rechecked against the criteria, and if they were eligible, their scientific quality was assessed. Full details about the review methodology are given in the Appendix.

In this review, the term nutrition labelling has been used to refer to the nutrition information panel provided on pack. The primary focus of the review was consumer understanding of nutrition labelling, particularly their understanding and use of different formats that have been used to present this information. Research examining consumer understanding of broader aspects of food labelling, such as brand naming and package design, was excluded.

There are other aspects of nutrition information, besides nutrition labelling, that may help consumers make food purchase decisions. Because one of the objectives of the review was to seek information about the enhancement of consumer understanding of nutrition information, research about educational initiatives at point-of-purchase, such as shelf labelling schemes was included. Research identified through the search strategy relating to nutrition claims was also included, although this was not the primary focus of the review. However, an assessment of consumer understanding of other types of nutrition information provision (such as ingredient listing, health claims and quality assurance schemes) was excluded.

Two broad types of nutrition labelling format are discussed in this review. The first format refers to nutrition labelling which provides information about a range of single nutrients. This type of nutrition labelling requires the consumer to consider each single nutrient in order to assess the nutritional composition of the product. Within this format, two types of labelling were found a) numerical information (including the standard nutrition labelling format in many countries) and b) non-numerical formats that aim to represent the nutritional composition of the product in a verbal or graphical way. In the case of non-numerical formats some degree of interpretation has usually been necessary to present numerical information in a different format.

The second format refers to nutrition labelling which provides integrated information about a range of nutrients. This type of nutrition labelling aims to help consumers make a choice based on the overall nutritional composition of the product rather than based on an assessment of each single nutrient. With this type of nutrition labelling (for example, healthy logo schemes where labelling of some type appears on foods with defined nutrient levels) judgements are made about which foods should carry information and which foods are not eligible.

Nutrition claims and point of purchase educational initiatives (like shelf labels in supermarkets) are considered separately.

The review looked at the provision of nutrition labelling for a range of population groups, in a variety of situations. However, nutrition labelling in the catering setting was not included. This was because the UK Food Standards Agency recently published a world-wide review on labelling practice for consumers in catering outlets.<sup>12</sup> This review therefore focused on interventions in other settings, for example, food retail outlets.

Studies assessing whether consumers looked at nutrition labels and their knowledge, or attitudes, or beliefs, or perceptions, or understanding, or preferences for or ability to use nutrition labelling were all included, as were any interventions designed to enhance consumer understanding and use of nutrition labelling. Papers reporting any type of study design and any type of process or outcome measure were considered for inclusion in the review.



## Results

### 1 Overview

The search strategy resulted in the identification of 307 papers which were assessed for possible inclusion in the review. Of these, 18 were duplicates of other papers and were thus excluded. In addition, 159 papers were screened and excluded from the review because they failed to meet the agreed inclusion criteria. Table 1 shows further information about the excluded studies, which are listed in 'References'.

Table 1: Excluded studies – reasons for exclusion

<i>Reason for exclusion</i>	<i>Number of studies n = 177</i>
Paper contained no consumer data - thought piece/ consumer help piece	74 (42%)
Library unable to locate paper by 3/12/02	34 (19%)
Study not related to food labelling	23 (13%)
Paper reported modelling but no original consumer data	13 (7%)
Duplicates	18 (10%)
Other reasons – paper reporting study not relevant to current labelling, study located in a catering setting, reporting health claims	15 (8%)

A total of 130 studies were eligible for inclusion in the review. One of these studies (Mintel 2002) was too costly to purchase and was thus excluded from the review. A full reference list of the 129 studies included is provided in 'References' and a supplementary report is available which provides a summary of information about each study prepared during the data extraction process. 55% of the papers included reported studies from the USA and Canada. Table 2 shows the country of origin of the papers included.

Table 2: Country of origin of included studies

<i>Country of origin</i>	<i>Number of studies n=129</i>
USA and Canada	71 (55%) of which 64 (90%) were from USA
European countries	43 (33%) of which 28 (65%) were from UK
Pacific countries (Australia, New Zealand, Hong Kong, Japan)	8 (6%)
International	6 (5%)
Others (South Africa)	1 (1%)

The papers included reported studies undertaken in a variety of settings. Most (50%) took place in general community settings, with 28% reporting studies in a retail setting. 8% of studies were located in educational institutions. The remaining studies either reported reviews or single studies in mixed settings or did not provide any setting information.

Most studies included used adult population samples with only two studies particularly targeting older people and one study focused on teenagers. Some studies specifically targeted primary food shoppers within households. There was a gender bias in these studies, with a greater number of female participants compared with male subjects. The majority of studies used mainly white populations with only one study particularly exploring nutrition labelling issues with a minority population group. Four papers reported studies which focused on low income populations.

Table 3: Study design of included studies

<i>Study design</i>	<i>Number of studies n=129</i>
Quantitative observational methods (e.g. cross sectional survey)	68 (53%)
Experimental	25 (19%)
Mixed designs	14 (11%)
Qualitative methods	12 (9%)
Reviews	8 (6%) of which 1 was systematic
Other methods (quasi-experimental, not enough information to judge)	2 (2%)

The papers included reported studies using a range of study designs. 53% of the studies used quantitative observational methods. Table 3 provides further information about the study design of the studies included.

Table 4 provides information about the quality assessment scores given to the studies included. Only six (5%) of these were assessed as high quality studies, meeting all the relevant criteria (see the Appendix). About one third (12) of experimental studies took place in retail settings. The majority of experimental research took place in a general community setting or educational institution. More details about the quality of the studies included are presented in the sections reporting the specific results of studies. In general, however, there were several common reasons why papers failed to meet some or all of the quality criteria for the relevant study design.

Many failed to provide enough information about, for example, recruitment and/or sampling of the study population, the characteristics of the sample and data collection and data analysis methods. Many had biased samples through, for example, convenience sampling or recruiting non-representative population groups such as people of higher educational achievement. Where relevant, some studies used no control or had a poorly matched control group. Nearly one third of studies (29%) used self reported measures of label use and few studies used validated measures. Only 16 papers (12%) reported a theoretical base to the study.

Some papers did report the limitations of their study.

Table 4: Quality assessment scores for included studies

<i>Quality assessment score</i>	<i>Number of studies n=129</i>
High	6 (5%)
Medium-high	6 (5%)
Medium/medium-high	1 (1%)
Medium	44 (34%)
Medium-low	43 (33%)
Low	21 (16%)
Insufficient information to assess	8 (6%)

## 2 Do consumers look at nutrition labelling?

### Summary

General findings which emerged from the studies included in this section, with an emphasis on those from higher quality research were:

- Most people claim to look at nutrition labels often or at least sometimes. Some claim that looking at labels influences their purchases, especially for unfamiliar foods.
- Label readers report using nutrition labels to avoid certain nutrients and to assess the specific nutrient content (particularly fat, calories and sugar) of different products.
- Reasons for not reading nutrition labels include lack of time, size of print on packages, lack of understanding of terms and concerns about the accuracy of the information.
- Men are less likely to report an interest in reading nutrition labels. Women, those on a higher income and people who have attained a higher level of educational achievement are most likely to report looking at labels. The label reading habits of older people is unclear.
- Those with a special interest or positive attitude to diet and health are more likely to report higher levels of label reading.
- There is some evidence that label reading is associated with some aspects of diet quality although the nature of this relationship remains unclear.
- Although levels of self reported label reading are generally high, studies using protocol analysis suggest that people may simply look at the nutrition information panel but not process the information further.

Seventy two (56%) of studies included addressed the question of whether consumers look at nutrition labels when they are buying food. Most studies were based on USA populations (30). Twenty eight studies came from European countries, with 19 (68%) of these using UK populations. Eight studies were from Australia or New Zealand (6), Hong Kong (1) and Japan (1). The remaining studies came from South Africa or were based in two countries, Sweden/USA and UK/USA.

In total, 52 of the studies (72%) used a quantitative observational design. Three studies combined an experimental method with quantitative observations and three used a qualitative design in combination with an experimental approach. Six studies combined qualitative and quantitative observational methods and six used qualitative methods alone. Two papers were reviews. Table 5 provides information about the quality assessment scores of these studies.

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*Quantitative observational studies**High quality*

Guthrie (1995) reported findings from the USDA 1989 diet and health knowledge survey using a weighted population sample. They found that most (71%) of main meal planners claimed to use nutrition labelling at least sometimes. The characteristics found to be positively associated with the likelihood of using in nutrition labels were having at least some college education, being female, living with others rather than living alone, being more knowledgeable about nutrition, believing that following the principles of the dietary guidelines for Americans is important, and being more concerned about nutrition and product safety and less about taste when shopping for food. Label use also appeared to be associated with the consumption of diets that were higher in vitamin C and lower in cholesterol but not with any other food component.

*Medium-high quality*

A Canadian paper (National Institute of Nutrition 1999) reported a survey of a weighted sample of nationally representative French-speaking adults who claimed to have diabetes or heart disease. 71% of participants indicated that nutrition-related information on food packages played at least a quite important role in their purchase decisions and a similar number (70%) claimed to refer to the nutrition information panel often or sometimes. Most participants were in favour of having nutrition information on all or most foods. The main reasons for this interest was the need to be informed about what one is eating (54%) and to have information for people on special diets (20%). Just over one third (38%) of this sample disliked nothing about current nutrition labels. Other participants offered criticisms related to the overall complexity (17%), insufficient (11%) and sometimes misleading (8%) information, and difficulty reading the information (9%). Of the 30% of Canadians who reported rarely or never using the nutrition information panel, most identified a lack of need due to their familiarity with the food products they eat (40%) or a general disinterest in the information provided (22%). 23% indicated that it takes too much time to read.

Neuhouser (2002) report a study of nutrition label use amongst adults taking part in the Washington State Cancer Risk Behaviour Survey. Data was adjusted to be representative of Washington State. Evaluation measures used in this survey were self reported label use and a validated fat/fruit and vegetable intake questionnaire. Almost 80% of the sample reported some use of food labels. The most frequently read component was fat, followed by calories (total and % fat) and cholesterol. Less than 30% reported reading % Daily Value. Overall, the strongest predictor of label use was a person's understanding of the importance of eating a low fat diet for health. Although no association was found between reported label reading and history of chronic disease, this survey reported that obese people were twice as likely to read calories and fat levels than healthy weight subjects. Gender differences were also reported, with women more likely to report reading information on serving size, calories and fat. Men

were more likely to read about cholesterol. Those aged over 35 were also more likely to report reading information about cholesterol whereas younger subjects were more likely to read about serving size, calories and fat. No associations were found with income levels. Those with a lower fat intake reported higher levels of label reading although this association was not found for fruit and vegetable intake.

### *Experimental/qualitative studies*

#### *Medium-high quality*

Black (1992) used discussion groups with women shoppers in social classes C1 and C2 to find out whether people read labels in order to inform an experiment around different label formats. Most participants claimed to look at nutrition labelling of foods, although some said they only looked occasionally. Participants reported looking for information about calories, sugar, fat, salt, fibre and additives. However they were mostly interested in fat content. The reported level of checking of labels increased with increasing interest in nutrition and health, with more interested people claiming to look at several different factors on labels compared with less interested participants who usually looked at only one factor.

A second UK study (Institute of Grocery Distribution 1998) also used small-scale discussion groups to explore consumer attitudes about nutrition labelling and to provide guidance for the development of the quantitative part of the study (reported in 'Results' – 3.1). Participants in this study reported most frequently looking at labels for information on fat and calories, followed by protein and sugar. Fibre and salt stimulated little concern.

#### *Medium quality*

Meuldijk (1996) gave a small sample of women shoppers a seven item shopping list and asked them to gather the product they would normally purchase for each item. They were then asked to shop again for the same seven items but instructed to choose corresponding products with less fat than the previous trip, using information on the food label. The women were subsequently interviewed individually to assess the reasons for the choices they had made. For many participants, the nutrition label was reported as the most important source of information in choosing low-fat products. However, 38% of participants said they did not use the nutritional value label at all in the second round. When it was used, it was often used to verify information from other sources such as claims, brand name, and product name.

### *Qualitative/quantitative observational studies*

#### *High quality*

Two papers (Higginson 2002a,b) report different aspects of the same UK study which was designed to explore directly how consumers read nutrition labels when shopping 'normally' and for 'healthy' foods. A small number of dietitians and members of the general public (n=14) were trained in the

techniques for verbal protocol analysis – a method which elicits participant's thoughts as they are undertaking a task. They then visited a supermarket, together with the investigator. On the first occasion they were instructed to undertake a 'normal' shop. On the second occasion the investigator presented the subject with a shopping list of nine different common types of food and asked her to shop for the healthier version of each of these. In the course of this second shopping trip, consumers were asked to undertake a number of tasks. During 'normal' shopping, nutritional labelling information was used during the choice of only 4% of products purchased and used by only four out of ten subjects (Higginson 2002a). Energy was the most popular type of information looked at, followed by fat. During the 'healthy' shop, eight items of label information were accessed per subject per product with fat being the most frequently looked at information, followed by energy, carbohydrate, saturated fat and sugar. Unsurprisingly, dietitians accessed more information than the general public subjects. Higginson (2002b) reports that much activity reported as nutrition label reading involves simply looking at the information without processing it further, even when seeking healthier foods.

#### *Medium-high quality*

Paterson (2001) reports a study which combined focus groups with intercept interviews of shoppers in Australia and New Zealand. They found that shoppers primarily report using food labels to assist in determining product choice while shopping, and also to learn more about the product in order to seek reassurance that is a 'safe' choice. Participants reported most usually reading labels when a new product is being considered, or when considering an alternative brand. Although most people reported reading labels at the point of selection, many consumers said that they felt pressured to make a quick selection and not get in the way of other shoppers, which limited their capacity to study labels. Parents of young children and the more health conscious were more likely to be interested in reading labels. The fat content was more usually monitored by people choosing food for themselves or their partner, whereas sugar content was evaluated by parents buying food for their children.

#### *Qualitative studies*

##### *Medium-high quality*

A small number of UK shoppers were asked to undertake a normal and healthy shopping trip in a supermarket (Wyn Thomas 1997). Protocol analysis was used to ascertain their thoughts during the process. Consumers were shown to use the nutrition information panel in less than 1% of purchases but this increased when prompted to shop for healthier products. However, about one third did not look at the nutrition information panel even when asked to select healthy items.

Table 5: Study design and quality assessment scores of studies of whether consumers look at nutrition labels

<i>Study design</i>	<i>Quality assessment score</i>	<i>No. of studies n=72</i>	<i>References</i>
Quantitative observational	High	1	Guthrie 1995
	Medium-high	2	National Institute of Nutrition 1999; Neuhouser 2002
	Medium	18	Anderson 2001; Bender 1992; Consumers' Association 1995; Crawford 1990; Dairy Crest Ingredients 1990; Edris 1991; Feick 1986; Food Standards Committee 1990; Food Standards Agency 2002; Geiger 1991; Hersey 2001; Levy 2000; McArthur 2001; Reid 1996; Scott 1994; Scott 1997, Smith 2002; Worsley 1996
	Medium-low	25	Abbott 1997; Baghurst 1995; Byrd Bredbenner 2000a,b,c; Byrd Bredbenner 2001; Cotugna 1998; Coulson 2000; Daly 1976; Glerum-Van der-Laan 1986; Institute of European Food Studies 1996; Kessler 1999; Kreuter 1997; Kristal 1988; Kroesbergen 1985; Marietta 1999; McCullum 1997; Michel 1994; Naismith 1990; Nayga 1998; Ozimek 1996; Sakamoto 2001; Shine 1997 a,b; Siu 1998;
	Low	4	Dunn 1992; Heimbach 1982; United Soybean Board 2002; Krinke 1990
	Insufficient information to assess	2	Mintel 2000; Pudal 1996
Experimental/quantitative observational	Medium	1	Byrd-Bredbenner 2000d
	Medium-low	1	Kloop 1981
	Low	1	Dooley 1998
Experimental/qualitative	Medium-high	2	Black 1992; Institute of Grocery Distribution 1998*
	Medium	1	Meuldijk 1996
Qualitative/quantitative observational	High	2	Higginson 2002a,b
	Medium-high	1	Paterson 2001
	Medium	3	Research Services Ltd 1995; Wandel 1996; Which? 1989
Qualitative	Medium-high	1	Wyn-Thomas 1997
	Medium	3	Food Standards Agency 2001; Miller 1997; Miller 1999
	Medium-low	1	UK Consumer Council 1997
	Insufficient information to assess	1	Balasubramanian 2002
Review	Medium	1	Derby 1994
	Medium-low	1	Reutersward 1999

\*the qualitative element of this paper was judged as medium and the quantitative methodology as medium-high



*Other studies*

The remaining studies largely support the findings outlined above. When asked, the majority of participants generally claim to look at food labels often or at least sometimes, during purchase or at home. Some claim that label reading always or sometimes affects their purchases. For example, some particularly look at the nutrition panel when making a new product purchase or looking at unfamiliar products. However, general reasons for not reading labels include lack of time, size of print on packages, lack of understanding of terms and concerns about the accuracy of the information. In general, men report less interest in looking at labels and some studies report that people with lower educational achievement and on those with a lower income are also less likely to read labels. Some studies suggest older people are less likely to look at labels but others suggest an opposite finding. Some studies also suggest that those with more positive attitudes towards diet and health or with a special interest in nutrition (for example those following a weight loss diet) were likely to report higher levels of interest in label reading.

### 3 Do consumers understand nutrition labelling?

There have been a variety of approaches to assessing consumers' understanding of food labelling. Broadly speaking these can be divided into a) those which rely on perceived understanding or expressed preferences (subjective measures) and b) those which aim to assess the performance (an objective measure).

Where possible these two broad approaches are differentiated in the presentation of the results in this review. However, some studies used both of these approaches, either in a structured way or unstructured way (for example a combination of subjective and objective approaches contained within the same questionnaire) and did not clearly differentiate. Where this was the case, it has not been possible to be clear in the review about which approach was used.

### 3.1 Preferences and understanding for terms used in nutrition labelling

#### Summary

General findings which emerged from the studies described in this section, with an emphasis on those from higher quality research were:

- Consumers regarded standard nutrition labelling as complex, especially the use of technical terms, and numerical information that required calculations. People also had difficulty in understanding the role that different nutrients mentioned on labels play in their diet.
- Nutrition knowledge relevant to the interpretation of nutrition information on labels was reported to be generally low.
- The terms that appeared to be best understood from studies using self reported measures (with some experimental evidence for fat) were: fat, calories (or kilocalories) (note: the order of fat and calories were reversed in some studies), sugar, vitamins, and salt. Dietary fibre had an indeterminate position in this list.
- The terms and concepts which appeared to be least well understood from self reported measures were the relationship between calories and energy; sodium and salt; sugar and carbohydrate; and the terms cholesterol and fatty acids. Experimental evidence supported the difficulty people found in understanding the terms saturated fat, and sodium.
- People had difficulty converting information from grams per hundred grams to grams per serving. However, serving size information also proved difficult to interpret in some studies.
- When percentage energy was used on labels it was not well understood.
- People had difficulty putting nutrition labelling information into the context of dietary recommendations if the label did not provide this context.
- Older people, the socio-economically disadvantaged and people with lower levels of education or income were likely to have the most difficulty understanding the terms used on food labels.

19 studies were identified which looked at consumers' preferences and understanding for the terms that are used in nutrition labelling. This includes both nutritional descriptors and units of measurement.

Most of the identified studies (9) were carried out in the UK, with five from the USA, two from European countries other than the UK (Germany and Holland), two from Canada, and one from South Africa.

The majority of studies (13) used a quantitative observational approach, and in four cases these also had an experimental component that probed people's understanding of terminology. One of these 13 studies was medium-high quality. Five were medium, four were medium-low, two were

rated as low, and it was not possible to assess one because of lack of information. Table 6 shows further details of the quality scores assigned to these papers.

Six studies used a qualitative approach, and two of these were judged to be medium-high quality, three were medium quality, and the remaining study was given a low rating.

#### *Quantitative observational studies*

These are cross sectional studies which use questionnaire or interview approaches to obtain quantitative information from a group of people. Some studies had a component that was experimental, and was applied to either all of the sample, or a sub-sample. This component generally consisted of a set of questions or test labels, and people were asked to either interpret or manipulate information.

#### *Medium-high quality*

The highest quality study that was identified (medium-high) was carried out in Canada, in a nationally representative sample of just over 1300 people (National Institute of Nutrition 1999). In-home interviews were carried out, including a component where respondents were asked about their understanding of six possible test labels. These test labels incorporated two alternative methods of declaring nutrient content, based on either weight (grams per 100g), or percentage of dietary recommendations. The findings which were relevant to this section were that: 17% of people criticised the overall complexity of the information on nutrition labels; 83% claimed some understanding of the information, 43% saying that they understood it very well. In particular, they felt confident about their understanding of the terms of fat, calories and sugar. However, there was confusion about the relationship between calories and energy. In relation to the measurements used on food packets, lack of understanding of the serving size information appeared to be a barrier to correctly interpreting panel information. Barriers to effective use of the nutrition information panel were faced most by older people, the socio-economically disadvantaged, and people with lower levels of education or income.

#### *Medium quality*

Two of the medium quality studies were carried out in the UK over twelve years ago (British Market Research Bureau 1985; Dairy Crest 1990). These indicated that the nutrients people wanted to see on the label, in descending order, were calories, sugar, fat, vitamins and salt. There was a lack of reported understanding about the relationship between sodium and salt, and sugar and carbohydrate. In terms of measurement people said they had difficulty in converting information in grams per 100gram to amount per serving. From an experimental subsection of one of these studies, it was clear that the concept of percentage energy was also not well understood. Finally, questionnaire responses indicated that people had difficulty in putting nutrition labelling information into the context of dietary recommendations.

Anderson (2001) found that, generally, nutrition labelling knowledge was poor. As knowledge scores increased, attitudes towards nutrition labelling also became more positive. People reported understanding 'sugars' and 'recommended dietary amounts' on labels, but not feeling very confident about 'cholesterol' and 'saturated fat'. Those who wanted more information would like it to be more standardised, and in a format which would help them in planning daily food patterns and meal preparation.

#### *Medium-low quality*

Four studies were rated as a medium-low (Glerum van 1986; Michel 1994; Naismith 1990; Co-operative Wholesale Society 2002). On the whole, these reinforced the findings of the higher quality studies. Label related nutrition knowledge was generally not good, with younger people and the better educated scoring better.

The nutrients people wanted to see on the label were ranked similarly to the order given in the section on medium quality studies. The only notable exception was in a study from Holland (Glerum van 1986) where fat was still top of the list, but was followed by vitamin B1 and C. In one study 80% of consumers would like sugar listed separately from carbohydrate (Co-operative Wholesale Society 2002). In the same study, when people were asked interpretative questions, 58% were correct for fat, 46% for saturated fat, and 14% for sodium. 28% thought that salt and sodium were the same. In the Dutch study (Glerum van 1986) there were a high number of correct answers on iron and calcium, with far fewer correct answers for other nutrients.

In relation to units of measurement, one of these studies (Co-operative Wholesale Society 2002) indicated that people would prefer decimal points to be rounded to the nearest whole number, and also preferred calories to joules as a measure of energy. Another UK study (Naismith 1990) reported that the sample was better at interpreting percentage contribution to food energy than grams per 100g.

#### *Other studies*

The remaining studies confirmed the main conclusions of the previously described studies, with a few exceptions. For example, a study from the USA carried out at the beginning of the 1980s amongst a sample including nutritionists (Heimbach 1982), food industry employees and consumers, prioritised information about calories, sodium, protein, total carbohydrate, and total fat, which is somewhat at odds with the findings of the studies described previously.

A finding additional to those from previous studies was reported in a study from Germany (Pudel 1996). People said they would prefer use of common household measures to quantities expressed per 100g or per 100ml. The same consumers also had difficulty in understanding information given as percentage of the recommended daily amount.

Table 6: Quality assessment scores of studies of preferences and understanding for terms used in nutrition labelling

<i>Study design</i>	<i>Quality assessment score</i>	<i>No. of studies n=19</i>	<i>References</i>
Quantitative observational	Medium-high	1	National Institute of Nutrition 1999
	Medium	5	Anderson 2001; British Market Research Bureau 1985; Dairy Crest 1995; Miller 1999; Reid 1996;
	Medium-low	4	Co-operative Wholesale Society 2002; Glerum Van der-Laan 1986; Michel 1994; Naismith 1990.
	Low or insufficient information to assess	3	Dooly 1998; Heimbach 1982; Pudal 1996
Qualitative	Medium-high	2	Black 1992; Wyn Thomas 1997
	Medium	3	Food Standards Agency 2001; Miller 1999; Susie Fisher Research 1985
	Low	1	Co-operative Wholesale Society 1993

### *Qualitative studies*

#### *Medium-high quality*

There were two qualitative studies that were assessed as medium-high quality, both from the UK.

Whereas most qualitative research uses interviews or focus groups to collect information, a few studies in this review have used a rather different approach – protocol analysis. This is a way of trying to elicit people's thoughts whilst they are engaged in a particular process, in this case looking at labels whilst food shopping. One such study yielded some information on the understanding of terms used on nutrition labels (Wyn Thomas 1997). 40% of people in this study said they found the nutrition label information confusing because they did not understand the role of the different nutrients in their diet, and they could not do the calculations to make sense of the numbers (for 40% this was because they did not have time to process the information when they were buying the food).

The other medium-high qualitative study used a more conventional approach, with five focus groups (Black 1992). Relevant results largely reinforce those from the quantitative observational studies. People said that they fully understood and were influenced by energy, kilocalories, fat and dietary fibre. However, saturated fat, sodium, and kilojoules were poorly understood.

*Medium quality*

Two of the three medium quality studies came from the UK (Food Standards Agency 2001; Susie Fisher Research 1985). There were some common themes that emerged, and also some differences.

In relation to nutrients, people wanted information on calories and fat. People said they had most difficulty understanding 'technical' terms, including saturated fat, kilojoules, carbohydrate, fatty acids and energy.

A recent study from the Food Standards Agency (2001) said that many people knew that sodium and salt are interrelated. This is, on the face of it, is somewhat at odds with the findings of other studies, but knowing that terms are interrelated does not necessarily mean that people understand them. It may also be that many of the other studies were carried out some time ago, whereas the Food Standards Agency study was more recent. However, one of the quantitative studies mentioned earlier (Co-operative Wholesale Society 2002) is also recent and reported a lack of understanding of the relationship between the two terms. So, whilst it is possible that consumer understanding of these terms has improved, this would need confirming by other research.

Both studies indicated that expressing information 'per 100g' caused confusion (as did mention of RDAs in the earlier of these studies), and people preferred information per serving or for the product as a whole. Figure 1 shows the current EU labelling format, used in the Food Standards Agency study.

Figure 1: Current EU labelling format, as used in Food Standards Agency 2001

This pack contains 1 serving of 450g		
NUTRITION INFORMATION		
Typical values	Per serving	Per 100g
Energy	3200kJ 760kcal	710kJ 170kcal
Protein	36g	8g
Carbohydrates	59g	13g
Of which sugars	11g	3g
Fat	43g	10g
Of which saturates	18g	4g
Fibre	2g	1g
Sodium	1g	Trace

The last study in this section is from the USA, and was based on focus groups carried out amongst women aged over 65, with type II diabetes. In this study the nutrients that people wanted to see on the label were sugars, cholesterol and sodium. The participants were not so interested in calories from fat, total fat or saturated fat, and most ignored information on total carbohydrate. This difference of priority compared to other findings might be due to this group having different levels of interest and motivation to the general population, given their chronic condition.

#### *Other studies*

There was only one study in this category (Co-operative Wholesale Society 1993). The findings accord with earlier studies, including the difficulty consumers had in understanding the meaning of sodium and relating it to the salt content.

### **3.2 Single nutrient labelling**

This section is about labelling formats that aim to present nutrition information about a range of single nutrients, across a complete range of foods. This type of nutrition labelling enables (and requires) the consumer to consider each single nutrient in order to assess the nutritional composition of the product.

The two main types of nutrition labelling format are a) numerical information (including the standard nutrition-labelling format in many countries), and b) non-numerical formats that aim to represent objective numerical information in a verbal or graphical way. In the case of non-numerical formats some degree of interpretation has usually been necessary to present numerical information in a different format. However, with either type of labelling within this format, information is presented on all foods.

#### **3.2.1 Numerical formats**

Forty nine studies were identified which addressed the issue of consumer preference and understanding of numerical nutrition labelling.

The majority of these were from the USA (31), with 12 from the UK, three from Australia and New Zealand, two from Canada, and one from the Netherlands.

## Summary

General findings which emerged from the studies described in this section, with an emphasis on those from higher quality research were:

- Numerical labels could be used by most people for simple comparison tasks, but people's ability to use the information decreased with the complexity of the calculation task.
- Information on single nutrients in foods was most useful when a dietary context or benchmark was provided, for example dietary reference values or guideline daily amounts.
- There was conflicting evidence on the usefulness of %DRV appearing on labels. Higher quality experimental studies reported favourable results. A medium quality experimental study indicated that inclusion of information on dietary reference values improved performance for higher knowledge consumers, whereas lower knowledge consumers were relatively insensitive to the presence or absence of this information. Medium-low quality experimental and quantitative observational studies reported conflicting results.
- In a medium-high quality experimental study in which %DRV was presented, it was useful to provide information on absolute amounts as well as relative measurements (%DRV). For micronutrients, relative information alone appeared to be sufficient.
- Labels were easier to use if the printing was as large and clear as possible. Alignment lines (thinner rather than thicker) could be helpful, so could boxing and emboldening information, and having a standard format for all products.
- Additional information panels and multiple columns reduced people's performance in extracting and manipulating information.
- It was easier for people to find information which was further away from the 'dense' centre of a label.
- The nutrition panel was not used in isolation. People read other available information, including brand name, product name, any claims, or other information on the package.
- Younger people, those with higher levels of education, and in higher social groups, were better able to manipulate figures on numerical labels
- People were better able to use labels if they were familiar with that particular format
- There were weak indications that interventions could be effective in increasing understanding and use of labels. However, very little research was identified on this.
- Lack of time whilst shopping emerged as a barrier to using and trying to understand labels



Table 7 provides further detail about the study design and quality assessment scores of the papers included in this section. In the rest of this section these components have been disaggregated where possible. This means that experimental studies which aim to assess the performance of different formats are considered alongside the experimental components of other studies, thus bringing the work which uses a more objective approach to assessing the performance of a label together in the same section. Similarly qualitative studies and qualitative component of other studies are also considered together, and give more insight into subjective preferences for formats.

Information on the quality assessments of studies is given in the more detailed sections below.

### *Reviews*

There were three literature reviews that contained information on the numerical format of nutrition labelling, but none of these were systematic. Two were rated as medium quality (Glanz 1992; Caudill 1994) and one was assessed as medium-low (Geiger 1991). These reviews were based on studies that have also been identified for the current review, with the exception of a few papers that were excluded because of lack of relevance to current labelling formats.

Caudill (1994) reported that there were mixed results about consumer understanding of different levels of complexity of formats and the order of presentation of nutrients. The main conclusions of the medium quality reviews focused on methodological issues related to the types of study they included. Glanz (1992) reported that many studies did not address the issue of non-response bias, many surveys relied on self-reporting and some included leading questions. Many evaluations did not use a randomised design and follow-up was often short. Where interventions appeared to have a positive impact, the studies were often not replicated. Caudill (1994) believed that the role of motivation and efforts to gain a better understanding of purchase behaviour had not been adequately addressed.

### *Experimental studies*

This section includes the 19 papers which described purely experimental studies and 11 papers which also had a quantitative observational or qualitative element.

Of these 30 papers, only one was assessed as high quality. There were three that were rated as medium-high, eight were medium, 13 were medium-low, and five were judged to be low quality.

#### *High quality*

One high quality experimental study was carried out in the USA by Levy (Levy 1998) using standard numerical format labels. In this study nearly 400 people were asked to complete a task (task one) and 800 were asked to complete three further tasks. Task one was to compare two products and was done successfully by 78% of the sample. Task two was to evaluate a

claim about the nutrient level in a food and was done accurately by 58% of subjects. In Task three, people were asked “If you ate three servings of this food in a day, what nutrients should you try to get more of in the other foods you eat that day, and what nutrients should you try to cut back on?” 45% of people managed to work out how to balance nutrients over a day. Task four asked “How many servings of this food would you need to get all of the carbohydrate you need in a day?” Only 20% managed to calculate this. The overall conclusion, unsurprisingly, is that more people are able to use numerical labels for tasks requiring a minimum of calculation skills. However, few people are able to perform complex tasks.

#### *Medium-high quality*

There were three studies that were rated medium-high. One of these was carried out in the UK and consisted of a qualitative and an experimental stage (Black 1992). The qualitative stage provided background for the development of sets of numeric, verbal and graphic representations of nutrition information tailored to consumers’ understanding and needs. In the second stage these representations were tested with individual consumers in decision-making tasks that resembled decisions made in shopping or planning meals. In the experimental stage the main measurements of the effects of the different nutrition information formats were a) length of time participants took to start responding, b) length of time participants took to explain their responses and c) number and quality of reasons given in their explanations. The main findings were that people made inaccurate assessments of the relative levels of nutrients in single foods (i.e. is this food high or low in a particular nutrient) because they did not know what level of nutrients might be appropriate to look for; they could make simple comparisons between foods using numeric information, but not complex comparisons; many felt they had insufficient background knowledge to understand numeric information, and some suggested information about recommended daily intake should be presented.

The second study was also from the UK (Institute of Grocery Distribution 1998). This contained a relatively rigorous experimental element which aimed to assess the readability and performance of 9 different nutrition labelling systems. Presenting fat and saturated fat information in a separate box under the standard nutrition panel significantly improved the accuracy with which respondents read this information from the nutrition label. Participants favoured adding ‘guideline amounts’ to the labels.

The third study was Canadian and consisted of an experimental component within a quantitative observational study (National Institute of Nutrition 1999). In the experimental component respondents were shown one of six possible test labels, which incorporated two alternative methods of declaring nutrient content (weight or % RDI). The relevant findings were 1) For macronutrients such as fat or protein, the perceived usefulness of information on both absolute (grams) and relative (% RDI) amounts appeared sufficient to overcome the reduced ease of use resulting from the greater quantity of information. 2) Absolute and relative amounts communicated macronutrient content equally well (in each case extracted

correctly by >84% of the sample). The information provided by both methods was said to be quite easy to find (66% for grams + % RDI; 74% for grams only). 3) The complement of absolute and relative information was regarded as more useful than the absolute amount only (57% versus 50%, respectively). 4) For micronutrients, presentation of the % RDI information only appears sufficient to help consumers' assessments.

#### *Medium quality*

There were eight medium quality studies, of which six were carried out in the USA.

Three of these studies were about either people's label reading abilities or the readability of nutrition information on labels. Byrd-Bredbenner (2000) used label reading knowledge scales to assess nutrition labelling reading skills amongst different groups of women. Although most people were able to locate quantitative information on standard labels, and to manipulate information to some extent, older people found it more difficult. The next study focused on older people (Sullivan 1995) and found that compared with younger people they had particular difficulty in performing label related calculations. Goldberg (1999) carried out a study using eye tracking techniques, to measure people's ability to search for specific information on labels under different conditions. People who used labels regularly made fewer mistakes; it took 35% longer to find information near the 'denser centre' of the label; and thinner alignment lines were more helpful than thicker ones.

The next set of three studies focused on the consumers' understanding of different formats for labelling. Two of these were by Levy (Levy 1991; Levy 1996). In the earlier of these two (Levy 1991), five labelling formats were tested, three of which were numeric. Evaluation was based on objective measures including accuracy, false positives, and time taken to perform different tasks. The three numeric formats tested were the standard USA food label at the time, a similar label with additional information on dietary reference values, and a numeric format modified from the standard label. The standard label format performed best. The label with information on dietary reference values gave similar results, except that the time taken for tasks increased. The other numeric format increased task time, and the number of false positive results. The later study (Levy 1996) used a similar methodology, but with seven labelling formats, and performance measures which included comparing products and assessing the nutritional value of single products. The control format this time was numeric information using metric units only. For tasks measuring ease of use and perceptual accuracy of numeric information, no format improved performance relative to the control. However, formats with a simple display of numeric amounts performed as well as the control. Formats which deviated from this (with additional information panels, multiple columns) performed less well. The weakness of the control format was apparent with performance tasks involving placing a food in a broader dietary context. The format that performed consistently best was percentage declaration of nutrient amounts based on daily reference values for each nutrient. Both of the Levy studies emphasise that people's

preference for a particular format did not predict its performance. The third study (Geiger 1991) also examined different formats. This research used the subjects' perception of the usefulness of the formats, rather than objective measures, and found that consumers preferred information dense formats.

The last two studies in this section attempted to look at food label use whilst people were shopping. The first was quasi experimental (Moorman 1996). This study was carried out 8 months before the introduction of the new USA food label and 5 months afterwards. Shoppers were unobtrusively observed making a choice from 20 different product categories. When shoppers had chosen their brand, they were randomly selected from the aisles and asked to recall some nutrition information (about fat content). The authors concluded that the new labels (shown in Figure 2) were comprehensible to consumers with a range of motivation and knowledge. However, the new labels appeared to widen consumer differences in terms of how much information was acquired, with more motivated and less sceptical consumers acquiring more information. The next study, examining label use whilst shopping, was carried out in the Netherlands and combined an experimental and qualitative approach (Meuldijk 1996). 21 women were given a seven item shopping list and asked to go and gather the product they would normally buy for each item. They were then asked to undertake a second shopping round, and choose corresponding products with less fat than the product in the first-round, using the information on food packages. 73 % of all chosen products contained less fat than the products chosen in the first-round, and 21% chose products in the second round which were not lower in fat (although lower-fat products

<b>Nutrition Facts</b>		
Serving Size 1 piece (50g)		
Servings per Container 12		
<hr/>		
Amount per Serving		
Calories 160    Calories From Fat 36		
<hr/>		
	% Daily Value*	
Total Fat 4 g		6%
Saturated Fat 4 g		20%
Cholesterol 0 mg		0%
Sodium 135 mg		6%
Total Carbohydrate 30 g		10%
Dietary Fiber 0 g		0%
Sugars 5 g		
Protein 1 g		
<hr/>		
*Percents (%) of a daily value are based on a 2000-calorie diet. Your daily values may vary higher or lower depending on your calorie needs:		
	2000	2500
<b>Nutrient</b>	<b>Calories</b>	<b>Calories</b>
Total Fat	Less than 65g	80 g
Sat Fat	Less than 20 g	25 g
Cholesterol	Less than 300 mg	300 mg
Sodium	Less than 2400 mg	2400 mg
Total Carbohydrate	300 g	375 g
Fiber	25 g	30 g
<hr/>		
1 g Fat = 9 calories		
1 g Carbohydrate = 4 calories		
1 g Protein = 4 calories		

Figure 2: Current USA nutrition label, as used in Moorman 1996

were available). The nutritional value label was overall the most important source of information in choosing low-fat products. However, 38% of participants said they did not use the nutritional value label at all in the second round. When it was used, it was often used to verify information from other sources, such as claims, brand name, and product name.

#### *Medium-low quality*

There were 13 experimental studies which were assessed as medium-low quality. Four of these were only of marginal relevance and are not included in the description below. It is important to bear in mind that all of the studies in this section had some methodological weaknesses.

Three studies looked at people's attitudes to and ability to use different label formats. One of these studies was from the USA, and looked at attitudes towards two possible formats for new labelling (NLEA) compared with the previously used format (Burton 1994). The authors concluded that there were more favourable attitudes to the format with which people were already familiar.

The second evaluated the abilities of women in the UK to locate and manipulate information on the USA NLEA label compared with labels prepared in accordance with the EU labelling directive (Byrd-Bredbenner 2000d). There was no significant difference in their ability to locate and manipulate information from the two types of label.

The next group of studies looked at the abilities of different groups of people to use nutrition labelling. Older people were consistently less able to manipulate figures on numerical labels than younger ones (Burton 1996; Byrd-Bredbenner 2000c).

In a study looking at attitudes, perceived understanding, and accuracy of use of several different formats including the pre-NLEA format, and a simplified version of the new format (Burton 1994), there was no difference in how high and low knowledge consumers responded to the different formats. However, another more recent study (Li 2002) indicated that inclusion of information on dietary reference values improved performance for higher knowledge consumers, whereas lower knowledge consumers were relatively insensitive to the presence or absence of this information.

Two papers referred to interventions to increase knowledge in groups of people, but the interventions are not well described. One intervention was a nine week programme of 90 minute education sessions in women with type II diabetes (Miller 1999) and appeared to be effective in increasing knowledge. In the other study, women who were taught about labels subsequently used the information more often, with an influence on purchasing decisions (Byrd Bredbenner 2000). These studies provide a weak indication that some types of intervention may be helpful in increasing understanding and use of labels.

Another study adopted a rather different approach. Instead of using standard or modified form of existing food labels, the researchers rotated the order and form of presentation of nutrients, and tested subjects' ability to make choices with the different presentations (Cole 1990). As with the

previously mentioned studies, older subjects took longer to make decisions. Fixing the information in particular predictable spots, and boxing of relevant information were helpful for people who had the most difficulty in performing the tasks.

Finally, one study (Burton 1999) indicated that people who were able to use nutrition labelling information more accurately were better able to positively evaluate 'good' foods and negatively evaluate 'poor' foods.

#### *Low quality*

These studies are not described in detail since all had significant methodological flaws. However they supported the previously reported finding that older people are not able to use food labelling as quickly or accurately as younger people. One paper (Yeomans 1986) also reported that men performed better than women, people in higher socio-economic groups were also able to use labels more easily, as were people with children, and those on slimming diets.

Two papers gave contradictory findings about the value or otherwise of including dietary reference value information (Byrd Bredbenner 1994; Barone 1996).

#### *Quantitative observational studies*

In this section, there were eight studies which were based purely on quantitative observational research. In a further eight this was combined with an experimental component, and in three studies quantitative research was combined with qualitative research. This gives a total of 19 papers using quantitative observational techniques.

Two papers were assessed as medium-high quality, eight were medium, six were medium-low, one were low, and there was insufficient information to assess the quality of the remaining two papers.

#### *Medium-high quality*

The first of these papers was from Australia and New Zealand (Paterson 2001). It was a qualitative study which only contained a small quantitative element, and recommended further in depth quantitative research. For this reason, it is considered in detail in the section on qualitative studies.

The second paper came from Canada (National Institute of Nutrition 1999) and has been mentioned in previous sections. There were no additional relevant findings to describe in this section.

#### *Medium quality*

Of the eight medium quality studies, three were more concerned with the aspects of the label which people said made them more or less understandable. The remaining five were more concerned with the ability of different sub groups of the population to use labels.

In interviews consumers said that they prefer plenty of information (Geiger 1991). However in the other two studies respondents said that they found

the use of percentage DRV (or RDA) confusing (Levy 2000; Consumers Association 1995). The single thing that would make it easier to read the food label was clear and larger print (Consumers Association 1995).

In terms of the preferences and skills of different sub groups in the population, two studies from the same research group reported that women were more interested in label content than men (Scott 1994; Worsley 1996) as did a study from the UK (Research Services 1995). People with higher levels of education (Scott 1994; Research Services 1995) were more interested in labels; as were the health conscious, and those in higher social groups (Research Services 1995). Older people were less likely to read labels (Research Services 1995; Bryd-Bredbenner 2000c; Scott 1994; Sullivan 1995).

#### *Medium-low quality*

The findings of many of the papers in this section reinforced those described earlier, and only one study will be described in any detail.

This was a study from the USA that compared knowledge, label use and perceptions amongst users and non-users of labels (Klopp 1981). Non-users said they did not need the information on labels, or that shopping practices stopped them using the information (for example because of lack of time). The authors concluded that shortcomings with the label itself were not the main reason for non-use. This shifts attention to the role of motivation which is mentioned in other studies, but not explored in detail in any of the studies in relation to people who do not read labels (as opposed to those who do).

#### *Other papers*

One of these papers was assessed as low quality, but this was because there was very little methodological information given in the report, and the rating was not necessarily a reflection of the real quality of the study (Co-operative Wholesale Society 1993). The main findings of the quantitative aspects of the research reinforced previous findings, that most consumers find standard numerical labelling confusing. As in other studies, one of the contributing factors to this was that they said they did not have the appropriate context (i.e. dietary recommendations). The report also emphasised that nutrition information on food labels was not used in a rigorous or organised way, but was part of an overall judgement. This echoed the findings of other studies where consumers made judgements based on various aspects of the packaging, including product name and promotional information.

Another study from the Co-op in the UK also gave very little methodological information, and so was assessed as low quality (Co-operative Wholesale Society 1997). The main relevant finding was that consumers thought that information should be standardised on the front of packs, to enable easy comparison of products.

Finally, for one of the papers in this category (Mintel 2000) it was not possible to obtain a full copy of the research.

### *Qualitative studies*

In this section, there were five studies which were based purely on qualitative research. In a further three this was combined with an experimental component, and in three qualitative research was combined with quantitative research. This gives a total of 11 papers using qualitative techniques.

Two papers were assessed as medium-high quality, six were medium, two were low, and there was insufficient information to assess the quality of the remaining paper.

#### *Medium-high quality*

The first of these studies has been referred to previously (Black 1992). It included a qualitative stage (5 focus groups) which provided background for the development of sets of numeric, verbal and graphic representations of nutrition information which were tailored to consumers' understanding and needs. With numerical formats, interested participants gave higher ratings to formats showing the percentage of recommended daily allowance provided by a serving of a food.

The second was from Australia and New Zealand (Paterson 2001) and consisted of twelve discussion groups. There was a lot of confusion about the use and interpretation of the nutrition panel. In particular, people had difficulty in placing the information into context, and in the absence of any stated benchmarks, some people developed their own. From the qualitative element of the research the authors made the following recommendations for label design 1) standardise the positioning and location of the label information 2) standardise the layout and format of the nutrition information 3) use plain English 4) have a complementary marketing and consumer education strategy.

#### *Medium quality*

Two of these studies (Meuldjik 1996; Susie Fisher Research 1985) only contained a minor qualitative component, and no particularly relevant findings, and so are not described here.

One study focused on comparing perceived usefulness of the pre NLEA and the NLEA labels in the USA (Miller 1997) and was carried out a few years after this format had become widely available (in comparison with some earlier studies which were mentioned, which were carried out before or at the time the new label was released). Consumers preferred the new labels, but the main barrier to using them was reported to be time.

The quantitative element of a study reported by Institute of Grocery Distribution (1998) was rated as medium-high, but the qualitative element was assessed as medium. This was only a small scale exploratory piece of research. However there were some relevant findings which included: standard labels being seen as frustrating and too complicated; widespread support for putting bench mark information on labels.



Table 7: Study design and quality assessment scores for numerical format papers

<i>Study design</i>	<i>Quality assessment score</i>	<i>No. of studies n=49*</i>	<i>References</i>
Experimental only (19) + experimental component of other studies (11)	High	1	Levy 1998
	Medium-high	3	Black 1992; Institute of Grocery Distribution 1998; National Institute of Nutrition 1999
	Medium	8	Byrd-Bredbenner 2000; Geiger 1991; Goldberg 1999; Levy 1991; Levy 1996; Meuldijk 1996; Moorman 1996; Sullivan 1995
	Medium-low	13	Burton 1993; Burton 1994; Burton 1996; Burton 1999; Russo 1986; Byrd-Bredbenner 2000c; Byrd-Bredbenner 2000d; Cole 1990; Daly 1976; Li 2002; Miller 1999; Mohr 1980; Klopp 1981;
	Low	5	Barone 1996; Byrd-Bredbenner 1994; Co-operative Wholesale Society 1993; Jacoby 1977; Viswanathan 1994.
Quantitative observational only (8) or + experimental component (8) or + qualitative component (3)	Medium-high	2	National Institute of Nutrition 1999; Paterson 2001
	Medium	8	Byrd-Bredbenner 2000a; Consumers Association 1995; Geiger 1991; Levy 2000; Scott 1994; Research Services 1995; Sullivan 1995; Worsley 1996
	Medium-low	6	Burton 1999; Byrd-Bredbenner 2001; Byrd-Bredbenner 2000c; Byrd-Bredbenner 2000d; Daly 1976; Klopp 1981
	Low or insufficient information to assess	3	Co-operative Wholesale Society 1993; Co-operative Wholesale Society 1997; Mintel 2000
Qualitative only (5) or + experimental component (3) or + quantitative observational component (3)	Medium-high	2	Black 1992; Paterson 2001
	Medium	6	Food Standards Agency 2001; Institute of Grocery Distribution 1998; Meuldijk 1996; Miller 1997; Research Services 1995; Susie Fisher Research 1985
	Low or insufficient information to assess	3	Balasubramanian 2002; Co-operative Wholesale Society 1993; National Consumer Council 2002
Review	Medium	2	Caudill 1994; Glanz 1992
	Medium-low	1	Geiger 1991

\*multiple components in some studies so numbers in column do not add up to no. of studies

Two pieces of research from the Food Standards Agency in the UK, and its predecessor, supported previous described findings and added some additional insights (Research Services of 1995; Food Standards Agency 2001): 1) individual nutrients were perceived in different ways, and people were better at recognising the 'healthier' products when the differences between products concentrated on a better known nutrient e.g. fat 2) there was added value in re ordering, emboldening and boxing specific nutritional values 3) consumers welcomed the inclusion of the guideline

daily amounts, and these were more likely to be used if they were in the same box as nutritional values.

#### *Other studies*

It is worth specifically mentioning one of the three studies in this section. This was an observational study of over 300 shoppers, carried out before and after the introduction of the NLEA label in the USA (Balasubramanian 2002). It was only possible to obtain a preliminary report of this study, and so was not possible to assess its quality. The researchers reported no difference in the way people went about gathering information from nutrition labels before and after introduction of the new label, and no difference in recall of nutrition information

### 3.2.2 Non-numerical formats

#### **Summary**

General findings which emerged from the studies described in this section, with an emphasis on those from higher quality research were:

- Simple numerical labels appeared to be most useful in comparing products and for simple calculations. However supplementing nutrition information with verbal descriptions or graphical information, was shown to help people in placing a food or nutrient in the context of their overall diet.
- As described in the previous section dietary reference values and the guideline daily amounts have also been shown to be useful in providing dietary context.
- Although people preferred bar charts to several other formats, there are mixed findings on their usefulness in performing tasks, compared with information on %DRV.
- Except for one low quality study, there was general agreement that people do not like pie charts, and are not able to use them well.
- Verbal descriptors (adjectival), like high-medium-low, seemed to be comparable to %DRV information, in experimental situations. More work is needed to test their use in 'real life' situations. Although they were fairly well liked by people, they often did not seem to fare as well in preference tests as bar charts.

Twenty four studies were identified which addressed the issue of consumer perception of non-numerical nutrition labelling. All of these were from the USA (16) or the UK (8).

Table 8 shows details of the study design and quality assessment scores of papers describing studies of non-numerical formats. As in the previous section, these components have been disaggregated where possible so that studies which used a particular design are considered alongside components of other studies which used a similar design. Information on

the quality assessments of studies is given in the more detailed sections below.

*Reviews*

There were three medium quality reviews, one of which did not address the issue of non numerical labelling in any detail (Glanz 1992). The other two referred to the varied findings on the use of a verbal (or adjectival) descriptions on labels (Caudill 1994; Derby 1994).

The remaining medium low quality review described six preference studies (Geiger 1991). One of these described the use of pie charts compared with a labelling system being proposed by the FDA. However, this study dated back to 1972, and is likely to be of little relevance to the current labelling situation.

*Experimental studies*

*Medium-high quality*

The only study in this section has already been referred to extensively during this review (Black 1992), and was from the UK. As well as a qualitative component it contained experimental work, testing nutrition information presented in different formats in short decision making tasks. The different formats included a variety of numerical and non numerical formats. Many interested participants gave higher ratings to formats showing the percentage of dietary reference values provided by a serving of a food (i.e. a numerical format). However, the overall conclusion was that supplementing nutrition information with words or well designed graphic information could help consumers choose a healthier diet. Banding systems using words or graphic representations were more versatile and generally more helpful than formats based on dietary reference values. Figure 3 shows an example of one of the formats tested in this study.

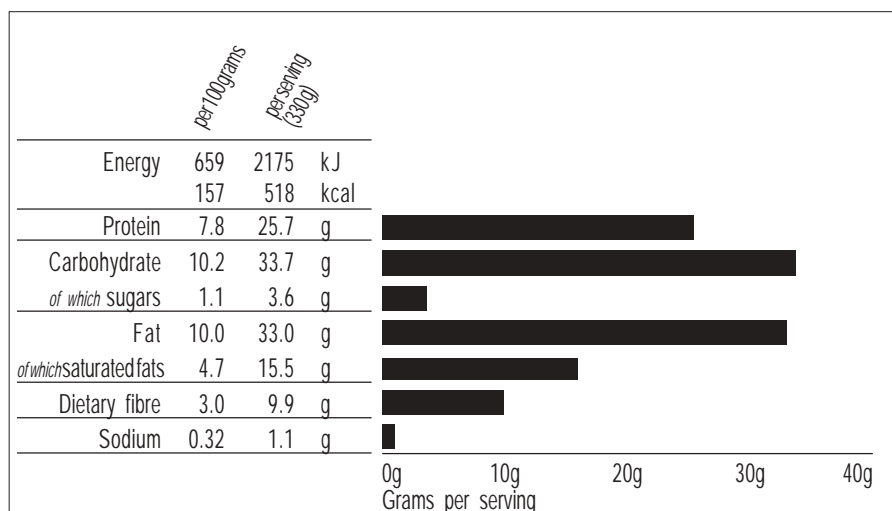


Figure 3: Bar chart format as used in Black 1992

*Medium quality*

All five studies in this section tested the performance and in some cases also the preference for different labelling formats. Four were carried out in the USA, and one in the UK.

The earliest of those reported from the USA (Geiger 1991), estimated the effects of changing multiple levels and combinations of nutrition information format, load (some, more, most), expression (e.g. traditional, absolute numbers, percentages) and order of nutrient presentation on consumers' perceptions of label usefulness in purchase decisions. The testing and information collection was computer administered. Strong preferences were found for bar graph formats compared to the traditional and bar graph/nutrient density formats ( $p < 0.0001$ ). Consumers found the bar graph/nutrient density format as useful but not more useful than the traditional format. People preferred nutrients grouped by amount likely to be consumed.

The next study was published a year later (Lewis 1992). The study included qualitative research, but also included specific tasks intended to target ability to use and interpret the format, not just their preference and attractiveness. 12 graphics were used, with attention directed towards specific issues. Formats included bar graphs, pie charts, adjectival descriptors and numeric listings. Participants were asked to use each format to compare the amount of a designated nutrient in two samples of a product (cheese, cereal). The qualitative discussion was guided to indicate how and why the participant had used the information, the ways in which the information was helpful or confusing and helpful modifications. Bar graphs were considered confusing and unnecessary when % information was present. Although participants did not seem concerned that long bars could be positive or negative, some seemed to suggest that many long bars on the label would imply a healthy food. Pie charts elicited strong negative reactions, and were seen as confusing and space wasting. Verbal descriptors were mistrusted by some. However, when asked to compare two layouts, most preferred a list of descriptors compared with a grid arrangement with tick marks. Overall, participant responded very favourably to numeric formats rather than non numeric formats.

Similarly to the previous study, the next paper also looked at performance when comparing products, and was referred to in 'Results' – 3.2.1. Levy (1991) tested five labelling formats for preference and performance. The formats were: control format (1991 USA food label i.e. pre NLEA), Control plus DRV format, adjectival (verbal) format (shown in Figure 4), numeric format and bar graph format. Subjects were presented with two labels side by side and asked to identify all nutrition differences between them. Subjects performed this task 5 times each time with a different format and a pair of products from a different product category. Overall the control format performed best. The bar graph consistently scored worst. The control plus DRV format performed as well as the control except for task time. The adjectival format increased task time further and performed poorest on false positives. The numeric format performed well on accuracy and judgement but less well on false positives and task time.



using a variety of performance tasks (Mohr 1980; Rudd 1886; Rudd 1989). The graphical nutrient density label appeared to perform better overall than the standard pre NLEA USA label. A simpler graphical format was even better when people were asked how they would eat for the rest of the day, after consuming selected labelled products. The remaining 1980s study (Russo 1986) looked at the effect of a numerical, and a summary 'star' label format on knowledge and purchases. Both had a positive effect on knowledge, although the numerical format was better overall. A separate experimental component looked at the effect of the formats on purchases of breakfast cereals, and found that purchases of low sugar brands increased, and high sugar brands decreased.

The fifth study was described in the section on numerical formats, but it also included a verbal format, and so is included in this section as well (Burton 1994). In this study consumers were asked about preferences for four different label formats, and also some questions were put to assess the accuracy of their understanding. Accuracy was highest for the verbal format, but perceived understanding of this format was low. Overall no label format out performed the others across all the aspects measured, neither were there any differences between how high and low knowledge consumers responded to the different formats.

#### *Low quality*

There were four studies in this group, one of which was only of marginal relevance (Levy 1985).

Two were carried out in USA. One reported that verbal ratings did not improve performance compared with other formats, in a series of tasks (Byrd Bredbenner 1994). The same study also reported that labels with pie charts did as well as those without. The other study primarily looked at numerical information, but also included verbal descriptions (Viswanathan 1994). Performance was assessed by asking about the healthiness of products and recall of information. Including verbal information increased these two measures of performance.

The remaining study came from the UK in the 1980s (Yeomans 1986). Subjects were asked about preferences for six different label formats, and to perform a simple calculation. The formats included bar graphs, pie charts, and verbal descriptions. Bar graphs were the most popular, but  $\frac{1}{4}$  of people had difficulty with calculations using them. Pie charts were regarded as not very easy and  $\frac{3}{4}$  of people had difficulty using them. In the testing, numerical information accompanied by verbal descriptions performed best.

#### *Quantitative observational studies*

##### *Medium quality*

The two studies in this section had a strong experimental component, and have been described in some detail in the preceding experimental section (Geiger 1991; British Market Research Bureau 1985).

Table 8: Study design and quality score for studies of non-numerical formats

Study design	Quality assessment score	No. of studies n=24*	References
Experimental only (11) or + quantitative observational component (2) or + qualitative component (2)	Medium-high	1	Black 1992
	Medium	5	British Market Research Bureau 1985; Geiger 1991; Lewis 1992; Levy 1991; Levy 1996
	Medium-low	5	Burton 1994; Mohr 1980; Rudd 1886; Rudd 1989; Russo 1986
	Low	4	Byrd Bredbenner 1994; Levy 1985; Viswanathan 1994; Yeomans 1986
Quantitative observational only (2), + experimental component (2) or + qualitative (1)	Medium	2	British Market Research Bureau 1985; Geiger 1991
	Medium-low	2	Abbott 1997; Co-operative Wholesale Society 2002
	Low or insufficient information to assess	1	Cooperative Wholesale Society 1993
Qualitative only (2) or + experimental component (2) or + quantitative observational component (1)	Medium-high	1	Black 1992
	Medium	3	Food Standards Agency 2001; Lewis 1992; Susie Fisher Research 1985
	Low or insufficient information to assess	1	Cooperative Wholesale Society 1993
Review	Medium	3	Caudill 1994; Derby 1994; Glanz 1992
	Low	1	Geiger 1991

\* multiple components in some studies so numbers in column do not add up to no. of studies

#### *Medium-low quality*

The two studies in this section both came from the UK. The first was a postal questionnaire of 400 people (Abbott 1997). The respondents indicated that 55% of them wanted labels to give more detailed information, 45% wanted simpler words, 23% wanted more symbols or pictures, 35% wanted less information as numbers, and 14% wanted labels to stay as they are. A study based on in-home interviews with over a thousand people, also reported that people would like to see high, medium and low assessments for key nutrients (Co-operative Wholesale Society 2002).

#### *Other studies*

The remaining study has been mentioned in preceding sections (Co-operative Wholesale Society 1993). It was not possible to assess its quality. Consumers were asked about different labelling formats. Simple verbal labelling was said to aid understanding. Visual treatments, including bar charts and circles created confusion.

## *Qualitative studies*

### *Medium-high quality*

The study in the section has been mentioned in several previous sections (Black 1992). It had a strong experimental component, and the results for this have already been described. The qualitative component provided the background for developing formats which were tested experimentally.

### *Medium quality*

One of the three studies in this section had an experimental component and all the main findings have already been described (Lewis 1992).

The other two studies were purely qualitative, and were both carried out in the UK.

One of these studies was intended to inform later quantitative work, and was a relatively small scale piece of qualitative research including discussion groups and in-depth interviews (Susie Fisher Research 1985). In this stage visual formats were initially liked. However, pie charts proved difficult to use. When using bar charts, consumers had a tendency to compare the length of bars, irrespective of scale. Rating systems, particularly those using colour codes, elicited sometimes hostile responses.

A more recent study by the Food Standards Agency in the UK (Food Standards Agency 2001) was based on similar number of people (56). This indicated that the inclusion of 'high', 'medium', or 'low' guidance against specific nutritional values enabled people to judge the healthiness of a product, and people found them hard to ignore.

### *Other studies*

The only study in this section was from the Co-operative Wholesale Society (1993), and the qualitative and quantitative aspects were integrated in the final published report. Relevant information has been given in the previous section.

## **3.3 Integrative nutrition labelling**

This section reports the findings of studies of nutrition labelling which provide integrated information about a range of nutrients, namely 'healthy' logo schemes (where labelling of some type appears on foods with defined nutrient levels). This type of nutrition labelling aims to help consumers make a choice based on the overall nutritional composition of the product rather than based on an assessment of each single nutrient. In these studies, rather than nutrition labelling being provided across all products, a judgement has been made about which foods should, and should not, be eligible to carry such information.

Ten studies were identified which reported use of on pack 'healthy' logo schemes. Table 9 provides information about the studies included, six of which were located in European countries, two were international studies and two were based in Australia and New Zealand.



### Summary

General findings which emerged from the studies described in this section, with an emphasis on those from higher quality research were:

- Consumers generally appear to recognise logos on healthier items although confusion about their purpose has been consistently reported.
- There are mixed views about which consumers make use of such logo schemes. Several studies reported that women were most likely to hold positive attitudes towards the logos but another suggested they had broader appeal.
- Self reported use of logo schemes seems to be higher than 'actual' use recorded through protocol analysis.
- The studies included reported a general concern from consumers about the organisation of logo schemes. There was a consensus that they should be run by credible and authoritative sources independent of government and food manufacturers and provide clear guidance about how they could be used.

### *Quantitative observational studies*

#### *High quality*

Larsson (1999) looked at the knowledge of the Green Keyhole symbol and its relationship to intake of foods labelled as part of the scheme in a general population in Sweden. 76% of women and 53% of men understood the meaning of the symbol with those who understood the scheme being younger than those who did not. Based on self reported intake, they found that both men and women who knew of the scheme reported higher intakes of Green Keyhole labelled low-fat foods. They concluded that people who knew of the scheme seemed to have adopted its low fat message. However, in certain sub-groups, particularly those with lower educational achievement, the message of the symbol appeared to have no association with dietary intake.

#### *Medium quality studies*

Scott (1994) explored how consumers understood a range of nutrition labels and symbols, including the Australian Heart Foundation Tick, in their study of New Zealand shoppers. They found that women were more likely than men to claim to have seen the Tick logo. The Tick logo was found to generally appeal to the sample, especially to men, older shoppers and those with a lower educational achievement. However, the logo was misinterpreted by shoppers, for example, almost half thought that to prevent coronary heart disease, they should only eat foods with these labels. The criteria for the award of the Tick logo were not understood.

In one UK study, 5% of consumers said they took notice of logos (Consumers Association 1995).

Table 9: Study design and quality assessment scores for included studies of 'healthy' logo schemes

<i>Study design</i>	<i>Quality assessment score</i>	<i>No. of studies n=10</i>	<i>References</i>
Quantitative observational	High	1	Larson 1999
	Medium	2	Consumers Association 1995; Scott 1994
	Medium-low	1	Baghurst 1995
	Low	1	Pykko 2002
	Insufficient information to assess	1	Bond 1994
Qualitative and quantitative observational	Medium	1	Rayner 2001
Qualitative	Low	2	Raats 1998; Van Dis 2002
Review	Medium-low	1	Reutersward 1999

#### *Qualitative studies*

One study was primarily a qualitative study but also used a quantitative approach. Rayner (2001) reported a study to examine consumers' use of health-related logos in the UK and Australia. In this study, protocol analysis and interviews were used to assess how shoppers used two supermarket healthy eating logos in the UK and the Australian Heart Foundation's Tick logo in Australia. Forty nine shoppers were asked first to complete a 'normal' shop then to return the following week when they were asked to shop for healthy products from a pre-determined list of food categories. They found that shoppers only rarely used logos when shopping normally or for healthier products. In three of the four supermarkets, no reference to logos was made at all. Logos were mentioned most often when shopping healthily. In the one supermarket where participants did use logos, they did so at a rate of less than one use per trip. Despite this, recall of symbols was high. However, declared notice and use of logos was greater than actual mention or use detected by protocol analysis. Shoppers reported that they used logos to gather information to help them make a choice, to evaluate the information gathered, to reject or select a product and for reassurance that a product was healthy. They concluded that consumers' use of logos was complex, especially when used for rejecting items. Shoppers looked for other information to support their use of the logo rather than believing it.

*Other studies*

For schemes using 'logos' to mark healthier items, the other studies included suggested that symbols were generally well recognised although there was some confusion about their purpose. Some consumers reported that they did use them whilst others suggested that they might use them in the future. Some consumers did agree that logos and symbols did have some influence on their purchasing decisions although another study suggested that such logos did not influence prior beliefs about product healthiness. In general, women seemed more likely to report a positive attitude towards such schemes, along with men with particular health problems. The studies reported a general concern about the organisation of such schemes. There was a consensus that they should be run by credible and authoritative sources, independent of government and food manufacturers, consistent with existing national healthy eating guidelines and be supported by clear explanations of how they could be used.

## 4 Point of purchase educational initiatives

**Summary**

General findings which emerged from the studies described in this section, with an emphasis on those from higher quality research were that :

- Point-of-purchase programmes in a supermarket setting had a modest effect on sales of some labelled products for as long as the intervention was in place.
- Point-of-purchase shelf labelling programmes are considered to be feasible interventions that help consumers compare between brands.
- Point-of-purchase shelf labelling programmes which combine appealing and targeted messages which are highly visible and supported by other information (like booklets and recipes) seem to offer most promise.

Thirteen studies assessed point-of purchase educational initiatives such as additional shelf labelling or whole store campaigns.

Table 10 provides further information about the studies included, nine of which were based in the USA. Two reviews had an international focus and the remaining studies were located in Canada and the Netherlands.

*Reviews*

Four reviews were located which included point-of-purchase programmes. Only one of these reviews was systematic and judged to be of high quality.

As part of a review of the effectiveness of interventions to promote healthy eating Roe (1997) found three good quality interventions in supermarkets, using supermarket shelf signs supported by brochures and advertising. Two

of these programmes demonstrated increases in the market share of products of 1-2% over a two year period whilst the other intervention showed no effect. This review concluded that point-of-purchase programmes in a supermarket setting had a small effect for as long as the intervention was in place.

### *Experimental studies*

Two experimental studies were assessed as medium quality.

Levy's (1985) Special Diet Alert study explored whether shelf tags increased the sales of labelled products in 10 supermarkets in Washington and 10 matched stores in Baltimore. Shelf tags giving single word flags (for sodium, fat and cholesterol) and with low or reduced descriptors were placed alongside the item name and unit price. They concluded that sales of shelf marked products did increase or showed less decline in the intervention stores during the two year evaluation compared to control stores without shelf tags, although the size of the effect was modest.

Muller (1985) tested how sales of products were affected by different presentations of nutrition information at point of purchase. Signs were hung from two supermarket ceilings providing nutritional information for five categories of food items alongside shelf tags directing consumers to relevant information. Different formats of the signs were randomly assigned to different shopping periods in the two stores across a two week period. This study concluded that there was a tendency for nutritional information to motivate consumer choices towards healthier products but that effect sizes were modest (4% compared with a normal price cut effect of 10-50% sales impact).

Table 10: Study design and quality assessment scores for included studies of point-of-purchase initiatives

<i>Study design</i>	<i>Quality assessment score</i>	<i>No. of studies</i> <i>n=13</i>	<i>References</i>
Review	High	1	Roe 1997
	Medium	3	Caudill 1994; Contento 1995; Glanz 1992
Experimental	Medium	2	Muller 1985, Levy 1985
	Medium-low	1	Russo 1986
	Low	2	Hoerr 1993, Schucker 1992
	Insufficient information to assess	1	Steenhuis 2001
Quantitative observational	Medium	2	Lang 2000; Pennington 1988
	Low	1	Hunt 1990

*Quantitative observational studies*

Three studies used survey methods to assess consumer awareness, perception and use of point-of-purchase programmes. None of these studies were assessed as higher than medium quality.

*Medium quality studies*

Lang (2000) reported a study to evaluate the awareness and use of a supermarket shelf-labelling programme in a predominantly African American community in the USA. The programme consisted of shelf labels designed to highlight the best and acceptable choices from a range of products using different coloured shelf markers. Posters, banners, a shopping guide and informal instruction on how to use the programme were also used. They found that 29% of shoppers at an exit interview reported being aware of the programme and 17% of the sample reported using the shelf labels often or always. They concluded that awareness of the programme was modest but some use was high amongst those who were aware of the labels.

Pennington (1988) reported a study to examine the presence of nutrition information shelf labels in 83 supermarket chains with a market share about 10% for at least one of the top 50 market areas. 64% had no in-store programme at the time of the survey but 36% claimed they either had a scheme in place or were developing one. Supermarkets reported that programmes were time consuming and costly to run and update.

*Other studies*

The other studies generally supported the conclusions of the studies outlined above. Taken together they report a mixed view of the usefulness of point-of-purchase shelf labelling schemes, some of which had a positive impact of sales of labelled products and some of which did not. Several authors concluded that such programmes may influence purchase decisions, but only for the duration of the intervention and for particular foods. There seems to be general agreement across the studies that point-of-purchase shelf labelling programmes are feasible interventions that can facilitate comparison between brands. Programmes which combine appealing and targeted messages which are highly visible and supported by other information (like booklets and recipes) seem to offer most promise.

## 5 Nutrition claims

### Summary

General findings which emerged from the studies described in this section, with an emphasis on those from higher quality research were:

- Information about the value of nutrition claims to consumers suggests a mixed pattern. Some consumers appear to take no notice of claims whereas others see products with claims as more informative than those without.
- No clear picture emerges from available literature about how nutrition claims are used by consumers. Some seem to view nutrition claims as a quick and easy way of assessing the healthiness of a food product or to decide between two products without having to read the entire label. There is evidence that some consumers do use nutrition claims instead of the nutrition information panel when looking for healthy products. However, some consumers report checking of the nutrition information panel to verify a nutrition claim.
- Although some consumers can interpret nutrition claims with moderate accuracy, others report confusion about different claims and some fail to differentiate between nutrition and health claims.
- Consumers generally report concerns about the truthfulness of claims with particular scepticism for claims they interpret as being used by manufacturers to market their products.
- Few consumers seem aware that nutrition claims are usually legally regulated.

Table 11 provides information about the 27 studies included in this section. 11 of these studies were based in the USA and 10 studies took place in Europe, mostly based in the UK. The other studies originated from Australia and/or New Zealand, Canada and South Africa.

### *Quantitative observational studies*

Sixteen studies (59%) were cross sectional surveys reporting views and usage of nutrition claims. None of these studies received a higher quality assessment score than medium quality.

### *Medium quality studies*

Two UK based studies found that 28% of the sample reported taking notice of nutrition claims. In the first study, participants thought that claims were a quick and easy way of assessing the healthiness of a food product but concerns were expressed about the truthfulness of claims (Consumers Association 1995). More recently, the Food Standards Agency (2002) reported that 43% of a representative sample of the UK population did not understand the meaning of an 80% fat free claim.

A Canadian study (Reid 1994) explored the understanding about fat and cholesterol information with a small sample of shoppers, the majority of which (80%) were women. They reported that 58% of respondents could correctly interpret low fat claims but 19% of the sample believed that a reduced fat claim represented a low fat content. Respondents were also confused about low in saturated fat and cholesterol claims. Many of the sample (52%) reported relying on no cholesterol claims to aid their purchase decisions, compared with 34% who indicated that they would check the nutrition panel as well.

A study assessing the attitudes towards food labelling of white, middle income women in South Africa specifically asked participants to use a real food label to answer a series of questions (Anderson 2001). Results suggested that they did not take notice of nutrition claims.

### *Experimental studies*

Four studies used either an experimental approach or used a mixed experimental and observational method. Only one of the studies was assessed as medium-high quality.

#### *Medium-high quality*

Two experiments were reported together by Corney (1996), one from the UK and one from France. These used realistic materials to examine consumers' perceptions of food package labels where health and nutrition claims were present and where they had been removed. Products with claims were seen to be significantly more informative than those without. The subjective norm (what the person believes that others whose opinion they value would wish them to do) was higher when there were claims on the package. In the French group the impact of claims was less than in the British participants.

### *Qualitative studies*

In a study using protocol analysis, Wyn Thomas (1997) found that consumers were twice as likely to use nutrition claims compared with the nutrition information panel when looking for healthy products.

In the first of two USA based studies, Miller (1997) reported that women aged between 40-60 with type II diabetes were likely to mistrust nutrition claims when they came from a manufacturer and participants were unaware that low fat claims were legally regulated. With older women with type II diabetes (Miller 1999), participants were aware that nutrition claims did not guarantee a reduction in risk of disease.

Paterson (2001) undertook a mixed qualitative and quantitative study of shoppers in Australia and New Zealand. They reported that people generally liked nutrition claims on packages as a quick and easy way to decide between two products without having to read the entire label. However, there was also some scepticism about manufacturers claims.

Table 11: Study design and quality assessment scores for included studies of nutrition claims.

<i>Study design</i>	<i>Quality assessment score</i>	<i>No. of studies n=27</i>	<i>References</i>
Quantitative observational	Medium	4	Anderson 2001; Consumers Association 1995; Food Standards Agency 2001; Reid 1994
	Medium-low	11	Abbott 1997; Baghurst 1995; Byrd Bredbenner 2000b,c,d; Byrd Bredbenner 2001; Co-operative Wholesale Society 2002; Grenier 1996, Hrovat 1994; Narietta 1999; McCullum 1997
	Insufficient information to assess	1	Sainsbury's 2002
Experimental	Medium-high	1	Corney 1996
	Medium-low	1	Meier 1993
	Low	1	Garretson 2000
Experimental and quantitative observational	Medium	1	Byrd Bredbenner 2000a
Quantitative observational and qualitative	Medium-high	1	Paterson 2001
Qualitative	Medium-high	1	Wyn Thomas 1997
	Medium	2	Miller 1997; Miller 1999
	Medium low	1	UK Consumer Council 1997
	Insufficient information to assess	1	Balasubramanian 2002
Review	Insufficient information to assess	1	Bureau Européen des Unions des Consommateurs 2001



*Other studies*

In general, the other studies included in this section supported the findings reported above. Nutrition claim information was read by some consumers but few rated this type of label information as key. No clear picture emerges from available literature about how nutrition claims are used. Some studies suggest that consumers are more influenced by descriptor terms like a claim compared to a nutrition information panel and there was evidence that consumers used nutrition claims as a short cut to choose healthier foods. However, other studies suggested that people were more likely to refer to the nutrition information panel to check claims. Several studies reported that participants could judge claims with moderate accuracy. However, some found that consumers were confused, particularly by low fat and fat free claims. A common finding was that consumers mistrusted nutrition claims. They were aware that manufacturers used nutrition claims to market their products and were concerned about the truthfulness of nutrition claims. Only a minority of consumers knew that nutrition claims were backed by legislation. One study found that consumers did not differentiate between nutrition claims and health claims.

## Gaps in research

We have presented a summary of the existing evidence base on consumer use and understanding of nutrition labelling despite our concerns about the quality of some of the research evidence available on which to base our conclusions. The following gaps in research in this area need to be addressed in order to provide a more solid foundation for proposals for the further development of nutrition labelling in Europe.

- More research is needed to understand consumer use and understanding of nutrition labelling in European countries other than the UK, in particular, those in southern Europe.
- More use of methodologies that assess understanding and use of labels in real life situations is required.
- Objective methods of assessing nutrition label use and understanding need to be developed and refined.
- The evidence base would benefit from studies using larger, more representative samples and by eliciting information about the label reading habits and interpretation abilities of special population groups such as older people, minority ethnic groups and younger people.
- More research is needed to explore what motivates people to use nutrition labels. Not much is known about any differences between label users and non-users and in particular what measures would encourage non-users to change their behaviour.
- Very little research was identified of interventions to increase use and understanding of nutrition labels.
- More research could help to explore any association between label reading and diet quality.
- Existing literature provides only a limited understanding about the usefulness of logo schemes. Additional work into developing and refining techniques for the objective measurement of consumer use and understanding of such programmes is required.
- Most of the available evidence about nutrition claims comes from moderate quality observational studies, using self reported measures of use of nutrition claims. Good quality observational and experimental studies would help to clarify understanding of consumers' use of nutrition claims.
- The findings of the point-of-purchase shelf-labelling programmes are based on a small number of intervention studies, mostly from the USA. Further good quality intervention research is required to understand how such programmes might function in a European context.

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## Discussion

This review has found that many consumers report looking at nutrition labels during food purchase. However, their ability to accurately interpret and use the information provided varies.

This review used a systematic approach to searching and assessing the existing worldwide evidence base on nutrition labelling. Although we attempted to be comprehensive, it is likely that some studies will have been missed in the reviewing process. Time and budget constraints have meant that the reference lists of relevant papers were not routinely searched to find additional papers. Also, a single reviewer assessed each paper rather than a sample of papers being cross-checked by a second reviewer, another potential source of bias. Despite these concerns, this review is presented as the most thorough review of the evidence on nutrition labelling to date.

Of the 129 papers included in the review, only 10% (12) papers were judged to be of high or medium-high quality. Most papers were of moderate quality and others had significant methodological flaws. Of all the studies included in the review, only about one third took place in realistic settings, with people actually making food purchase decisions. Many studies also relied on subjective, self-reported measures of use and understanding and some studies used samples of volunteer participants whose views and use of nutrition labelling may not be typical of the general population. This makes it difficult to use the evidence base to build up a picture that accurately reflects consumers' habitual use of nutrition labelling.

This review included papers of any study design. There are methodological challenges of assessing the value of such a mixed evidence base. Our approach has been to assess each paper individually against a set of established criteria and to weight our conclusions towards the higher quality evidence. However, we acknowledge that a wider debate exists around these criteria and their use. Weighting the evidence in this way also means that our conclusions are largely based on a relatively few studies.

About half of the papers included in the review reported studies based in the USA. Although one third of papers looked at nutrition label use in countries in Europe, most of these studies were from the UK. The remaining European studies that were based outside the UK mostly took place in northern Europe (in the Scandinavian countries, Ireland, the Netherlands and Germany). We found no studies which met our inclusion criteria from southern European countries.

Recommendations drawn from the existing research need to be considered in the context of these limitations of the review.

Accepting this, there are some general issues to be raised from its findings. Although reported use of nutrition labels is high, more objective measures suggest that actual use of nutrition labelling during food purchase may be much lower. Reported reasons for non-use of nutrition labels include lack of time, the presentation of the information, lack of understanding of terms and concerns about the accuracy of the information.

However, it seems likely that, generally, consumers who look at nutrition labels can understand some of the terms used but are confused by other types of information. They can make simple comparisons between similar products using nutrient composition information similar to that provided on European food labels, but their ability to accurately interpret the nutrition label reduces as the complexity of the task increases.

Consumers particularly seem to find it difficult to use nutrition label information to place an individual product into the context of their overall diet. Adding some kind of benchmark, whether numerical (e.g. percentage of dietary reference values which is used in the USA, or guideline daily amounts used on a voluntary basis in the UK) or non-numerical seem to help consumers make this kind of judgement. Of the non-numerical labelling systems, people prefer bar charts but adjectival descriptors (words like high-medium-low) perform best in more objective tests of label usage. The use of 'healthy' logos on selected products has met with a mixed response.

There are indications in the literature that, not surprisingly, people both prefer and are better at using label formats with which they are familiar. It is not clear to what extent this is due to exposure to the format or due to educational initiatives which may have accompanied the introduction of a new format (as in the USA, where the label format was completely revised in 1994). Many studies consistently reported finding poor or moderate levels of general nutrition knowledge amongst their participants. However, we found very few reports of intervention studies which had attempted to address this nutrition knowledge deficit, so the impact of increasing knowledge on label usage is still unknown. Other interventions such as adding additional information at point-of-purchase (such as shelf tags) has prompted consumers to purchase 'tagged' products.

## Conclusions and recommendations

Drawing firm conclusions and developing a framework for action to improve nutrition labelling in Europe is problematic when so little is known about consumer use and understanding of nutrition labelling in a European context. More work needs to be done to explore the needs of consumers in Europe, in particular those in southern Europe.

Any research in this area should adopt robust methodologies, take place in realistic food purchase settings and use objective measures of consumer use and understanding.

The complexities of the influences on food choice and behaviour change are well documented. It is essential to recognise the limited but important contribution that nutrition labelling can make to the promotion of healthy eating. Improvements in nutrition labelling can make a small contribution towards improving the currently hostile food choice environment. Such improvements must be set within a context of wider action to promote better nutrition across Europe.

There needs to be clarity about the purpose of nutrition labelling. Available evidence suggests that some consumers are able to use existing labelling to make comparisons between products. However, if nutrition labelling aims to enable consumers to assess a product in a wider dietary context, format changes may help more consumers with this task.

From the available evidence, labels with the following characteristics are most easily and effectively used by consumers:

### *Format/layout*

- Using alignment lines (thinner rather than thicker)
- Using boxing and boldening information
- Using a standard format for all products
- Not having additional information panels and multiple columns
- Putting important information away from the 'dense' centre of a label
- Ensuring consistency amongst all of the information in the label, including the brand name, product name, any claims, or other information on the package

### *Order of nutrients/highlighting*

- The terms that appear to be best understood are fat and calories (or kilocalories), sugar, vitamins, and salt. Dietary fibre had an indeterminate position in this list.
- %DRV may be useful on the label, particularly to put the food item into the context of the overall diet. If it is provided, it is best if it is additional to information on absolute amounts as well as relative measurements (%DRV) for macronutrients. For micronutrients, relative information alone appears to be sufficient.

*Language used to express terms*

- Non technical terms and language
- Not using terms such as percentage energy

*Legibility/font size*

- Labels are easier to use if the printing is as large and clear as possible

*Accuracy*

- Rounding decimals to the nearest whole number

*Reference quantities – 100g/portion*

- People had difficulty converting information from grams per hundred grams to grams per serving. However, serving size information also proved difficult to interpret in some studies.

*Reference to whole diets versus straight comparisons*

- Dietary reference values and guideline daily amounts have been shown to be useful in providing dietary context. Verbal descriptions (like high-medium-low) or graphical information (particularly bar charts) also help people in placing a food or nutrient in the context of their overall diet.

Little is known about how to motivate and encourage non-users to change their behaviour or about what types of interventions might improve consumers understanding and use of nutrition labelling. There is a need for further work in this area.

Any initiative aimed at helping consumers to understand and use nutrition labelling is likely to also require a concurrent consumer education and marketing strategy to be developed. The issues and terms about which there is most confusion are: the relationship between calories and energy; sodium and salt; sugar and carbohydrate; and the terms cholesterol and saturated fat, and fatty acids. If the label aims to put the food into the context of an overall diet, it is important that consumers understand the concept of dietary recommendations.

In summary, this review is the first systematic review of nutrition labelling which has been carried out. It presents the evidence on consumer preferences for different formats and explores whether they are able to use these formats for different types of tasks. The two main types of tasks are comparing the nutrient composition of different products, and assessing the contribution of a product to the overall diet. Formats similar to those currently used in Europe are adequate for the former, but the latter needs some dietary reference information similar to that provided in the USA.

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## Appendix

### 1 Which studies were included and excluded?

The review *included* studies which:

- were either published and unpublished, carried out anywhere in the world, but focused on consumer understanding and use of nutrition labelling which could be culturally applicable to a European setting (Consumers are defined as free living individuals making point-of-choice food selection decisions. Research which may be culturally applicable to a European setting is defined as carried out in a country with an overlapping cultural heritage and perceptions to European countries (e.g. including countries where Europeans previously had a presence) or if carried out elsewhere the research must be carried out in such a way that cultural perceptions are unlikely to influence the results)
- focused on nutrient related information (and any associated information like Guideline Daily Amounts) on the nutrition panel provided on packaged food
- included information on nutrition claims and healthy logo type schemes (but research in these two categories was not searched for systematically)
- included assessments of consumer understanding and use of nutrition labelling and interventions designed to enhance consumer understanding and use in any setting other than a catering outlet (defined as assessing knowledge, or attitudes, or beliefs, or perceptions, or understanding, or preferences for or use of food labelling)
- considered any population group, apart from those excluded below
- included any type of study design
- included either process or outcome measures

The review *excluded* studies which:

- looked at nutrition labelling practice for consumers in catering outlets
- looked at nutrition labelling intended for people with pre-existing disease or during specific physiologically different life stages (such as people with diabetes, foods intended for consumption by infants and during the weaning period, foods intended for the frail elderly, foods intended for people engaging in intense physical activity such as athletic/sports foods).
- were concerned with other aspects of food labelling, including nutrition information like health claims, ingredient listing and quality assurance schemes.
- were concerned with labelling not relevant to that currently found on food packets in Europe or in the country where the study was carried out

## 2 Search strategy

### 2.1 Published research

Details of the databases and search terms that were used are given below.

All electronic databases were searched from the earliest record to the end of June 2002. Identified research was managed using Reference Manager bibliographic software.

#### *Electronic databases*

AMED

Aslib Index to Theses

ASSIA via Cambridge Scientific Abstracts CSA

BIOLOGICAL ABSTRACTS

Biological Sciences via CSA

BIOME

CAB Abstracts using ERL

CAB Health using ERL

CINAHL

COCHRANE and Associated registers

EMBASE on web

ERIC via CSA

Inspec

JNEB

LISA – Library and Information Science Abstracts on web

MEDLINE

PAIS International

PSYCHINFO

Sociological Abstracts via CSA

Science Citation Index via ISI

SIGLE

Social Science Citation Index via ISI

Zoological records



*Search terms*

The following MeSH index and free text terms were used for all of the electronic searches except for ASSIA, CAB and ISI where a simpler combination of the same terms was used.

*No. Request*

- 1 food
- 2 nutrition
- 3 diet
- 4 #1 or #2 or #3
- 5 labelling
- 6 labeling
- 7 label
- 8 information
- 9 point-of-choice
- 10 point-of-purchase
- 11 packet
- 12 package
- 13 food
- 14 industry
- 15 food industry
- 16 nutrition
- 17 policy
- 18 nutrition policy
- 19 #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18
- 20 #4 and #19
- 21 consumer
- 22 #20 and #21

No hand searching was undertaken but additional searching was carried out using the reference lists of some relevant articles that were obtained from papers identified during the search. Searches in specific journals that were likely to contain relevant research (for example, *Journal of Nutrition Education*, *BNF Nutrition Bulletin*) but are not included in standard electronic sources were also undertaken.

An initial screen of title/abstract was done to ensure that papers included reflected the needs and scope of the review. This included a full-text translation of all non-English abstracts. When a title/abstract could not be rejected with certainty, the full text of the article was obtained for further scrutiny. Additional information was sought by personal communication with the study's first author on occasion, when required.

## 2.2 Unpublished research

Unpublished research was searched for in two ways, by identifying key people internationally and by searching the Internet.

### *Key people*

The approach used was a mixture of direct contacts and 'snowballing'. The European Heart Network (EHN), the International Union of Health Promotion and Education (IUHPE) and the researchers undertaking the review were the initial points of reference to identify contacts in Europe and across the world. Initial contact was made by e-mail. When this was unsuccessful, a second attempt was made a day or so later. If this was still unsuccessful, a final attempt was made using the telephone or a letter.

Contacts were asked whether they or their organisation had been concerned with any work on consumer understanding and use of food labelling, and if so details were collected. They were also asked if they knew of anyone else or other organisations in their country who may have undertaken relevant work. If they did, the new contact was pursued in the same manner as the first contact.

### *Internet searches*

A search was carried out using the Google search engine. The search terms were:

labelling OR labeling, AND food OR nutrition, AND consumer, AND research, NOT genetic OR irradiation OR allergy OR allergies.

## 3 Data extraction and validation

Full text translations were obtained for non English studies which met the inclusion criteria and if the study could not be rejected from the title/abstract alone.

Studies included were divided between the two reviewers. Information from each included study was entered into a data extraction form. A list of the headings used are shown below. Each reviewer assessed their batch of studies but no cross-checking between reviewers was undertaken, as originally planned, due to the quantity of studies which were reviewed.

*Data extraction headings*

Date of data extraction  
Citation  
ID number  
Name of reviewer  
Re-verification of study eligibility  
Setting  
Focus of study  
Stated objectives  
Study population  
Number in study  
Participant characteristics  
Recruitment procedures  
Study design  
Theoretical rationale  
Study name  
Study description  
Study mode of delivery  
Study duration  
Study follow up  
Evaluation measures  
Baseline data  
Results  
Analysis  
Authors conclusions  
Reviewers quality assessment  
Justification of quality assessment  
Reviewers notes  
Type of food labelling  
Country of study

#### 4 Quality assessment criteria

Criteria for research carried out using different types of study design were developed and were largely based upon the criteria described by the NHS Centre for Reviews and Dissemination<sup>13</sup> and the criteria used in constructing the Health Evidence Bulletins for Wales (for further information see <http://hebw.uwcm.ac.uk>). These were adapted and

supplemented where necessary to make them relevant for this systematic review. The final criteria used are show below.

#### **4.1 Banding**

High quality studies (H) – meet all criteria

Medium-high (M-H) – intermediate between medium and high

Medium quality studies (M) – meet half of relevant criteria

Medium-low (M-L) – intermediate between medium and low

Low quality studies (L) – meet no criteria

#### **4.2 Criteria for research carried out using different types of study design**

##### *Reviews*

Was the review conducted using transparent and replicable methods?

Did it include a trawl for information that was as comprehensive as possible (including published and unpublished information)?

Did it address a clearly focused issue?

Did the studies that were included address the review's question?

Were the important relevant studies included, as far as it possible to ascertain this?

Did the authors assess the quality of the studies included?

Were all of the important outcomes considered (both negative and positive)?

##### *Experimental Studies*

Was the assignment to the treatment groups really random?

Adequate approaches to sequence generation include:

- computer generated random numbers
- random number tables

Inadequate approaches include use of:

- alternation
- case record numbers
- birth dates
- week days

Was the treatment allocation concealed?

Adequate approaches include:

- Centralised randomisation

- Serial number of identical containers (e.g. presentation of packaged food)
- On-site computer based system with a randomisation sequence that is not readable until allocation
- Other robust methods

Inadequate approaches include:

- Use of alternation, case record numbers, birth dates or week days
- Open random numbers lists

Were the groups similar at baseline?

Were the eligibility criteria specified?

Were the point estimates and measure of variability presented for the primary outcome measure?

Did the analyses include an intention to treat analysis?

#### *Cohort studies*

Was there sufficient description of the groups?

Was the intervention reliably ascertained?

Were the groups comparable on important confounding factors?

Was there adequate adjustment for the effects of these confounding variables?

Was outcome assessment blind to exposure status?

Was follow up long enough for the outcomes to occur?

Were drop out rates and reasons for drop out similar across intervention and unexposed groups?

#### *Cross-sectional surveys*

Was the sample representative of the population?

Was there sufficient description of the group?

Did authors reflect the current state of knowledge according to an unbiased review of the literature?

Was that the choice of study method appropriate?

Were the results reported clearly?

Were the statistical techniques appropriate?

Are conclusions adequately supported by the information cited?

Were all key outcomes/results considered?

*Qualitative studies*

Was the choice of qualitative approach appropriate?

Theoretical adequacy:

- Did the authors reflect the current state of knowledge according to an unbiased review of the literature?
- Was the study design and sampling strategy theoretically grounded?
- Did the researchers make explicit the process by which they moved from data to interpretation?

Were the authors' positions clearly stated (perspective, role, potential bias, and influence)

Was the sampling strategy clearly described and justified?

- Was the method of sampling stated or described
- Did the investigators sample the most useful or productive range of individuals and settings relevant to their question?
- Were the characteristics of those included in the study defined?

Was an adequate description of the method of data collection given?

- Was the method data collection described?
- Was a rationale for the method given?
- Were appropriate data sources studied?
- Were observations taken at different times?

Were the procedures for data analysis and interpretation described and justified?

- Was a description given of how themes and concepts were identified in the data?
- Did more than one researcher perform the analysis?
- Were negative or discrepant results taken into account?
- Were the data fed back to the participants for comment?



