Communicating healthier food choice – Food composition data, front-of-pack nutrition labelling and health claims.

by

Charo Elena Hodgkins

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Department of Nutritional Sciences
Faculty of Health & Medical Sciences
University of Surrey

Supervisors: Prof Monique Raats & Dr Michelle Gibbs

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ABSTRACT

Background: Food composition data, front-of-pack nutrition labelling and nutrition and health claims have an important role to play in the development of appropriate policy, regulation and public health interventions ultimately aimed at reducing the burden of diet-related chronic disease. The overarching aim of this thesis is to explore whether the communication of healthier food choice through front-of-pack (FOP) nutrition labelling and health claims can be enhanced by the development of consumer derived frameworks (typologies) of these domains, a greater understanding of the degree to which the different FOP labelling schemes impact on consumer health inferences and an improved approach to the sharing of food composition data between stakeholders.

Method: The potential for more effective approaches to the transfer of food composition data on processed foods, was explored via a survey conducted within the UK food industry (Study 1). To facilitate the development of a consumer derived typology of FOP nutrition labelling schemes in Europe, a free-sorting study utilising the ‘Multiple Sort Procedure’ (MSP) was performed in four countries; France, Poland, Turkey and the United Kingdom (Study 2). Building on the MSP methodology utilised in Study 2, a further study on nutrition and health claims was performed in five countries; Germany, the Netherlands, Slovenia, Spain and the United Kingdom. (Study 3). The final study in this thesis sought to quantify the extent to which consumer perceptions of healthiness are impacted by the interpretative elements of the prevalent FOP labelling schemes in four countries; Germany, Poland, Turkey and the United Kingdom (Study 4).

Conclusion: The outcomes of this research propose an optimised approach to the sharing of food composition data, an optimised approach to FOP labelling and consumer derived typologies for both the FOP labelling and nutrition and health claims domains.
DECLARATION OF ORIGINALITY

This thesis and the work to which it refers are the results of my own efforts. Any ideas, data, images or text resulting from the work of others (whether published or unpublished) are fully identified as such within the work and attributed to their originator in the text, bibliography or in footnotes. This thesis has not been submitted in whole or in part for any other academic degree or professional qualification. I agree that the University has the right to submit my work to the plagiarism detection service Turnitin UK for originality checks. Whether or not drafts have been so assessed, the University reserves the right to require an electronic version of the final document (as submitted) for assessment as above.

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Date: 14th November 2016
PREFACE

The studies within this thesis were funded by the following European Union Research projects:

- The European Food Information Resource Network project (EUROFIR FP6 2005-10) – Study 1
- Food Labelling to Advance Better Education for Life (FLABEL FP7-211905) – Studies 2 & 4
- The role of health-related claims and symbols in consumer behaviour (CLYMBOL FP7-311963) – Study 3

Since the description of works for the EU projects agreed with the funding bodies did not specify the experimental methodology that should be utilised to answer the research questions being addressed it was agreed, following discussion with Professor Monique Raats, the Principal Investigator on each of these projects, that I would develop the work undertaken by me into a PhD thesis. I therefore took responsibility for the design, implementation, analysis and reporting of the studies included in this thesis. However, collaboration and support from other project members was an essential part of the implementation of these studies, particularly in terms of translation of study materials into local language and for the recruitment and data collection across the countries involved. The valuable contribution of these project partners is recognised both in the acknowledgements section of this thesis and in the authorship of the resultant published manuscripts that have arisen/will arise from the studies within this thesis.

The European Food Information Resource Network project (EUROFIR FP6 2005-10)

My work started when I was appointed as a research fellow within The European Food Information Resource Network project (2005-10; EuroFIR), a Network of Excellence (NoE) comprising of 48 partners from academia, research organisations and small-and-medium size enterprises (SMEs) in 27 countries. The project was funded by the European Community's Sixth Framework Programme
(Priority 5: Food Quality and Safety; Contract no FP6-513944). The main objective of this project was to develop a harmonised European online platform of food composition data and to establish a sustainable platform to support ongoing development, management, publication and application of food composition data within Europe. My role within the project was to determine the extent to, and format in which, food composition data is used by various user and stakeholder groups. This resulted in the development and implementation of a survey based study, conducted with participants from the UK food industry, in order to gain an insight into the potential barriers to more effective methods for food composition data transfer between industry, health professionals and policy makers. This study constitutes Chapter 2 of this thesis and has been published in a peer-reviewed journal;


Food Labelling to Advance Better Education for Life (FLABEL FP7-211905)

I also acted as a research fellow on another European funded project from the European Community’s Seventh Framework Programme; ‘Food Labelling to Advance Better Education for Life (FLABEL)’, Contract no FP7-211905. The main objective of this project was to establish the role of, and identify what can be achieved when, communicating nutrition information to consumers via food packaging labels. Two of the studies within this thesis were performed to support this project; Chapter 3 (Study 2) ‘Understanding how consumers categorise nutritional labels; a consumer derived typology for front-of-pack nutrition labelling’ and Chapter 5 (Study 4) ‘Guiding healthier food choice: Systematic comparison of four front-of-pack labelling systems and their effect on judgements of product healthiness’. Both studies have been published in peer-reviewed journals;


**The role of health-related claims and symbols in consumer behaviour (CLYMBOL FP7-311963)**

The study performed in Chapter 4 (Study 3) was funded and performed as part of my involvement on a further European funded project from the European Community's Seventh Framework Programme; 'The role of health-related claims and symbols in consumer behaviour (CLYMBOL)', Contract no FP7-311963. The main objectives of this project were to determine how health-related claims and symbols are understood by consumers, and how they affect purchasing and consumption. My role within the project was to design and implement a study to explore how consumers categorise health related claims and to develop a consumer derived typology of health claims. The outcome of this study is currently being prepared for submission to a peer-reviewed journal.

**Disclaimer**

Although the research in this thesis was supported by these projects, the content of this thesis reflects only the views of myself as its author; the European Commission is not liable for any use that may be made of the information contained herein.
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To my wonderful husband, and two lovely boys, a huge thank you for your understanding and unwavering support which allows me to achieve my goals – I dedicate this thesis to you!
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>ii</td>
</tr>
<tr>
<td>DECLARATION OF ORIGINALITY</td>
<td>iii</td>
</tr>
<tr>
<td>PREFACE</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>TABLE OF CONTENTS</td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>xiv</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xv</td>
</tr>
</tbody>
</table>

## CHAPTER 1 - INTRODUCTION

1.1 Background ......................................................................................................................... 1
1.2 Food composition data ......................................................................................................... 4
  1.2.1 Food composition data and health policy ................................................................. 5
  1.2.2 Food composition data and research ............................................................................ 6
  1.2.3 Food composition data and industry ........................................................................... 7
1.3 Nutrition labelling and nutrition and health claims ................................. 8
  1.3.1 Nutrition labelling regulation .................................................................................... 8
  1.3.2 Front of Pack (FOP) nutrition Labelling ................................................................. 8
  1.3.3 Nutrient profiling ........................................................................................................ 9
  1.3.4 Types of FOP Labelling .............................................................................................. 10
  1.3.5 Categorisation of FOP labelling schemes .................................................................. 12
  1.3.6 Consumer understanding of FOP labelling ................................................................. 13
  1.3.7 Consumer use of FOP labelling ................................................................................... 15
  1.3.8 Nutrition and Health Claims regulation ..................................................................... 15
  1.3.9 Consumer understanding of nutrition and health claims ........................................... 16
1.4 Outlining the studies .......................................................................................................... 18
  1.4.1 Thesis rationale and aims ............................................................................................ 18
  1.4.2 Study 1 - Optimising food composition data flow within the UK Food Supply Chain and to external stakeholders ................................................................. 20
  1.4.3 Study 2 - Understanding how consumers categorise nutritional labels; a consumer derived typology for front-of-pack nutrition labelling .......................... 20
1.4.4 Study 3 - Understanding how consumers categorise health related claims; a consumer derived typology of health claims ................................................. 21
1.4.5 Study 4 - Guiding healthier food choice: Systematic comparison of four front-of-pack labelling systems and their effect on judgements of product healthiness. .................................................................................................................. 22
1.4.6 The Multiple Sort Procedure (MSP) and Multiple Scalogram Analysis (MSA). .................................................................................................................. 22

CHAPTER 2
STUDY 1 - OPTIMISING FOOD COMPOSITION DATA FLOW WITHIN THE UK FOOD SUPPLY CHAIN AND TO EXTERNAL STAKEHOLDERS.

2.1 Introduction and aims ........................................................................................................... 25
2.2 Materials and Methods ......................................................................................................... 26
   2.2.1 Participants ...................................................................................................................... 26
   2.2.2 Data collection ................................................................................................................ 26
2.3 Results .................................................................................................................................... 27
   2.3.1 Sample description .......................................................................................................... 27
   2.3.2 Food composition data sources ...................................................................................... 27
   2.3.3 Principal needs ................................................................................................................ 27
   2.3.4 External data sharing ....................................................................................................... 28
   2.3.5 Perceived barriers to data sharing .................................................................................. 30
2.4 Discussion .............................................................................................................................. 30
   2.4.1 Food composition data and the supply chain ................................................................. 31
   2.4.2 Optimisation of food composition data flow ................................................................. 32
2.5 Conclusions .......................................................................................................................... 33

CHAPTER 3
STUDY 2 - UNDERSTANDING HOW CONSUMERS CATEGORISE NUTRITIONAL LABELS; A CONSUMER DERIVED TYPOLOGY FOR FRONT-OF-PACK NUTRITION LABELLING.

3.1 Introduction and aims ............................................................................................................ 35
3.2 Materials and Methods ........................................................................................................ 36
   3.2.1 Participants ...................................................................................................................... 37
   3.2.2 Rationale for the development of the study stimuli ....................................................... 38
3.2.2.1 FOP labelling Types.................................................................38
3.2.2.2 FOP labelling across the countries......................................40
3.2.2.3 FOP labelling elements .........................................................41
3.2.2.4 Development of the stimuli ..................................................41
3.2.3 Data collection ......................................................................42
3.2.4 Analysis ......................................................................................42
3.3 Results .........................................................................................43
  3.3.1 Constructs utilised by participants in their first free sort ...........43
  3.3.2 Interpretation of the MSA plots ..............................................45
    3.3.2.1 MSA Plot - UK .................................................................45
    3.3.2.2 MSA Plot - Turkey ............................................................47
    3.3.2.3 MSA Plot - Poland .............................................................47
    3.3.2.4 MSA Plot - France .............................................................48
  3.3.3 Nutrition claims .....................................................................49
3.4 Discussion ...................................................................................50
  3.4.1 Proposed consumer derived labelling typology .......................50
3.5 Conclusions .................................................................................53

CHAPTER 4
STUDY 3 - UNDERSTANDING HOW CONSUMERS CATEGORISE HEALTH
RELATED CLAIMS; A CONSUMER DERIVED TYPOLOGY OF HEALTH CLAIMS.

4.1 Introduction and aims.................................................................55
4.2 Materials and Methods ..............................................................56
  4.2.1 Participants .............................................................................57
  4.2.2 Rationale for the development of the study stimuli ..................57
  4.2.3 Data collection .......................................................................62
  4.2.4 Structured sorting - Expert typology headings .......................63
  4.2.5 Background measures ............................................................64
  4.2.6 Free sort analysis ....................................................................65
  4.2.7 Structured sort analysis ............................................................66
4.3 Results .........................................................................................66
  4.3.1 Sample description ..................................................................66
  4.3.2 Constructs utilised by participants in their first free sort ..........67
  4.3.3 First free sort top plots .............................................................68
  4.3.4 Explanation of the MSA plots ..................................................71
4.3.4.1 MSA Plot – United Kingdom (UK) ................................................................. 71
4.3.4.2 MSA Plot – Germany (DE) ............................................................................ 74
4.3.4.3 MSA Plot – The Netherlands (NL) ................................................................. 77
4.3.4.4 MSA Plot – Slovenia (SL) ............................................................................... 79
4.3.4.5 MSA Plot – Spain (ES) .................................................................................. 81
4.3.5 Structured sorting into expert group headings ..................................................... 84
  4.3.5.1 Placement of Article 14a and b claims ............................................................... 84
  4.3.5.2 Placement of Article 13 claims ........................................................................ 86
  4.3.5.3 Placement of nutrition claims overall .............................................................. 89
  4.3.5.4 Placement of nutrition claims by country ......................................................... 89
  4.3.5.5 Reflecting on the expert typology group headings / structured sorting task ......................................................................................................................... 96
4.3.6 Factors impacting consumer acceptance of health and nutrition claims ....... 98
4.4 Discussion .................................................................................................................... 102
  4.4.1 Consumer derived typology for nutrition and health claims ................................ 102
  4.4.2 Policy implications ............................................................................................... 105
4.5 Conclusions ................................................................................................................... 106

CHAPTER 5
STUDY 4 - GUIDING HEALTHIER FOOD CHOICE: SYSTEMATIC COMPARISON OF FOUR FRONT-OF-PACK LABELLING SYSTEMS AND THEIR EFFECT ON JUDGEMENTS OF PRODUCT HEALTHINESS.

5.1 Introduction and aims ................................................................................................. 107
5.2 Materials and Methods ............................................................................................. 107
  5.2.1 Participants ........................................................................................................... 108
  5.2.2 Design .................................................................................................................. 108
  5.2.3 Development of the study stimuli ........................................................................ 109
    5.2.3.1 Rationale for the selection of food categories .................................................. 111
    5.2.3.2 Rationale for selection of portion sizes ............................................................ 111
    5.2.3.3 Mapping the objective healthiness of the foods ................................................. 111
  5.2.4 Data collection ...................................................................................................... 114
  5.2.5 Measures .............................................................................................................. 116
  5.2.6 Statistical analysis ............................................................................................... 116
5.3 Results ......................................................................................................................... 117
5.3.1 Utilising DV1 (participants’ perceived healthiness ratings) as the dependent variable ................................................................. 117
5.3.2 Utilising DV2 (error scores) as the dependent variable .......... 123
5.4 Discussion ................................................................................................. 126
5.5 Conclusions ....................................................................................... 127

CHAPTER 6
GENERAL DISCUSSION

6.1 Overview .................................................................................................. 129
6.2 Improved approach to the sharing of food composition data between stakeholders. ......................................................................................... 129
6.3 A consumer derived framework (typology) of FOP labelling .................. 130
6.4 FOP labelling schemes; towards an optimal approach.......................... 132
6.5 A consumer derived framework (typology) of nutrition and health claims. .. 133
6.6 The MSP methodology ........................................................................... 136
6.7 Limitations ............................................................................................... 137
6.8 Opportunities for future research ........................................................... 138
6.9 Conclusions .............................................................................................. 140

REFERENCES ................................................................................................ 142

APPENDICES

APPENDIX 1 : Study 1 - Questionnaire ................................................................. 161
APPENDIX 2A: Study 2 – Participant information Sheet and Consent Form.. 169
APPENDIX 2B: Study 2 – FOP Label Stimuli Cards ........................................ 171
APPENDIX 2C: Study 2 - Multiple Sort Data Recording Form ....................... 174
APPENDIX 3A: Study 3 – Participant information Sheet and Consent Form.. 177
APPENDIX 3B: Study 3 - Claim Stimuli Cards .................................................. 179
APPENDIX 3C: Study 3 - Multiple Sort Data Recording Form ....................... 186
APPENDIX 3D: Study 3 – Background Questionnaire ...................................... 190
APPENDIX 4 : Study 4 – All factors and interactions (ANOVA Table) ............. 194

AUTHOR PUBLICATIONS ........................................................................ 199
LIST OF TABLES

CHAPTER 1

Table 1.1 Traffic Light labelling criteria defining green, amber, red colour-coding for foods ..................................................... 11

CHAPTER 3

Table 3.1 Socio-demographic characteristics of participants by country ... 38
Table 3.2 Content elements of the label stimuli (Expert categories) ........ 39
Table 3.3 Frequencies of first sort constructs used in sort rationale/group headings in at least 3 of the 4 countries .................................. 44
Table 3.4 Categorisation of study labels according to proposed typology.. 51

CHAPTER 4

Table 4.1 Socio-demographic characteristics of participants by country ... 57
Table 4.2 Health claim and nutrition claim stimuli ........................................ 59
Table 4.3 Structured sort headings (expert typology) and associated stimuli cards ........................................................................ 63
Table 4.4 Mean scores for background variables ........................................ 67
Table 4.5 Categories of constructs utilised in free sorting for all countries combined............................................................................. 69
Table 4.6 Categories of constructs utilised in free sorting per country ...... 70
Table 4.7 Frequency of cards placed in Structured Sort Group 7 “Don’t know” by country ................................................................. 87
Table 4.8 Typology dimensions for nutrition and health claims ............. 105

CHAPTER 5

Table 5.1 Participant characteristics ...................................................... 109
Table 5.2 Nutritional profile of label stimuli .............................................. 113
Table 5.3 Means and 95% Confidence Intervals for subjective healthiness ratings (DV1) and error scores (DV2) .......................... 119
Table 5.4 Repeated measures ANOVA results for subjective healthiness ratings (DV1) and error scores (DV2) ...................... 121
# LIST OF FIGURES

## CHAPTER 1

| Figure 1.1 | Overview of the relationship between food composition data, nutrition labelling and nutrition and health claims | 3 |
| Figure 1.2 | Overview of the studies in this thesis in relation to food composition data, nutrition labelling and nutrition and health claims and the stakeholder activities embedded within the process of enabling consumers to make healthier food choices | 19 |

## CHAPTER 2

| Figure 2.1 | Percentage of Respondents according to Sector, Market, Annual turnover and Role | 29 |
| Figure 2.2 | Food composition data flow within the food supply chain | 32 |

## CHAPTER 3

| Figure 3.1 | MSA Plot – United Kingdom (UK) | 46 |
| Figure 3.2 | MSA Plot – Turkey (TK) | 47 |
| Figure 3.3 | MSA Plot – Poland (PL) | 48 |
| Figure 3.4 | MSA Plot – France (FR) | 49 |

## CHAPTER 4

| Figure 4.1 | MSA Plot – United Kingdom (UK) | 71 |
| Figure 4.2 | MSA Plot – Germany (DE) | 75 |
| Figure 4.3 | MSA Plot – The Netherlands (NL) | 78 |
| Figure 4.4 | MSA Plot – Slovenia (SL) | 79 |
| Figure 4.5 | MSA Plot – Spain (ES) | 82 |
| Figure 4.6 | Average frequency (%) of placement in appropriate structured sort groups across all countries | 85 |
Figure 4.7 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 19 ‘Rich in vitamin C’ ................................................................. 90
Figure 4.8 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 20 ‘Naturally low in sodium’ ................................................................. 91
Figure 4.9 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 21 ‘Fat free’ ........................................................................ 92
Figure 4.10 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 22 ‘No added sugar’ .......................................................................................................................... 93
Figure 4.11 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 24 ‘Source of omega-3’ ................................................................................................................................ 94
Figure 4.12 Frequency of placement of nutrition claims under the various structured sort group headings per country – Cards 23 ‘Contains wholegrain’ ........................................................................................................ 95
Figure 4.13 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 25 ‘One of your 5 a day’ ............................................................................................................ 95

CHAPTER 5

Figure 5.1 Examples of the basic label and four test FOP label systems . 110
Figure 5.2 Flowchart of stimuli sequence within a subject ......................... 115
Figure 5.3 FOP*Healthiness*System interaction utilising DV1 (Mean healthiness ratings) ......................................................................................................................... 120
Figure 5.4 Food*Healthiness interaction utilising DV1 (Mean healthiness ratings) ................................................................................................................................. 122
Figure 5.5 Food*Healthiness interaction utilising DV2 (Mean error scores) ................................................................................................................................. 124
Figure 5.6 Food*FOP*System interaction utilising DV2 (Mean error scores) ................................................................................................................................. 125
CHAPTER 1
INTRODUCTION

1.1 Background

Recent years have witnessed an increasing burden of noncommunicable diseases (NCDs) such as obesity, type 2 diabetes and cardiovascular disease, with some reaching epidemic levels (Prentice, 2006). A major contributory factor to the development of these chronic diseases is lifestyle changes that include reduced physical activity and a shift to more energy dense diets (Popkin & Gordon-Larsen, 2004). In developed countries there is a ready supply of processed or pre-prepared foods which now constitute a significant proportion of the population’s diet (van Raaij, Hendriksen & Verhagen, 2009) and many of these foods are energy dense and high in risk nutrients such as saturated fat, sugar and salt (Monteiro, 2009).

In 2004, the World Health Organisation’s (WHO) Global Strategy on Diet, Physical Activity and Health, identified elevated consumption of foods high in fat, sugar and salt, as an underlying determinant of the increased NCD disease burden (WHO, 2004). The greatest impact from the four main NCDs (cardiovascular disease, diabetes, cancer and respiratory disease) has been observed in the European Region, where it is estimated they collectively account for 86% of premature mortality (WHO, 2014). It is of concern that other WHO regions are following this trend with increasing rates of weight gain and obesity (Swinburn et al., 2011) and it is recognised that increased accessibility to energy dense processed foods is playing a part in this phenomenon (Monteiro et al., 2010; WHO/FAO, 2003; World Cancer Research Fund/American Institute for Cancer Research, 2009).

Transparency is seen as an important regulatory tool (Weil et al., 2005) and mandatory disclosure of information is used widely by governments as a means of reducing the information asymmetry between producers and consumers (van Kleef et al., 2008). The provision of information on packaged processed foods is seen as having the potential to support informed choice by the consumer in the food domain (Cowburn & Stockley, 2005), whilst not curtailing the food industry’s freedom in terms of the products they produce (van Kleef & Dagevos, 2015). In addition, the disclosure of nutrition information on pack is seen as having the potential to impact on the food environment by encouraging food producers to voluntarily improve the health of the products they produce in order to display more favourable nutrition
labels (Vyth et al., 2010; Roodenburg, Popkin & Seidell, 2011). With the mandatory introduction of nutrition labelling for all packaged foods required by 2016 (European Commission [EC], 2011), the concept of informed choice by consumers within the food domain has become synonymous with health policy related to encouraging consumers towards a healthier choice.

Nutrition and health claims, which often exist on pack in conjunction with nutrition labelling, are seen as having the potential to help guide consumers to healthier food choices whilst also stimulating healthier food innovation and competitiveness within Europe (Hieke et al., 2015). The need to ensure that consumers are protected from misleading information and that the food industry is afforded a level playing field resulted in the Nutrition and Health Claims Regulation (NHCR) EC No 1924/2006 (European Commission [EC], 2006a).

An overview of the relationship between food composition data, nutrition labelling and nutrition and health claims and the stakeholder activities embedded within the process of enabling consumers to make healthier food choices is depicted in Figure 1.1.
Figure 1.1 Overview of the relationship between food composition data, nutrition labelling and nutrition and health claims
1.2 Food composition data

‘A knowledge of the chemical composition of foods is the first essential in the dietary treatment of disease or in any quantitative study of human nutrition’ (McCance and Widdowson, 1940 p.5).

The earliest food composition tables in Europe were published in Germany in the late 1870s and this was closely followed by publication of tables in the United States in the mid 1890’s (Church, 2005). Other countries have over the years developed their own systems of nationally accepted food composition data. Traditionally, in the UK the national food composition tables, managed by the Food Standards Agency (FSA) - commonly known as ‘McCance and Widdowson’ tables (FSA, 2002) - have been used as the primary source of food composition data.

Initiated in the 1920s, the McCance and Widdowson data (FSA, 2002), originally available in paper format and more recently electronically, have been maintained and updated over time in an attempt to reflect the most commonly consumed foods. Much of the data in these tables are derived from laboratory analysis driven by the needs of the UK National Diet and Nutrition Surveys (NDNS) (Bates et al., 2014). Typically, the UK and other European countries, national tables have contained reasonable coverage of the nutrient content of primary produce and basic cooked food recipes. However, it is difficult for them to keep abreast of the fast moving processed and convenience food market, which exhibits a high rate of reformulation and constant new product introduction programmes (Gillanders, Steeper & Watts, 2002; Church, 2005). Since processed foods are increasingly contributing to the modern diet, Gillanders, Steeper & Watts (2002) suggested that ‘Food composition database providers must consider new and novel approaches to describing a rapidly changing food supply’ (p.1). Similar difficulties have also been experienced in relation to maintaining nutrient databases that underpin nutritional research (Schakel, 2001). The increase in global food brands and the greater focus on large-scale international research studies means there is a greater need for current and reliable data with increased accessibility to data on foods from other countries (Church 2005).
1.2.1 Food composition data and health policy

The World Health Organisation’s Global Strategy on Diet, Physical Activity and Health (WHO, 2004) states four main objectives;

(1) to reduce the risk factors for noncommunicable diseases that stem from unhealthy diets and physical inactivity by means of essential public health action, health-promoting and disease preventing measures;

(2) to increase the overall awareness and understanding of the influences of diet and physical activity on health and of the positive impact of preventive interventions;

(3) to encourage the development, strengthening and implementation of global, regional, national and community policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive, and actively engage all sectors, including civil society, the private sector and the media;

(4) to monitor scientific data and key influences on diet and physical activity; to support research in a broad spectrum of relevant areas, including evaluation of interventions; and to strengthen the human resources needed in this domain to enhance and sustain health’. (WHO, 2004 p.3-4).

In order to implement any, if not all of the above objectives, there is a need for the food composition data on processed foods to be available to policy makers, researchers, health professionals and consumers. For policy makers and health professionals, the data on processed foods is important for the effective research of diet-related health, the monitoring of the nutritional profile of commonly consumed foods and the subsequent setting of appropriate targets for risk nutrients within industrially processed foods.

Provision of nutrition information on processed foods is seen as a key driver in the creation of a healthier food environment by encouraging industry to
reformulate products to display a better nutritional profile (van Kleef & Dagevos, 2015) and providing governments with the information needed to affect more directed public health reformulation strategies, such as those recently implemented in the UK on salt reduction (He, Brinsden & MacGregor, 2014). For consumers, it is suggested that food composition data, translated into nutrition information on pack and in some cases nutrition and health claims, can facilitate consumer understanding of the nutritional content of the foods that they purchase, particularly for complex processed foods, thus enabling them to make healthier food choices (WHO, 2014; European Commission [EC], 2011).

1.2.2 Food composition data and research

When attempting to perform large-scale research into the relationship between diet and health, such as the European Prospective Investigation into Cancer and Nutrition (EPIC), data within the national databases has been shown to have limitations in terms of coverage, compatibility and data quality (Deharveng et al., 1999; Moller et al., 2007). In addition, historical differences between the various national food composition tables, in terms of the way in which food composition data is documented, has led to issues with effective interchange of this type of data (Becker, 2010).

With the expansion of the European Union and subsequent increase in cross border trade, harmonisation of food composition data, accompanied by the creation of durable and sustainable structures to maintain the viability and sharing of this data is an important issue within Europe (Egan et al., 2007). So much so that in 2005, a large European funded research project ‘EUROFIR FP6 2005-10’ was initiated which involved 48 universities, research institutes and small-to-medium-sized enterprises from 27 European countries and was tasked with developing a sustainable pan-European food composition information resource to underpin food and health research and the ongoing development of public health policy and health claim regulation.

1.2.3 Food composition data and industry

It is important to recognise that food composition data are also fundamental to many activities within the food supply chain. These include nutritional labelling, optimisation of product composition and nutrition and health claim support
(Roodenburg & Leenan, 2007). In order to create the nutrition declaration/labelling for a given food product, food producers can either; [1] perform direct analysis of the food, [2] calculate the nutritional values of their food using average nutritional data from ingredients specified in the tables, or [3] calculate the nutritional values for their food from generally established and accepted data (European Commission [EC], 2011). Due to the costs associated with direct analysis, this option is often prohibitive for the smaller food producers. However, within larger companies, direct analysis may be performed either for labelling purposes or as part of their ongoing product development programme.

In terms of new product development (NPD) and optimisation of existing products, food composition data may be generated within industry as a result of the analysis of potential new ingredients by either the food producer, or indeed the ingredient supplier further back in the supply chain. Similarly, food composition data may be generated on the food product as part of the NPD or optimisation process, particularly if there is a desire for the food to ultimately carry a nutrition or health claim.

Once a product has been developed and is ready to be marketed, elements of food composition data - either in the form of a back-of-pack nutrition table or, where desired, nutrition and health claims - are listed on pack to comply with food labelling legislation (European Commission [EC], 2011) and health claim legislation (European Commission [EC], 2006a). For commercial purposes, the data is sometimes also translated into marketing and advertising materials which may be communicated to the end consumer via leaflets, media and websites. On an ad-hoc basis, data may also be shared with trade organisations, slimming organisations and other commercial organisations that develop and market data management tools such as, software packages and apps for use in the field of personal management of nutrition and health. Food producers are also regularly required to provide food composition data they have generated or calculated on their products to government bodies and research representatives for use in various activities such as national dietary surveys, or the many nutrition and public health research initiatives.

Although it would appear that food composition data on processed foods readily exists within the food industry, it should be recognised that there are limitations with regards to the quality of this food composition data due to the lack of standardised procedures for recipe calculation, sampling and analysis of these often very complex foods (Krines & Finglas, 2006; Church & Krines, 2008).
1.3 Nutrition labelling and nutrition and health claims

1.3.1 Nutrition labelling regulation

The regulation of the European Parliament and the Council of 25 October 2011 EC No 1169/2011 on the ‘Provision of food information to consumers’ (European Commission [EC], 2011) requires all pre-packaged foods to be labelled with energy, fat, saturates, carbohydrates, sugars, protein and salt per 100g or per 100ml, and if desired per portion where the portion is clearly stated on the pack. Additionally, expression as a percentage of Dietary Reference Values (DRV) per 100g/ml and per portion is permitted. Typically manufacturers present this nutritional information in the form of a table on the back-of-pack (BOP). Whilst the regulation does not legislate for mandatory front-of-pack (FOP) nutrition labelling, if voluntarily included by the manufacturer, it must be presented as specified in the legislation (European Commission [EC], 2011) as energy alone, or energy in conjunction with per portion values for the four key risk nutrients (fat, saturates, sugars and salt). If desired these may also be expressed in terms of percentage Dietary Reference Values (DRVs) (Wiseman, 1992).

1.3.2 Front of Pack (FOP) nutrition Labelling

For some time, it has been suggested that supplementing the BOP nutrition table with a summarised or simplified version of nutrition information in the form of a ‘signpost’ FOP label may be more effective in encouraging consumers to choose healthier foods when shopping (Scott & Worsley 1994; Geiger et al., 1999; IOM 2011; WHO, 2014). Government bodies, organisations concerned with health promotion, food producers and retailers have actively embraced FOP signpost labelling and have developed a wide range of schemes in varying colours and formats to communicate the nutritional content and relative healthfulness of their foods. These schemes range from the presence of a summary label on the front of the pack communicating the levels of energy and key risk nutrients, possibly overlaid with interpretative text or colour as a benchmark, through to the presence of a simple visual symbol or ‘health logo’ indicating that the product is considered to be a more healthful choice. However, it is worth noting that the various FOP labelling schemes are often underpinned by different approaches to nutrient profiling (Van
Der Bend et al., 2014) the detail of which is invisible to the consumer at point-of-purchase.

Ultimately, the FOP schemes employed in Europe must be principally aimed at facilitating consumer understanding of the energy/nutrient contribution of the food, with evidence showing that they are understood by the average consumer, while not presenting barriers to the free movement of goods (European Commission [EC], 2011). EU Member states are currently required to monitor the use of any additional forms of expression within their territory and submit supporting evidence to the Commission in 2017 for a report to the European Parliament on the use of additional forms of expression and presentation, their effect on the internal market and on the advisability of further harmonisation within the European Union (EUFIC, 2013).

1.3.3 Nutrient profiling

Nutrient profiling has been defined as ‘the science of classifying or ranking foods according to their nutritional composition for reasons related to preventing disease and promoting health’ (Rayner, Scarborough and Kaur, 2013, p.1). It is a means of objectively establishing the overall nutritional quality of a given food and the nutritional quality of that particular food relative to other foods (Lobstein & Davies, 2008). Over the years a variety of nutrient profiling schemes, with differing methodologies, have been developed by food producers, retailers, organisations concerned with public health and regulators.

Typically the nutrient profiling methodologies utilised are based on either; [1] a threshold approach for risk nutrients, as reflected in the Guideline Daily Amount and Traffic Light FOP labelling schemes, or [2] both risk and benefit criteria (Verhagen & van den Berg, 2008). The latter is the approach adopted by most health logo FOP labelling schemes employed in Europe. In this approach a maximum threshold approach is still applied to risk nutrients, but there is also a minimum threshold requirement for the presence of certain nutrients known to contribute positively to health (e.g. fibre).

Foods bearing nutrition and health claims are required to meet appropriate nutrient profiling before a claim can be made (European Commission [EC], 2006a) and therefore the importance of access to reliable food composition data by policy makers and enforcers of this legislation has been heightened. Efforts by the EU to establish a profiling system to determine which foods actually deserve nutrition or health claims (Drenowski & Fulgoni, 2008), and research into the provision of
summarised FOP schemes underpinned by different nutrient profiling schemes, have highlighted the need for a uniform approach to nutrient profiling (Butler, 2010). Adoption of a uniform approach will ultimately help all stakeholders in Europe, including policy makers, consumers, manufacturers and retailers (Lobstein & Davies, 2008).

1.3.4 Types of FOP Labelling

As far back as the 1980s, FOP labelling systems have been developed and implemented in Europe. An audit of 40,000 food products across 27 EU member states identified 48% displaying some form of FOP nutrition labelling (genannt Bonsmann et al., 2010). In the EU, three FOP labelling schemes dominate; Guideline Daily Amounts (GDA), Traffic Lights (TL) and Health Logos (HL) however, a wide variety of designs, colour schemes and formats of these schemes exist and therefore not all are implemented in the same way.

**Guideline Daily Amount (GDA) Schemes:** GDA schemes typically display the numerical values for calories and the key risk nutrients of sugar, fats, saturates and salt contained in a portion of the food. They also express these as a percentage contribution to the daily requirements of an average reference adult. GDAs were derived from the COMA report (Wiseman, 1992) on Dietary Reference Values (DRVs) and are championed by FoodDrinkEurope previously known as the Confederation of Food and Drink industries (CIAA) as well as many food manufacturers and retailers. When this scheme is employed, FOP labels appear on all foods regardless of whether they are considered to be a healthful choice or not.

**Traffic Light (TL) Schemes:** The UK Food Standards Agency Traffic Lights Scheme (FSA, 2007) communicates numerical values for calories, sugar, fats, saturates and salt in either grams per portion, or per 100g, on the front-of-pack. This scheme also overlays the risk nutrients with an interpretative colour code of red (High), amber (Medium) or green (Low). The thresholds for the colour bands (Table 1.1) include both per 100g and per portion criteria and for fats, saturates and salt were derived from existing advice from COMA (Committee of Medical Aspects on Food Policy) and SACN (Scientific Advisory Committee on Nutrition). An expert group was set up to determine appropriate criteria for sugars. Similarly to the GDA schemes, when employed, traffic light labels appear on all foods.
Table 1.1 Traffic Light labelling criteria defining green, amber, red colour-coding for foods (FSA, 2007).

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Green (Low)</th>
<th>Amber (Medium)</th>
<th>Red (High)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>per 100g</td>
<td>per 100g</td>
<td>per 100g</td>
</tr>
<tr>
<td>Fat</td>
<td>≤ 3.0 g</td>
<td>&gt; 3.0 to ≤ 20.0 g</td>
<td>&gt; 20.0 g</td>
</tr>
<tr>
<td>Saturates</td>
<td>≤ 1.5 g</td>
<td>&gt; 1.5 to ≤ 5.0 g</td>
<td>&gt; 5.0 g</td>
</tr>
<tr>
<td>Sugars</td>
<td>≤ 5.0 g</td>
<td>&gt; 5.0 to ≤ 12.5g</td>
<td>&gt; 12.5g</td>
</tr>
<tr>
<td>Salt</td>
<td>≤ 0.30 g</td>
<td>&gt; 0.30 to ≤ 1.50g</td>
<td>&gt; 1.50 g</td>
</tr>
</tbody>
</table>

**Health Logo (HL) Schemes:** In contrast to TL and GDA schemes, health logos only appear on those foods deemed to be healthier and they do not contain numerical values for the key risk nutrients, since the presence of the logo itself indicates that the product meets the underlying nutritional criteria set by the organisation responsible for the logo scheme (Butler, 2010). The Swedish Keyhole (Larsson, Lissner & Wilhelmsen, 1999) and the Smart Choices logo (Lupton et al., 2010) are examples of such schemes which evaluate both positive and risk nutrients to establish whether the product is deemed to be healthy in relation to other foods in the same category. These approaches recognise that different food categories typically have different risk nutrient profiles and therefore the criteria set are category specific.

Research commissioned by the UK Food Standards Agency indicated that the wide variety of FOP schemes that exist may make it difficult for consumers to compare between products if they display different FOP labelling (Malam et al., 2009). Following a subsequent consultation with key stakeholders and industry, the UK government proposed a hybridised approach utilising both TLs and GDAs within a single label as the preferred UK FOP labelling (DOH, 2013). Despite the fact that industry are being strongly encouraged to use this preferred FOP labelling scheme, under the current legislation it remains a voluntary approach. Within other EU member states no such consensus has yet been achieved at a policy level as to the preferred approach.
1.3.5 Categorisation of FOP labelling schemes

From a regulatory perspective, it is important to recognise that under the ‘Provision of food information to consumers’ (European Commission [EC], 2011) and the ‘Nutrition and Health Claims Regulation’ (European Commission [EC], 2006a) some of the prevalent FOP schemes may be classified as nutrition information and others as nutrition and health claims. This is because schemes utilising the GDA approach focus only on information provision in terms of nutrition and are an example of the former, whereas, HL schemes which communicate that a food has been evaluated as being healthy may also act as health claims (Andrews, Burton & Keys, 2011).

Due to the wide variety of FOP labelling schemes employed, and the different approaches adopted, there have been a number of categorisation systems proposed in an attempt to describe and evaluate the various merits and disadvantages of the different schemes. In his paper on the regulation of nutrient profile labelling (the term most commonly used in the US for FOP nutrition labelling), Lytton (2010) proposed a taxonomy (typology) which compares and contrasts the various schemes across a number of dimensions, including: source, scope, character, gradation, segmentation and aggregation. Around the same time, the Institute of Medicine (IOM) reviewed the prevalent schemes in use in the United States and proposed a system based around three different categories; nutrient specific systems, summary indicator systems and food group information systems (IOM, 2011). A further approach has categorised signpost labelling schemes as either fact-based or criteria-based (Periera, 2010), but Pereira further suggested that consumers themselves are unlikely to recognise the difference between these two categories of labels.

Within Europe, similar efforts were being made to describe and categorise this increasingly complex domain and in 2008, Verhagen and van den Berg proposed a methodology for the creation of simple visual models in order to facilitate the comparisons of the existing nutrient profiling schemes used as the basis for consumer education or FOP nutrition labelling purposes. Known as the ‘Arrow Approach’, the categorisation criteria utilised within this model include whether the scheme, [1] is utilised across the board or is category specific, [2] includes qualifying or disqualifying ingredients and what they are, [3] is applied per portion, per 100g or according to a reference value, and [4] whether the scheme utilises a threshold or scoring approach (Verhagen and van den Berg, 2008).
All of the above approaches propose dimensions on which the relative strengths and weaknesses of the various FOP schemes can be compared, and as such are useful dimensions for experts and policy makers for the purposes of informing regulation or informing the debate around the merits of standardisation. However, it is apparent that none are based on dimensions elicited directly from consumers. Experts, by definition, tend to have a higher degree of subject specific knowledge than non-experts and as such, are likely to demonstrate a more extensive and sophisticated categorisation (Rugg & McGeorge, 1997; Ellis, 1989). Since it has been suggested that there is a lack of understanding of the relevant psychological phenomena and consumer perspectives surrounding FOP labelling schemes and their optimal development (van Kleef & Dagevos, 2015) elicitation of categorisations from consumers or ‘non-experts’, on the prevalent FOP labelling schemes has the potential to provide a very important perspective in this arena.

1.3.6 Consumer understanding of FOP labelling

There has already been a good deal of research in the area of consumer understanding and use of nutrition labelling which has been detailed in a number of very comprehensive reviews (Cowburn & Stockley, 2005; Grunert & Wills, 2007; Campos, Doxey & Hammond, 2011; Hersey et al., 2011; Kroonenberg-Vyth, 2012). In their review, Grunert and Wills (2007) proposed that consumers ultimately require three key things from FOP labels. That is, they must be simple to use, include underlying nutritional information and must not be unduly coercive.

Despite much debate between stakeholders during the development of the recent regulation (European Commission [EC], 2011), little consensus has emerged as to the most effective FOP labelling approach. Whereas earlier research suggested that consumers found it hard to identify the nutrient content of foods using the GDA approach (FSA, 2006; Lobstein, Landon & Lincoln, 2007), more recent research suggests that consumers are able to identify more healthful products by using GDA labels (Grunert, Wills & Fernández-Celeanmin, 2010). There is however, little evidence to confirm whether consumers are able to effectively utilize GDAs in the context of their overall daily diet (Louie et al., 2008; Magnusson, 2010). Critics of the GDA approach also suggest that there is potential for misrepresentation of portion sizes to make foods appear more healthful than they actually are. It has also been suggested that consumers find it difficult to compare
products when the nutritional information is presented in different portion sizes (Sanders, 2006; Lobstein & Davies, 2008).

In comparison to GDA schemes, Lobstein, Landon and Lincoln (2007) suggest that the Traffic Light (TL) labelling scheme is better at facilitating more healthful food choices. This finding was reflected in a number of other studies (Kelly et al., 2009; Balcombe, Fraser & Di Falco, 2010). However, Grunert and Wills (2007) highlight that, although consumers generally like the TL scheme, the red colour could potentially be interpreted to mean ‘not allowed’ rather than ‘limit intake’ and that this approach may lead to avoidance by the consumer of important food groups which are essential for a well-balanced diet, such as dairy, because these types of food typically incur a high proportion of red or amber traffic lights.

Advocates of health logo (HL) approaches argue that these schemes take into account the food as a whole, by addressing both positive and risk nutrients. They suggest that the presence of a logo quickly communicates the healthfulness of the product, without the need for any numerical processing by the consumer at point-of-purchase, thus potentially being more useful in a real shopping situation where heuristic processing is more likely to take place. However, Feunekes et al. (2008) found that the TL scheme was rated higher than a HL scheme for liking, comprehension and credibility. Concerns have also been raised, particularly within the cereals category, regarding the potential for manufacturers to mask relatively high levels of risk nutrients, such as sugar, by fortifying their products with positive nutrients, such as fibre, in order to qualify for a logo (Center for Science in the Public Interest, 2009). In addition, a recent study by Andrews, Burton and Keys (2011), concluded that health logos may be acting as ‘implicit health claims’ (p.23) and lead to a higher subjective evaluation of product healthfulness when compared to a hybrid TL-GDA label or no FOP label condition.

In response to the growing evidence suggesting that colour coded FOP labelling schemes incorporating TLs may be the most promising at encouraging healthful food choices (Lobstein & Davies 2008; Thorndike et al., 2012; Hawley et al., 2012; van Herpen, Hieke & van Trijp, 2014a) there has been widespread adoption of the UK Department of Health’s hybrid TL-GDA FOP labelling scheme (DOH, 2013) by UK retailers and food producers and a number of large multinationals. However, strong opposition from other EU countries still exists towards the inclusion of traffic light colour coding on FOP labels and thus little progress has been made towards a rationalised pan-European approach.
1.3.7 Consumer use of FOP labelling

Although the introduction of FOP labelling was seen by many as the intervention needed to improve the populations’ diet by supporting informed choice, there is a lack of consensus as to whether it is really having the desired effect of leading consumers to make more healthful food choices in real-world shopping situations. Despite survey-based empirical research indicating that the presence of FOP labels is likely to increase purchase intentions of more healthful foods (Andrews, Burton & Keys, 2011; Feunekes et al., 2008), studies in more realistic shopping environments have demonstrated little effect. A study in a cafeteria environment in the Netherlands concluded that the Choices International Foundation HL did not result in a significant increase of sales of more healthful lunchtime foods (Vyth et al., 2011). Similarly, a study on the introduction of TL labelling in a UK retailer showed no impact on the healthfulness of food purchases in the first four weeks of the FOP labelling being introduced. Although, it should be noted that this study outcome may have been limited by the small range of food categories included (Sacks, Rayner & Swinburn, 2009).

In the real world most consumers do not have the time or motivation to process lots of nutritional information when they are shopping (Gerrier, 2010) and consumers struggle to utilise nutrition information to evaluate the contribution of foods to their overall diet (Cowburn & Stockley 2005). Perhaps, with hindsight policymakers and the health community in general have been somewhat naive to expect that simply providing nutritional information, in the form of FOP labelling alone, would result in healthier food choices. In their review, Weil et al. (2005) concluded that ‘transparency policies are effective only when the information they produce becomes embedded in the everyday decision-making routines of information users’ (p.1). In real-life settings, personal factors and context must be considered (Barker, Lawrence & Robinson, 2012), and these often take precedence over health considerations in driving choice.

1.3.8 Nutrition and Health Claims regulation

In conjunction with nutrition labelling, nutrition and health claims are an additional means by which health-related information may be communicated to the consumer on food packaging. Whilst studies have suggested that most consumers
perceive health claims positively (Urala, Arvola & Lahteenmaki, 2003; Williams, 2005), the plethora of nutrition and health claims on food products in Europe was seen as a cause for concern. This was due to the lack of a harmonised approach to the substantiation of such claims and their potential to mislead the consumer (DG SANTE, 2015). Implementation of the Nutrition and Health Claims Regulation (NHCR) EC No 1924/2006 initially sought to eliminate those unsubstantiated and potentially misleading claims from the marketplace and create a regulatory framework which would provide an appropriate level of consumer protection, while also supporting future innovation and fair competition within the EU food industry (European Commission [EC], 2006a).

The NHCR legislation requires all claims, implying a health benefit of consuming a food, to be substantiated by a review of the scientific evidence and included on the list of authorised health claims in the European Union (EU) Register (European Commission [EC], 2006b), before being used on a food product. The legislation primarily focusses on text based claims, but also encompasses pictorial, graphic or symbolic messages which state or imply that a food has particular nutritional or health benefits. For the purposes of implementing and enforcing the regulation, health claims are more specifically defined by three main categories; ‘general function’ or Article 13 claims, ‘risk reduction’ or Article 14(1)a claims, and claims relating to ‘children’s development’ or Article 14(1)b claims. All new claims need to be submitted for approval via an application dossier before they can be used on food products. The regulation also specifies that the use of a nutrition and health claim is only permitted if the average consumer can be expected to understand the beneficial effects expressed in the claim (European Commission [EC], 2006a).

Although the NHCR has exercised control over the way in which claims are presented and worded on pack, consumers’ interpretation of those claims is less well understood and there is a lack of evidence to establish the extent to which the average consumer is able to understand health claims (Nocella & Kennedy, 2013; Grunert, Scholderer & Rogeaux, 2011).

1.3.9 **Consumer understanding of nutrition and health claims**

Nutrition and health claims are placed on foods in order to inform consumer choice by emphasising the nutritional or health benefits of consuming the food. In general, claims have been shown to influence the perception of healthiness of a
product (Saba et al., 2010; Wills et al., 2012). However, it has also been reported that consumers do not easily distinguish between different types of claims in terms of their credibility or self-reported understanding (van Trijp & Van der Lans, 2007) and interpret them differently from scientific experts and regulators (Williams, 2005; Verhagen et al., 2010). It has also been demonstrated that people do not always understand health and nutrition claims in the way in which the NHCR intends (Leathwood et al., 2007; Verbeke, Scholderer & Lähteenmäki, 2009; Grunert, Scholderer & Rogeaux, 2011).

Health claims are perceived to be more convincing and beneficial if the consumer is familiar with the product and are more knowledgeable about functional foods (Verbeke, Scholderer & Lähteenmäki, 2009). Consumers’ reactions to health claims are also influenced by personal factors, products typically being perceived as healthier if the health claims are personally relevant (Krystallis, Maglaras & Mamalis, 2008; Dean et al., 2012; Wills et al., 2012).

It has been proposed by Roe, Levy & Derby (1999) that the presence of a health claim can lead to situations whereby incorrect inferences are made about the product by the consumer and they defined these as [1] positivity bias, [2] halo effect and [3] magic-bullet effect. Positivity bias’ is where a consumer may perceive a product to be healthier than other products of equivalent nutritional quality, simply because it displays a health claim. A ‘halo effect’ is when the presence of a claim impacts on positive perceptions of other aspects of a product even if those aspects were not directly mentioned in the claim. The ‘magic bullet effect’ is when a consumer infers that the overall product is healthy even though the claim only relates to a specific benefit.

In their paper on the determinants of consumer understanding of health claims, Grunert, Scholderer and Rogeaux (2011) suggest that the majority of previous research on consumer understanding in this domain has, in reality, predominantly focussed on how consumers react to health claims and has failed to effectively measure understanding. They point out that only a small number of studies have really explored understanding in terms of inference making in relation to health claims (e.g., Andrews, Netemeyer & Burton, 1998; Levy, Derby & Roe, 1997; Roe, Levy & Derby, 1999).
1.4 Outlining the studies

1.4.1 Thesis rationale and aims

In light of the increased contribution of energy-dense processed foods to the modern diet (Gillanders, Steeper & Watts, 2002), food composition data, front-of-pack nutrition labelling and nutrition and health claims have an important role to play in the development of appropriate policy, regulation and public health interventions (e.g. mandatory nutrition labelling). Ultimately all of these initiatives are aimed at reducing the burden of diet-related chronic disease. The overarching aim of this thesis is to explore whether the communication of healthier food choice, through FOP nutrition labelling and nutrition and health claims, can be enhanced by the development of consumer derived frameworks of these domains, a greater understanding of the degree to which the different FOP labelling schemes impact on consumer health inferences and an improved approach to the sharing of food composition data between stakeholders.

An overview of the relationship between food composition data, nutrition labelling and nutrition and health claims and the stakeholder activities embedded within the process of enabling consumers to make healthier food choices is presented in Figure 1.2. This thesis is comprised of four studies that have been developed to explore areas which, as explained in Chapter 1, have the potential to impact on this overall process; [1] the need to optimise the food composition data flow between stakeholders (Study 1); [2] the need for a deeper understanding of how consumers describe and perceive the nutrition labelling and health claim information provided to them (Studies 2 and 3); and [3] the extent to which nutrition information provided in the form of front-of-pack labelling can impact on consumer health inferences (Study 4).

In particular, it was hoped that studies 1, 2 and 3 would provide insight to better inform policy and the existing regulatory frameworks around FOP nutrition labelling. In addition it was envisaged that utilisation of the Multiple Sort methodology in studies 2 and 3 would enable the development of a consumer framework (typology) for FOP labels identifying a range of dimensions which can be further explored empirically in Study 4. More details on the aims of the individual studies are presented in the following sections 1.4.2 to 1.4.6.
Figure 1.2 Overview of the studies in this thesis in relation to food composition data, nutrition labelling and nutrition and health claims and the stakeholder activities embedded within the process of enabling consumers to make healthier food choices.
1.4.2 Study 1 - Optimising food composition data flow within the UK Food Supply Chain and to external stakeholders.

Ready access to food composition data on processed foods is key to facilitate public health reformulation strategies and to provide policy makers and other stakeholders the information needed to achieve a healthier food environment for consumers.

The collation and sharing of food composition data for a rapidly changing food environment in order to achieve effective public health improvements, and to undertake the appropriate research which underpins them, is a challenging task and requires novel approaches (Gillanders, Steeper & Watts, 2002). In order to gain an insight into the potential for more effective methods for food composition data transfer between industry and health professionals, policy makers and stakeholders, a survey was conducted within the UK food industry.

1.4.3 Study 2 - Understanding how consumers categorise nutritional labels; a consumer derived typology for front-of-pack nutrition labelling.

Due to the wide variety of FOP labelling schemes currently employed in Europe and the different approaches adopted, there is much debate amongst stakeholders as to the optimal approach. It has been suggested that there is a lack of understanding of the underlying psychological processes surrounding consumer understanding of FOP labelling schemes and their optimisation (van Kleef & Dagevos, 2015). This may, in some part, be due to the intrinsic differences between the schemes in terms of what they are attempting to communicate to the consumer to drive healthier choices.

The more detailed FOP labelling schemes, such as the GDA and TL schemes, focus on communicating risk in terms of nutrients contained within the food. Whereas, the symbolic schemes, such as HLs, communicate in terms of benefit, that is, the food is deemed to be healthier. Although the HL schemes do in fact contain criteria for risk nutrients embedded within the scheme, this is not visible at the consumer interface. In order to describe and evaluate the various merits and disadvantages of the different schemes, there have been a number of categorisation systems proposed by experts and these have identified a number of useful dimensions for research and regulatory purposes. However, the derivation of a consumer framework (typology) encompassing the range of dimensions which differentiate one system from another from a consumer perspective would provide
an invaluable and missing perspective from the debate as to the optimal FOP labelling scheme.

This study uses a semi-structured qualitative methodology called ‘The Multiple Sort Procedure (MSP)’ (Rugg & McGeorge, 1997; Barnett, 2004) which, although not novel to the area of psychological research, to my knowledge has not been previously used to explore the nutrition labelling domain. The value of this approach is that it allows for a systematic exploration of the way in which people, in this case consumers, make sense of a particular topic area rather than as is the case with questionnaires, the research being based on categories pre-imposed by the researcher. The resultant elicitation of constructs is then used to inform the development of a consumer derived categorisation or ‘typology’ of the domain.

1.4.4 Study 3 - Understanding how consumers categorise health related claims; a consumer derived typology of health claims.

Since it is recognised that consumers do not easily distinguish between different types of claims in terms of their credibility or self-reported understanding (van Trijp & Van der Lans, 2007) and interpret them differently from scientific experts and regulators (Verhagen et al., 2010), this raises questions about how relevant the expert categorisations utilised in the NHCR regulation (European Commission [EC], 2006a) are from a consumer perspective. In addition, the presence of a health claim can lead to situations whereby incorrect inferences are made about the product (Roe, Levy & Derby, 1999).

Building on the MSP methodology utilised in Study 2, this study seeks to develop a framework of nutrition and health claims encompassing dimensions derived from consumers, thus providing useful insight into how they make sense of this type of information and how claims may be optimised to enhance appropriate consumer understanding and use. Furthermore, this study will investigate how easily consumers are able to align claims to the expert taxonomy utilised by the NHCR regulation and therefore explore its appropriateness from a consumer perspective.
1.4.5 Study 4 - Guiding healthier food choice: Systematic comparison of four front-of-pack labelling systems and their effect on judgements of product healthiness.

The final study in this thesis seeks to establish the extent to which the various FOP labelling schemes impact on consumer understanding of the relative healthiness of foods presented to them. There has been extensive qualitative and quantitative research on FOP labels which has typically compared the performance of the different schemes in relation to each other and measured various dimensions of liking understanding and use. However, to my knowledge none of the studies have systematically explored the effect of the interpretive elements of the prevalent FOP labelling schemes on consumer perceptions of healthiness over and above that of a basic FOP label containing energy and nutritional information alone.

Inclusion of a hypothetical basic FOP label into a repeated measures design across a range of food categories and portion sizes could facilitate exploration of the extent to which consumer perceptions of healthiness are directly impacted by the interpretative elements of the FOP labelling schemes. Furthermore, by comparing the subjective healthiness ratings derived from consumers to an objective healthiness score within the study design allows for the optimal FOP scheme to be identified, that is, the scheme which results in perceived healthiness ratings closest to an objective healthiness rating than for other schemes.

1.4.6 The Multiple Sort Procedure (MSP) and Multiple Scalogram Analysis (MSA).

Studies 2 and 3 in this thesis utilise a methodology called ‘The Multiple Sort Procedure (MSP)’ (Rugg & McGeorge, 1997; Barnett, 2004) which involves ‘free sorting’ of a range of stimuli. MSP is a form of facet theory (Brown, 1985). Eliciting the descriptive terms or constructs derived by an individual, or group of individuals when freely categorising a range of stimuli, facilitates the development of a conceptual framework of a domain to be created. The value of this conceptual framework is that it is formed by a ‘bottom up’ approach and is therefore much more likely to lead to a deeper understanding of how a particular domain is really conceptualised by the group of interest. In addition, it is possible to further inform the conceptual framework derived from free sorting by imposing predefined categories in the form of a ‘structured sort’. In this way different dimensions and conceptual frameworks can be compared and explored.
The importance of categorisation is well established in the field of psychology (Smith & Medin, 1981) and MSP allows for a systematic exploration of the way in which participants’ make sense of a particular topic area. MSP has previously been used in a number of domains including environmental psychology (Krämer, 1995), criminal psychology (McGuickin & Brown, 2001) and in social psychology particularly within the architectural domain (Groat, 1982; Wilson & Canter, 1990), where elicitation of constructs pertinent to understanding these domains, from the group of interest, is considered more valid than the use of constructs pre-defined by the experts (Kelly, 1955; Adams-Webber, 1970). In their review on consumer understanding of claims and appropriate methodologies, Leathwood et al., (2007) highlight the usefulness of qualitative methodology as an important step towards gaining deeper insight into consumer understanding of health claims, but stress the need to avoid pre-defined concepts within this research area.

Whilst MSP is essentially a qualitative method, the underlying structure of the qualitative data generated can be explored using Multiple Scalogram Analysis (MSA) (Wilson, 2000; Hammond, 1997; Lingoes, 1979; Zvulun, 1978). MSA is a statistical procedure which does not impose any assumptions on the data, it simply produces a scatter plot depicting each item as a point in two dimensional space based on the way in which the item was assigned to categories in the sorting process. The spatial proximity or distance between the points on the plot is a reflection of the overall conceptual similarity or difference of the sorted items (Barnett, 2004). By overlaying the qualitative data onto the plot, the items can be partitioned into meaningful regions by the researcher.

It has been suggested that there is a lack of understanding of the relevant psychological phenomena and consumer perspectives surrounding FOP labelling schemes and their optimal development (van Kleef & Dagevos, 2015), similarly for health claims (van Trijp & Van der Lans, 2007). Therefore, the elicitation of categorisations from consumers (i.e. non-experts), has the potential to provide a very important perspective in these domains and MSP may be a particularly useful method to achieve this. Since experts tend to have a higher degree of knowledge than non-experts (Rugg & McGeorge, 1997; Ellis, 1989), there exists the potential for a mismatch between that which an expert hopes to communicate and that which a non-expert actually perceives, if an appropriate consumer framework is not developed or fully understood by the expert.
Within this research, it was envisaged that utilising MSP/MSA methodology in a free sorting study on the prevalent FOP labelling schemes (Study 2) would facilitate the development of a consumer derived framework or typology, which could be used to better understand the way in which the various FOP schemes, ultimately derived by experts, are perceived by consumers (non-experts).

It was also envisaged that the utilisation of both free and structured sorting of nutrition and health claims (Study 3) would facilitate the development of a consumer derived typology and an exploration of how relevant the expert typology of health claims as defined in the legislation (European Commission [EC], 2006a) may be from a consumer perspective.
CHAPTER 2

STUDY 1: Optimising food composition data flow within the UK Food Supply Chain and to external stakeholders.

2.1 Introduction and aims

With the expansion of the European Union and subsequent increase in cross border trade, harmonisation of food composition data, accompanied by the creation of durable and sustainable structures to maintain the viability and sharing of this data is an important issue within Europe (Egan et al., 2007). Since processed foods are increasingly contributing to the modern diet, Gillanders, Steeper and Watts (2002) suggested that ‘Food composition database providers must consider new and novel approaches to describing a rapidly changing food supply’ (p.1).

Provision of nutrition information on processed foods is seen as a key driver in the creation of a healthier food environment by encouraging industry to reformulate products to display a better nutritional profile (van Kleef & Dagevos, 2015) and providing governments with the information needed to affect more directed public health reformulation strategies, such as those recently implemented in the UK on salt reduction (He, Brinsden & MacGregor, 2014). Typically, the UK and other European countries, national tables have contained reasonable coverage of the nutrient content of primary produce and basic cooked food recipes. However, it is difficult for them to keep abreast of the fast moving processed and convenience food market. Therefore, there is a need for data on processed foods to be more readily available to policy makers, researchers, health professionals and consumers.

For policy makers and health professionals, the data on processed foods is important for the effective research of diet-related health, the monitoring of the nutritional profile of commonly consumed foods and the subsequent setting of appropriate targets for risk nutrients within industrially processed foods. The purpose of this study was to explore how industry uses food composition data to develop the nutritional information for their processed foods and to gain an insight into the potential for more effective methods of food composition data transfer between industry, health professionals and policy makers.
2.2 Materials and Methods

Cross-sectional survey of members of the UK food industry was conducted by means of a self-administered questionnaire. The semi-structured questionnaire (Appendix 1) consisted of both closed and open questions designed to elicit the typical sources and uses of food composition data by those working within the food industry. In order to gain a deeper insight into the extent to which the food industry is being approached to provide food composition data on their own products to stakeholders such as, national food composition dataset compilers, national government, regulatory authorities and/or trade organisations, questions on aspects of this type of data provision were also included. More specifically, the questionnaire sought to elicit the difficulties/barriers experienced by the food industry when approached to share their food composition data externally with a view to identifying how these potential barriers might be overcome.

2.2.1 Participants

Thirty-three employees of the UK food industry involved in the generation, use or sharing of food composition data for their food products. In order to ensure access to participants from a wide range of the UK food industry, the survey was conducted under the auspices of a joint European Food Information Resource Network (EuroFIR)/Institute of Grocery Distribution (IGD) working group facilitated by the British Nutrition Foundation (BNF). The IGD represents a cross section of the UK food industry with over 500 members spanning retailing, food service, food and drink manufacturing, government bodies and other agencies with an interest in the food sector.

2.2.2 Data collection

The survey questionnaire was distributed via email by the IGD principally targeting food industry members of their Industry Nutrition Strategy Group (INSG), a sub-group of the IGD established in 2003 to enable the food and drink industry to play a constructive role in the development of integrated, cohesive and balanced nutrition strategies throughout the UK. The self-completed questionnaires were returned by email or hard copy. The study was conducted in accordance with the University of Surrey’s ethical procedures.
2.3 Results

2.3.1 Sample description

A total of thirty-three questionnaires were returned which represents a reasonable response rate bearing in mind that the INSG subgroup consists of around 30 companies. It should be noted that within the responses received, a number of companies with more than one food category division completed a questionnaire for each separate division.

Of the responses received, the manufacturing sector represented over half of the sample (58%). A high proportion of companies described their market as global (61%) and in financial terms 64% reported annual turnover of greater than £5 million. The majority of respondents completing the questionnaires were nutritionists (46%), with others working in regulatory affairs (24%) and product development (3%). In terms of the ‘other’ category, respondents selecting this option tended to describe roles which appeared to be combinations of regulatory, product development and nutrition, although some also had responsibility for business development (27%). The sample composition is shown in more detail in Figure 2.1.

2.3.2 Food composition data sources

Within the survey, the primary source of food composition data reported was McCance & Widdowson’s Composition of Foods 6th edition (FSA, 2002), including its’ supplementary publications, with 85% of respondents accessing the data via paper based tables. Other sources of information included, the USDA nutrient databank, commercial nutrition analysis software, in house analytical data and supplier data. Labelling was mentioned most often as the reason for using food composition data, either to provide nutritional information, to calculate the composition of foods or to compare competitive products. Several respondents reported using published food composition data to calculate or verify on pack nutritional information, to estimate the nutritional composition of foods for comparative claims or to calculate the nutritional value of products/meals. Other uses included recipe analysis and new product development.

2.3.3 Principal needs

Respondents’ principal needs were identified as increased access to additional food composition data and associated documentation. More specifically, respondents highlighted the need for additional nutritional information on
ingredients, basic processed food intermediates, phytochemicals, a wider variety of fruits and vegetables as well as some indication of typical variations in the levels of nutrients (e.g. seasonal changes in fruits and vegetables). Respondents also reported a requirement for information on the quality of food composition data itself; details on methods of analysis, reproducibility of data and verification of supplier data.

2.3.4 External data sharing

A number of respondents (42%) reported having provided data to National Government bodies, such as the Food Standards Agency (FSA) and the Department for Environment, Food and Rural Affairs (DEFRA). Other recipients of food composition data from industry included trade organisations (39%) and various others (55%), such as slimming companies and the media. Ongoing interaction with numerous trade organisations was reported, generally relating to providing data on macronutrient/micronutrient content per 100g. These data are used in a variety of ways including updating of food composition tables, ongoing policy development, calculating the nutrient content of recipes, product purchasing decisions in the National Health Service and supporting salt reduction initiatives. Similarly there is regular provision of data on macronutrient content per 100g to slimming organisations and the media.

The majority (90%) of respondents envisaged continuing to provide such data in future. The principal reasons given by respondents for not providing data were that there appeared to be no requirement for this information, or that they had simply not been asked. The majority of respondents (81%) reported having access to an electronic dataset of the nutrient composition of their own products, and almost all respondents (91%) considered it beneficial to have access to an electronic dataset of the nutritional content of their products.
Figure 2.1 Percentage of Respondents according to Sector, Market, Annual turnover and Role.
2.3.5 Perceived barriers to data sharing

Barriers, or difficulties, to providing data externally fell into three broad categories; Resources, Technology and Confidentiality/ intellectual property. Within the ‘Resources’ category, key barriers were identified as time, cost and expertise. Providing data is perceived as a time consuming task particularly as data are only accurate at the time of transfer. Particular reference was made to the difficulties associated with maintaining accuracy of this type of data for large multinational companies as their recipes change, new product lines are developed and other products may be withdrawn. Issues with technology relate to incompatibility between database software, formatting of data and the extent of nutrient coverage. The issues relating to confidentiality of data generally referred to protection of recipes and any associated competitive advantage and not specifically to the sharing of nutrient composition data.

2.4 Discussion

Despite the small sample size, the survey results reported here provide an overview of the current sources, uses and provision of food composition data within a cross-section of the UK food industry. The results also give an insight into both the flow of food composition data within this sector and the barriers to transfer of data to external stakeholders, highlighting the need for a more effective method for capture and maintenance. They further highlight the potential need to improve the availability of data between organisations in order to enhance the quality and availability of the data each subsequently provides on their own finished products.

From the results of this survey, the UK national food composition data tables, McCance and Widdowson, appear to be the primary source of data for the food industry. However, the limitations of these tables necessitates the use of other sources, such as the USDA nutrient databank and other commercial software, that typically include food composition data on processed ingredients and more complex foods to a greater extent. Data also appear to be regularly shared across the supply chain and sometimes provided to the National Government bodies, such as the Food Standards Agency (FSA), Department for Environment, Food and Rural Affairs (DEFRA) and the Department of Health (DoH). With the increased focus on obesity and other nutrition-related diseases and the current changes in legislation relating to nutrition claims on foods, requests for the provision of accurate food composition
data are likely to increase thus emphasising the need for robust systems and processes for data transfer throughout the supply chain.

Providing compositional data both within the supply chain and to external stakeholders is perceived as a time consuming, costly task fraught with difficulties that include incompatibility between software packages, non-standardised formatting of data and differences in the extent of nutrient coverage. In addition, self-generated food composition data for the large multinational companies are often embedded in electronic format within the internal Enterprise and Resource Planning (ERP) systems of the organisation concerned, and need to be extracted to be shared outside the business.

2.4.1 Food composition data and the supply chain

It is important to recognise that the food industry is a complex supply chain often initiating in agriculture (primary produce) and terminating with the consumer. Food composition data are generated and utilised at almost every stage of the supply chain and data are frequently transferred or shared between the chain participants (Fig. 2.2). Primary producers frequently provide food composition data on their products to processed ingredient suppliers, the food manufacturing sector and also to food service providers. Using these data, combined with other published sources and possibly data derived from chemical analyses, food manufacturers generate food composition data on their finished products. Typically, these data are then provided to other members of the supply chain including food service providers, retailers, and finally the end consumer.

Over the past decade, ERP solutions have been widely adopted by both large and small organisations as a way to integrate the data and processes of the organization into a single system (Gupta & Kohli, 2006). As a result of this, food composition data generally require significant manipulation to suit the formatting requirements of the requesting party before they can be transferred. This is often an onerous and repetitive task and the resulting data file is simply a snapshot of the data, only accurate at the time of issue and very quickly superseded by ongoing reformulation or new product introduction. The data recipient is then left with the dilemma of either attempting to maintain and update the data themselves, an almost impossible task without a robust change control process in place, or alternatively requesting a repeat dataset at a later date and attempting to identify changes
therein. Overall this research suggests that the food industry might be willing, and in many instances eager, to share up-to-date food composition data on their products. This is reinforced by the fact that many have reformulated products to reduce salt content in the recent past and are frustrated by the knowledge that it may take some considerable time for this to be reflected in the various national food composition tables across Europe.

Figure 2.2 Food composition data flow within the food supply chain:
This figure represents the key stages (sectors) within the food supply chain where food composition data exists. The arrows represent the typical flow of food composition data between the sectors.

2.4.2 Optimisation of food composition data flow

In order to find a solution, it may be necessary to look outside the food composition data arena and more widely at how the food supply chain manages transfer of other types of technical data on their products. Industry is moving ever closer to a completely collaborative model, where companies increasingly share the
critical in-house information they once protected with their suppliers, distributors and customers (Loizos, 1988). Within the logistics process, for example, a vast amount of data, such as pack size, weight, case size etc. for each traded item is regularly transferred across the supply chain. Historically, the transfer of data within the logistics process had been marred by similar issues to that of food composition data, but significant progress has been made in recent years by the GS1 Global Data Synchronization Network (GS1). GS1 is a not-for-profit global organisation originally created by manufacturers and retailers to improve the efficiency of the food and consumer goods supply chain. The generation and implementation of GS1 standards provide a framework for interoperability ensuring accurate and up-to-date product data are available throughout the supply chain. Data can be readily accessed by trading partners via synchronised data pools and there is a central registry which ensures that accurate up-to-date information, maintained by the product owner, is always available. Core business information relating to a product is specified by the ‘Business Message Standard’ and ‘Data Extension’ standards and are implemented as appropriate for the different product sectors (e.g. foods, pharmaceuticals, electrical goods etc.).

Based on requirements from the food sector a data extension standard specifically for ‘Food and Beverage’ has been developed by GS1 (GS1, 2009) which specifies a wide range of food related information including nutritional and ingredient declarations, preparation method, allergen and dietary information and other usage instructions, ultimately enabling this type of data to be uploaded into the synchronized data pools. A pilot of the data extension was launched in the autumn of 2006 in the UK. However, unlike the core business data, uploading of the food and beverage extension data is optional. It is interesting to note that this approach appears to be quite strongly endorsed by some of the larger UK Food Service providers and retailers as they increasingly need this type of information for menu planning and nutritional declarations, especially when providing catering services within the care or educational sectors.

2.5 Conclusions

The food industry appears to have an inherent need to share nutritional composition information within its own supply chain and also with external customers and stakeholders. For the majority of food manufacturers, food
composition data for their own products are embedded in their ERP software alongside all their other critical business data including that on manufacturing, logistics and finance.

The GS1 approach for the sharing of high quality core logistics information could provide a model for effective transfer of up-to-date food composition information both within the existing supply chain infrastructure, but also to other stakeholders, such as food composition database managers, government, regulatory authorities and other interested health professionals. The approach has the potential not only to satisfy the needs of the participants within the food supply chain by minimising duplication of effort with respect to data transfer activities, but also to ensure that accurate food composition data are captured in a ‘real time’ pan-European manner. Data might then be accessed ‘at the push of a button’ by all those stakeholders that need it, if and when access to the central registry and/or synchronised data pools can be successfully negotiated.
CHAPTER 3

STUDY 2: Understanding how consumers categorise nutritional labels; a consumer derived typology for front-of-pack nutrition labelling.

3.1 Introduction and aims

There have been a number of categorisation systems proposed in both Europe and the United States in an attempt to describe and evaluate the various merits and disadvantages of the variety of FOP labelling schemes that exist in the marketplace (Verhagen and van den Berg, 2008; Lytton, 2010; Periera, 2010; IOM, 2011;).

Within Europe, efforts were being made to describe and categorise this increasingly complex domain and in 2008, Verhagen and van den Berg proposed a methodology for the creation of simple visual models in order to facilitate the comparisons of the existing nutrient profiling schemes used as the basis for consumer education or for FOP nutrition labelling purposes. Known as the ‘Arrow Approach’, the categorisation criteria utilised within this model included whether the scheme, [1] is utilised across the board or is category specific, [2] includes qualifying or disqualifying ingredients and what they are, [3] is applied per portion, per 100g or according to a reference value, and [4] whether the scheme utilises a threshold or scoring approach (Verhagen and van den Berg, 2008).

In parallel, work on this area was being conducted in the United States and in 2010 an alternative taxonomy (typology) approach was published (Lytton, 2010). This typology compares and contrasts the various schemes across a number of different dimensions, including: source, scope, character, gradation, segmentation and aggregation. The Institute of Medicine (IOM) was also engaged in reviewing the prevalent FOP schemes in use both in the US and Europe and proposed another approach based around three different categories; [1] nutrient specific systems, [2] summary indicator systems and [3] food group information systems (IOM, 2011). A further approach categorised FOP labelling schemes as either fact-based or criteria-based (Periera, 2010), but even Pereira suggested in the paper that consumers themselves are unlikely to recognise the difference between these two categories of labels.
All of the above approaches have proposed dimensions on which the relative strengths and weaknesses of the various FOP schemes can be compared, and as such are useful dimensions for experts and policy makers for the purposes of informing regulation or informing the debate around the merits of standardisation. However, it is apparent that none are based on dimensions elicited directly from consumers. Experts, by definition, tend to have a higher degree of subject specific knowledge than non-experts and as such, are likely to demonstrate a more extensive and sophisticated categorisation (Rugg & McGeorge, 1997; Ellis, 1989). Since it has been suggested that there is a lack of understanding of the relevant psychological phenomena and consumer perspectives surrounding FOP labelling schemes and their optimal development (van Kleef & Dagevos, 2015) elicitation of categorisations from consumers or ‘non-experts’, on the prevalent FOP labelling schemes, has the potential to provide more consumer relevant dimensions.

Previous FOP research has lacked a consumer derived framework encompassing the range of dimensions which differentiate one system from another and which may potentially explain why consumers perceive them as they do. Rather, past studies have focussed on simply comparing schemes and trying to establish a ‘winner’ in terms of their performance in guiding health perceptions. The derivation of a consumer framework (typology), encompassing the range of dimensions which differentiate one system from another from a consumer perspective, could provide an invaluable and missing perspective from the debate as to the optimal FOP labelling scheme. The task of developing a typology of the current European FOP labelling systems based around consumer categorisations of FOP labels was approached by elicitation of constructs using the Multiple Sort Procedure (MSP) and subsequent analysis of the categorical data using Multiple Scalogram Analysis (MSA). This exploratory study was performed in four European countries to ensure any resultant typology reflected a range of differing cultural perspectives and historical exposure to FOP labelling.

### 3.2 Materials and Methods

This study involved free sorting of a range of nutritional labels presented on cards in order to elicit the way in which participants described and categorised these elements. The underlying structure of the qualitative data generated by the MSP was then explored using Multiple Scalogram Analysis (MSA) (Wilson, 2000; Hammond, 1997; Lingoes, 1979; Zvulun, 1978).
Individual face-to-face interviews were conducted using a structured interview schedule. Participants were given a set of twenty two cards each of which displayed a single nutrition label and were instructed to sort the cards into groups so that all the cards in one group were similar to each other in some important way and different from the other groups. They were then asked to repeat this using a different sort rationale if they could. Participants were encouraged to ‘think aloud’ both about the cards and their sorting rationale. The interviews were audio recorded and on completion of each of the sorts, the interviewer manually recorded the overall sort rationale used by the participant, the reasons for each grouping of cards and which cards were assigned to each group.

This study received a favourable ethical opinion from the University of Surrey Ethics Committee (Reference: EC/2009/04/FAHS). The Participant information sheet and consent form utilised for the study are attached as Appendix 2A.

3.2.1 Participants

The study was carried out on a total of 60 participants regularly responsible for food shopping for the household and comprising of 15 participants from each of the following countries; United Kingdom (UK), Poland (PL), Turkey (TK) and France (FR). The resultant sample profiles per country are detailed in Table 3.1.
Table 3.1 Socio-demographic characteristics of participants by country.

<table>
<thead>
<tr>
<th></th>
<th>UK (n=15)</th>
<th>PL (n=15)</th>
<th>TK (n=15)</th>
<th>FR (n=15)</th>
<th>Total (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-25 years</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>26-35 years</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>36-49 years</td>
<td>4</td>
<td>3</td>
<td>6</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>50-64 years</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>65+ years</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>NS-SEC five class*</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>1. managerial and professional occupations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Intermediate occupations</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>3. Small employers and own account workers</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4. Lower supervisory and technical occupations</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>5. Semi-routine and routine occupations</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

* Measured by NS-SEC; see Office for National Statistics (2002).

3.2.2 Rationale for the development of the study stimuli

3.2.2.1 FOP labelling Types

The twenty two stimuli cards used in the study representing six overall expert categories are detailed in Table 3.2 and shown graphically in Appendix 2B. Selection was primarily based on the need to include a diverse range of FOP labels that exist within Europe. Since the study was to be performed in the United Kingdom, Poland, Turkey and France, it was also important that representation of the most prevalent nutritional labelling elements from each of these markets were reflected, including GDA, TL and HL schemes. One scheme originating in the US was also included; the US retailer Hannaford’s ‘Guiding Stars’, as it is an example of a graduated health logo which did not exist in Europe at that time, but could possibly appear on the European market at some point.
Table 3.2 Content elements of the label stimuli (Expert categories).

<table>
<thead>
<tr>
<th>Construct</th>
<th>Description</th>
<th>Label Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health logos (HL)</td>
<td>5 labels in total; 3 representing the different types of endorsement found in the marketplace; authoritative endorsement - specified, authoritative endorsement - not specified and brand/retailer owned. 2 representing graduated logos.</td>
<td>C1-C5</td>
</tr>
<tr>
<td>% Guideline Daily Amounts (GDA)</td>
<td>5 labels in total representing monochrome, specific nutrient colouring, energy only and graphical representation of nutrient name and content.</td>
<td>C6-C10</td>
</tr>
<tr>
<td>Traffic lights (TL)</td>
<td>2 labels; representing ‘with text’ (i.e. High, Med, Low) and ‘no text’ versions.</td>
<td>C11-C12</td>
</tr>
<tr>
<td>Hybrids (HB)</td>
<td>2 labels; representing ‘UK’ TL / % GDA hybrid and an example of a hybrid label using an alternative TL scheme (i.e. Amber, Yellow and Green).</td>
<td>C13-C14</td>
</tr>
<tr>
<td>Nutrition claims (NC)</td>
<td>5 labels each representing a different ‘low’ claim for energy (i.e. Low calorie) and one of the four key nutrients; fat, saturated fat, sugar or salt.</td>
<td>C15-C19</td>
</tr>
<tr>
<td>Nutrition tables (NT)</td>
<td>3 labels representing different levels of information in a nutrition table format; nutrients in grams, nutrients in grams plus % GDAs and nutrients in grams plus % GDAs and TLs.</td>
<td>C21-C23</td>
</tr>
</tbody>
</table>

The ‘Guiding Stars’ graduated logo approach is considered interesting because it has the ability to communicate ‘degrees of healthfulness’ (i.e. good, better, best) however, similarly to the more typical health logos which do not differentiate between the healthful foods once they have been defined as such, this graduated logo is still only capable of signposting those products within the more healthful spectrum. It should be noted that this scheme is typically implemented as a shelf tag as opposed to a label that appears on the food package itself. The different types of endorsement afforded to these types of labelling schemes were also considered of importance and therefore HL labels were included which
reflected some form of authoritative endorsement (e.g. heart foundation endorsed) and a brand/retailer owned scheme.

The stimuli set also included three different representations of typical UK back-of-pack nutrition tables all of which included nutrition information both per portion and per 100g, one of which also displayed percentage guideline daily amount values and another which also displayed both percentage guideline daily amount values and traffic light colours. Although, not typically considered as FOP nutrition labels, nutrition claims were also included in the stimuli set to explore how they might be conceptualised by the participants in each of the countries in relation to the various types of FOP labelling that might exist, bearing in mind that health logos may in fact operate as implicit claims in some situations (Andrews, Burton & Keys, 2011).

3.2.2.2 FOP labelling across the countries

The UK is one of the most developed European markets with respect to the availability of processed foods and accordingly it has the highest level of nutritional labelling activity (genannt Bonsmann et al., 2010). These include nutrition tables on back-of-pack and health logos (HL), traffic lights (TL), percentage guideline daily amounts (GDA) and nutrition claims (NC) on front-of pack, as demonstrated by the recent penetration study of nutrition information across Europe (genannt Bonsmann et al., 2010). However, the Polish market is quite different as GDAs are predominant with very little incidence of HLs or NCs. Conversely Turkey has a minimal incidence of GDAs, but some evidence of NCs and HLs. Whereas the French market has a reasonably high penetration and diversity of nutritional labelling using most of the elements existing in other European countries, it also has a number of unique systems. These include the Intermarché supermarket’s ‘Nutri-Pass’ system which utilises an alternative traffic light colour system (amber, yellow and green) to the typical UK system (red, amber and green) and the ‘Curseur Nutritionnel’, an example of a nutrient profiling system that appears on pack as a graduated logo (Serog et al., 2006). Two major brands, McDonalds and Kellogs had also recently introduced graphical representations for energy, and the other nutrients included on their nutritional signposts in an attempt to overcome the need for translation of the nutrient names into local languages, thus minimising the number of packaging variants required for their pan-European or global brands. Therefore examples
based on these were also included in the stimuli set as interesting to explore from a consumer perspective.

3.2.2.3 FOP labelling elements

The nutritional labelling schemes that exist in Europe and beyond differ widely in format, sequence and choice of nutrients, and for the purposes of this study it was necessary to focus only on the elements of the various schemes that attempted to communicate the healthfulness of the product rather than on specific format elements or aesthetics (i.e. horizontal or vertical presentation or other design characteristics). The elements of the study were further contained by focusing on those nutritional claims and signposting elements such as percentage GDA values, TL colour or interpretative text, such as ‘High’, ‘Med’ or ‘Low’ that predominantly relate to salt and the three most commonly communicated macro nutrients; fat, saturated fat and sugar. However, one example of an ‘energy only’ GDA was included based on the Mars ‘Be Treatwise’ presentation as this is becoming quite prevalent across Europe on snacks and chocolate bars.

3.2.2.4 Development of the stimuli

The label graphics were recreated in-house to produce the final label depictions since none of the ‘real-life’ examples existed in all languages and availability of the cards in local language were deemed to be essential. Therefore, the graphics used were close approximations of those typically used in the marketplace. The label text was generated in English and then translated into local language.

All labels containing nutrient levels or numerical information were standardised to avoid participants simply sorting on the numerical values as opposed to the labels themselves. A typical UK ready meal (Lasagna) was used as the source of the nutritional information as it provided nutrient levels for which traffic light labels would display at least one red, amber and green signpost across the five nutrients.

Finally, a brief explanatory statement was placed on four of the logos as it was felt that the participants would need some information regarding the provenance of these logos particularly if they had not encountered them before. For example, the Easy Choice health logo (Appendix 2B, label C3) was accompanied by
the statement ‘Food industry system for identifying products that are healthiest within a product category’.

3.2.3 Data collection

Four trained interviewers, one per country, conducted individual face-to-face interviews using a standardised interview schedule translated into local language prior to use. Participants were given a set of twenty two cards each of which displayed a single nutrition label. They were told that the label on each card tells them something about how healthful a food product might be and were instructed to sort the cards into groups so that all the cards in one group were similar to each other in some important way and different from the other groups.

Whilst performing the free sort, participants were encouraged to ‘think aloud’ both about the cards and their sorting rationale. The interviewer then instructed the participant to sort the same cards again grouping the cards in a different way. If they felt able, participants were encouraged to perform up to three free sorts. The interviews were audio recorded and on completion of each of the sorts, the interviewer manually recorded the overall sort rationale used by the participant, the reasons for each grouping of cards and which cards were assigned to each group (see Appendix 2C for an example ‘Multiple Sort Data Recording Form’).

3.2.4 Analysis

Multiple Scalogram Analysis (Wilson, 2000; Lingoes 1979; Zvulun 1978) involves the preparation of a data matrix in which each column represents an individual participant’s sort and each row represents a card (i.e. an FOP label). The Multiple Scalogram Analysis (MSA) output provides an overall ‘top’ plot which depicts the relationships between all the cards in that analysis. Each card is a point in geometric space and the closer the points are to each other the more similar they are considered to be. The program requires a ‘coefficient of contiguity’ of at least 0.9 to ensure that the solution being produced is an acceptable fit to the data. Regardless of whether differing numbers of categories were used by the participants during their free sorts, the cards that were most frequently placed together across the sample appear closest together on this top plot. In addition to this top plot, the MSA output also includes an ‘item’ plot for each sort included in the data matrix. The
configuration of the points on these item plots is the same as for the top plot, however, this time the points represent the category or group that the card was assigned to by the participant. Using the overall sort rationale, group headings and other qualitative data gathered during the sorting interviews, these item plots allow for the reasons that particular cards were grouped together in individual sorts to be overlaid onto the top plot in order to inform its’ interpretation. In this way the researcher is able to partition the top plot on the basis of why particular cards were put together, and offer an interpretation of the categories that have informed the way that the study participants have sorted the cards (Barnett, 2004).

Plots of the first free sorts for each country were prepared as a starting point for the analysis. Each country was analysed separately enabling exploration of the differences between countries. The resultant top plots are shown in Figures 3.1 to 3.4. Plots were also generated for the second free sorts for each country, however these did not appear to add any additional dimensions to the interpretations already provided by the first free sort analysis therefore analysis at this level was not pursued.

Following the sorting, a content analysis was conducted in order to provide an overview of the constructs participants used in their first free sorts. Overall sort rationales and group headings were reviewed to identify meaningful categories within which sorts could be subsumed. These categories (Table 3.3) were then used in conjunction with the individual constructs to facilitate the interpretation of the MSA plots.

3.3 Results

3.3.1 Constructs utilised by participants in their first free sort

Categories elicited in an individual’s first free sort are generally considered to have a higher salience than those in subsequent sorts (Barsalou, 1992). Of the twenty six constructs used as the sort rationale/group labels in the first free sorts, thirteen were used in three or more countries (Table 3.3), the top six of these accounting for over half that were used in total.

The most frequent constructs used by the participants in their first free sorts related to the type and level of information that the labels provided. Other high frequency constructs related to how clear and understandable the participants’ felt the labels were, the degree of healthfulness of the food being communicated and
the overall impact/attractiveness of the labels. On the whole constructs utilised by participants in their second and third free sorts tended to repeat those already elicited.

Table 3.3 Frequencies of first sort constructs used in sort rationale/group headings in at least 3 of the 4 countries.

<table>
<thead>
<tr>
<th>Construct/Country</th>
<th>UK</th>
<th>PL</th>
<th>TK</th>
<th>FR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information content</td>
<td>13</td>
<td>15</td>
<td>18</td>
<td>13</td>
<td>59</td>
</tr>
<tr>
<td>Labelling systems</td>
<td>8</td>
<td>1</td>
<td>4</td>
<td>20</td>
<td>33</td>
</tr>
<tr>
<td>Understanding/confusion</td>
<td>9</td>
<td>7</td>
<td>11</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Healthfulness of food</td>
<td>4</td>
<td>14</td>
<td>4</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Impact/attractiveness</td>
<td>8</td>
<td>5</td>
<td>1</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Clarity</td>
<td>12</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Legibility</td>
<td>2</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>Complexity</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Reliability/Trust</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>11</td>
</tr>
<tr>
<td>Colour</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Silly/ nonsense</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Serving/portion info</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Persuading/warning</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

The qualitative data gathered during the interviews suggested that it was the lack of a direct decision as to whether the food product overall was deemed to be healthy or not (i.e. the label’s health utility, in the high information content labels), which appears to drive certain participants to consider these labels as confusing and unclear and thus invoke a less favourable affective evaluation. Whereas, in the low information content labels that do communicate this direct decision, it was the lack of ‘information’ on energy or nutrient levels which appeared to drive participants to categorise these labels as confusing and unclear and also invoke trust issues.

It should be noted that legibility of the labels appeared to be an issue for the Polish participants, especially the older ones, possibly due to the fact that translation
of the text into Polish meant the label often included more text characters. This finding was therefore considered to be an artefact of the experimental design rather than a particular difference between the Polish participants and the other countries.

### 3.3.2 Interpretation of the MSA plots

#### 3.3.2.1 MSA Plot – United Kingdom (UK)

In the UK top plot (Fig. 3.1), the three main clusters of points and their distance from each other depicts the clear distinctions that participants made between three main groups of labels: health logos (HLs), nutrition claims (NCs) and the larger cluster of remaining labels which included the percentage guideline daily amount labels (GDA), traffic light (TL), hybrid (HB) and nutrition tables (NT). It is interesting at this stage to note that few UK participants used colour as a sort strategy or construct in their first free sort and the use of this construct only increased slightly in participants second free sorts. This contributes some degree to the lack of separation between the TL and the GDA labels.

Using the qualitative data and item plots to help identify the reasons for sorting particular groups of labels together revealed that the health logo (HL) labels were consistently described as containing low levels of information. Conversely, the main mixed cluster of labels were categorised as containing higher levels of information. The nutrition claim (NC) labels were often described as not having enough information to validate whether the claim was true or not and in the context of levels of information, this would appear to explain why they are separated from the other two clusters.

In terms of their health utility, labels containing numerical information on calories or macro nutrients, (i.e. GDA, TL, HB and NT labels), were frequently categorised as relating to unhealthful foods, whereas participants recognised that the health logo (HL) label cluster related to healthful foods and categorised them as such. Some ambiguity regarding the degree of healthfulness was associated with the nutrition claims, for example, low fat (Appendix 2C, label C17) and one of the graduated health logos (Appendix 2C, label C5). With regards to nutrition claims, participants expressed a need for more information to validate exactly how low the nutrient content actually was, and as such there was an element of mistrust associated with these types of statements. Despite the majority of health logos (HL) being clustered closely together on the plot, the French derived Curseur Nutritionnel system (Appendix 2C, label C5) did not fall within that cluster. Similarly to the
nutrition claims this logo was often perceived in terms of its health utility as ambiguous and it appeared to lack sufficient clarity of message for the UK participants. This is the most likely explanation for this label existing in the same partition on the plot as the nutrition claims and not within the health logo partition.

![Figure 3.1 MSA plot – United Kingdom (UK)](image)

See Appendix 2C for the visual representation of the labels referred to in this table. Key: HL = health logos; GDA = % guideline daily amount labels; TL = traffic light labels; HB = hybrid labels; NC = nutrition claims and NT = nutrition tables.

Based on the above interpretations, the UK top plot was partitioned with respect to the constructs of ‘information content’ and ‘healthfulness of food’. For the other high frequency constructs; ‘understanding/confusion’ and ‘clarity’, further partitioning of the plots did not appear to be possible since the labels in each cluster were not consistently described with regards to the polarity of these constructs. Some participants described the health logos (HL) as clear and easy to understand and the high information content labels as confusing whereas conversely, others found the health logos (HL) confusing and the labels containing higher information content clearer and easier to understand. A similar effect was observed for the construct of impact/attractiveness; here too there appeared to be a dichotomy with some participants indicating that they found the high information labels impactful or attractive and others disagreeing and preferring the health logos (HL) for impact and attractiveness. These differences in affective evaluation were not attributable to any socio-demographic factors.
3.3.2.2 MSA Plot – Turkey (TK)

For the Turkish data the interpretation process was repeated and the structure of the plot (Fig. 3.2) appeared to be dominated by the same two constructs prevalent in the UK plot, namely ‘information content’ and the ‘health utility’ of the label. In terms of the nutrition claims, overall the Turkish participants appeared to accept more readily these types of statements as indicators of the healthfulness over their UK counterparts, but similar to the UK plot, they were still categorised them as containing low levels of information.

![Figure 3.2 MSA plot – Turkey (TK)](image)

See Appendix 2C for the visual representation of the labels referred to in this table. Key: HL = health logos; GDA = % guideline daily amount labels; TL = traffic light labels; HB = hybrid labels; NC = nutrition claims and NT = nutrition tables.

3.3.2.3 MSA Plot – Poland (PL)

Partitioning of the Polish plot (Fig. 3.3) based on the construct of ‘information content’ again appeared to best explain the separation of the clusters however, references to the health utility of the labels in the qualitative feedback from this sample related much more to the difficulties/ambiguity in building health inferences rather than a clear healthful/unhealthful food distinction. This heightened ambiguity associated with the health utility of the label most likely relates to a lack of familiarity with the various FOP schemes since many do not exist in Poland.
3.3.2.4 MSA Plot – France (FR)

Partitioning of the French plot (Fig. 3.4) was dominated by the ‘information content’ construct alone. Similarly to the other three countries, health logos (HL) and nutrition claims (NC) appeared in the low information partition and the remaining labels appeared in the high information partition. However, in contrast to the other three country plots, the health utility of the label tended not to be used in the category descriptions of the French participants. Rather than use categories which related to how healthful they felt the foods that the labels represented were, they focussed more on the similarities/differences between the information presented on the labels and how useful they considered the various labels to be for their own needs. Interestingly this was not a construct used by any of the other countries in their first free sorts. Despite this slight difference, by virtue of the ‘information content’ construct alone the overall separation of the label clusters in the French plot is very similar to that of the other countries.
Similarly to the UK plot, the label clusters on the Turkish, Polish and French plots were not consistently described in terms of their affective evaluation with some participants responding positively overall to the low information content labels and less positively to the high information content labels and conversely others responding more positively to the high information content labels.

### 3.3.3 Nutrition claims

The qualitative data collected from the sorting interviews suggests that nutrition claims appear to offer some respondents a ‘short-cut’ cue to what they considered to be the most important message in the other nutrition information provided on pack. They indicated that claims such as ‘low fat’, might prompt them to check the nutrition information provided on either front or back-of-pack for fat levels since many participants felt that these types of ‘low’ claims did not offer sufficient detail to make a product choice and often invoked mistrust.

Some participants even suggested that claims could be misconstrued as being targeted towards people with specific dietary needs and may therefore be discouraging for those outside the perceived target group. For example, it was suggested by some participants that low fat claims are only relevant for people on a
weight-loss diet. However, this scepticism may have been amplified by the study being conducted in a lab setting since in a real-world shopping setting time constraints and other external factors often mean that evaluation of more detailed nutritional information is not possible.

3.4 Discussion

3.4.1 Proposed consumer derived labelling typology

Partitioning the MSA plots demonstrates that there is a relationship between how directive an FOP labelling system is in its health utility, and the amount of information that is included in the label. The relationship is in fact an inverse one such that the more directive, or using Lytton’s typology (Lytton, 2010), the more aggregated the label becomes, the less information is included. This is based on the assumption that the consumer does not need the additional information as in terms of health utility, the decision has already been made for them. This research suggests that it is most likely this very assumption that results in the negative affective evaluation attributed to the labels by many of the participants.

With less directive (non-aggregated) labels where the nutritional information is present, it is the absence of any decision for the overall health utility of the label at the food product level which appeared to cause many participants to consider these labels less favourably. Whilst the term ‘directiveness’ was not used verbatim as a construct by the participants, it does help to explain the inverse relationship between the two dominant constructs and might lead to a better understanding of why some FOP schemes may be more effective than others.

Many participants preferred directive labels and felt they would help them make a quick decision on the product as a whole. However, others responded negatively to being told something was ‘healthy’ in the absence of any nutritional information and indicated that they would prefer to be able to make or validate their own decision based on the levels of a single nutrient, or a combination of nutrients which they felt were relevant to their specific needs via the non-directive type labels. Classification of the stimuli labels according to the externally applied construct of ‘directiveness’ at food product level resulted in the proposal of three typology sub categories for the FOP labels; Directive, Semi-directive and Non-directive (see Table 3.4).
Table 3.4 Categorisation of study labels according to proposed typology.

<table>
<thead>
<tr>
<th>Category</th>
<th>Label Codes/ Descriptions a</th>
<th>Directive at</th>
<th>Present on</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Food level</td>
<td>Nutrient level</td>
</tr>
<tr>
<td>Directive</td>
<td>C1, C2, C3, C4, C5</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Non-directive</td>
<td>C6, C7, C8, C9, C10, C20, C21</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Semi-directive</td>
<td>C11, C12, C13, C14, C22</td>
<td>Partially</td>
<td>Yes</td>
</tr>
</tbody>
</table>

a See Appendix 2C for the visual representation of the labels referred to in this table.

Although the participants in this study did not make a significant distinction in their sorting between high information content labels which contained traffic light information and those containing GDA information, it is useful to discuss the dimension of ‘directiveness’ in the context of these types of labels to see how this dimension might enhance understanding over and above the use of the dimension of aggregation alone. Traffic light labels contain information on nutrient content, but also communicate decisions on the healthfulness of the levels of these individual nutrients with either colour coding or use of text such as ‘Red/High’, ‘Amber/Med’ or ‘Green/Low’. At either ends of the healthfulness spectrum, particularly when all the nutrients within the label for a given product are colour coded ‘red’ or alternatively all ‘green’, these labels communicate at a level more in line with the directive schemes. In these situations, the consumer is being given a greater degree of guidance as to the healthfulness of the food as a whole, than by the presence of nutrient levels.
alone. It is important to note however, that the instances of an all ‘red’ or all ‘green’ food product are fairly low and in reality most consumers will be faced with an array of colours across the nutrients for a given food and therefore, if using these types of labels when shopping the decision as to where to place the product on the continuum of healthfulness is still located with the consumer for the majority of foods. In reality, their decision will most likely be based on the predominance of red or green within the traffic light label overall and so whilst Traffic Light labels are actually no more aggregated in terms of the amount of information that they display than GDA systems, they do in fact warrant a separate position on the dimension of ‘directiveness’ due to the fact that in some situations, as explained above, they are more directive than GDA systems. As such it is proposed that TL schemes be classified as ‘Semi-Directive’.

Despite the differences in penetration of the various nutrition labelling systems in the four countries, on the whole the results suggest that consumers across the countries categorised and conceptualised the study labels in quite similar ways which is a positive when considering the possibility of developing an effective pan-European approach. Results for the sample as a whole demonstrated that the amount of information contained within a nutrition label has high salience for consumers, as does the health utility of the label although a dichotomy exists in the affective evaluation of the labels containing varying degrees of information aggregation. By recognising that when the directiveness of a FOP label’s health message decreases, the level of detailed information for the consumer to process has to increase, classification of labels on the dimension of directiveness might lead to a better understanding of why some FOP schemes may be more effective than others in particular situations and for particular consumers. In addition, a typology based on directiveness appears to better reflect the role of traffic lights in FOP labels than a typology based on aggregation alone.

In the real world it is known that most consumers do not have the time or motivation to process lots of nutritional information when they are shopping (Gerrier, 2010). However, the expressed need for more information by some participants when presented with the low information content directive labels should perhaps be considered in the context of Judgeability Theory (Yzerbyt et al., 1994). This suggests that although people often understand and respond to simple cues better, particularly when under time pressure, they often want to believe that they are making rational choices based on rational data. Non-directive labels with high
information content have many attributes; nutrient names, grams, percentages, that possibly make people believe that they are being given important evidence. Even if they do not use the actual content, they are simply more likely to be reassured by the fact that the information is there.

Another possible explanation may simply relate to an individual's preferred thinking style. Individuals may choose to process information presented to them quickly and superficially (heuristic) or alternatively prefer to engage in more elaborate systematic processing (Epstein et al., 1996; Chaiken & Trope, 1999). This framework suggests that heuristic processing is more likely to be employed by individuals with a low level of knowledge about a subject and/or lack of background or detailed information to draw on. Conversely, systematic processing tends to be employed when people have both the ability and willingness to process more information, that is, when additional information is present or when they have the time/cognitive resources to process the information. Despite the fact that individuals may have an inherent preference for one style over the other as a result of how well informed they are on the topic in question, it is likely that the processing style actually adopted will be influenced heavily by the situation.

In the context of a shopping visit, one might suggest that heuristic processing is very likely during routine shopping; low involvement, lack of time, overloaded cognitive resources etc. Under other circumstances, such as when following a weight loss programme or when attempting to eat more healthfully after an indulgent holiday period, individuals may be more motivated or involved and in consequence switch to systematic processing. It could be argued therefore that directive labels sacrifice all else for speed and ease of use, becoming both coercive and lacking in the necessary underlying nutritional information and subsequently contravening both the second and the third requirements for liking identified by Grunert and Wills (2007).

3.5 Conclusions

To be effective, the ‘ideal’ FOP labelling scheme must appeal to the widest audience across the widest set of shopping situations. One solution may lie in moving away from current thinking in terms of FOP labelling schemes utilising either an aggregated, or disaggregated approach and more towards the development of FOP labels that consist of directive, semi-directive and non-directive elements. Whilst lab-based research by van Herpen and van Trijp (2011) found that health
logos can enhance healthy product choice, in a supermarket environment this type of directive labelling will only ever be present on a small number of foods, that is, only the most healthful foods. Health logo schemes therefore only give half the story, leaving the consumer with no FOP label to guide them on the relative healthfulness of their choices on the vast majority on foods that remain unlabelled by these approaches.

The results of this research suggest that future studies may benefit from evaluating hypothetical FOP labelling schemes which combine directive, semi-directive and non-directive components according to this typology, and which clearly communicate both the presence and absence of the logo component. In its simplest form this potentially enhanced FOP label would consist of a logo supplemented by information on energy, sugar, fat, saturated fat and salt for those foods deemed to be healthful. For foods not deemed to be healthful, the FOP label should perhaps still be present and display values for energy and the risk nutrients, but make it visually clear when a product does not qualify for a health logo by leaving a space within the label where the logo should be.
CHAPTER 4
STUDY 3: Understanding how consumers categorise health related claims; a consumer derived typology of health claims.

4.1 Introduction and aims

In conjunction with FOP nutrition labelling, nutrition and health claims are an additional means by which health-related information may be communicated to the consumer on food packaging. Whilst studies have suggested that most consumers perceive health claims positively (Urala, Arvola & Lahteenmaki, 2003; Williams, 2005), the plethora of nutrition and health claims on food products in Europe was seen as a cause for concern. This was due to the lack of a harmonised approach to the substantiation of such claims and their potential to mislead the consumer (DG SANTE, 2015). Implementation of the Nutrition and Health Claims Regulation (NHCR) EC No 1924/2006 initially sought to eliminate those unsubstantiated and potentially misleading claims from the marketplace and create a regulatory framework which would provide an appropriate level of consumer protection, while also supporting future innovation and fair competition within the EU food industry (European Commission [EC], 2006a). For the purposes of implementing and enforcing the regulation, health claims are more specifically defined by three main categories; ‘general function’ or Article 13 claims, ‘risk reduction’ or Article 14(1)a claims, and claims relating to ‘children’s development’ or Article 14(1)b claims.

Despite this regulation, it is recognised that consumers do not easily distinguish between these different types of claims in terms of their credibility or self-reported understanding (van Trijp & Van der Lans, 2007) and interpret them differently from scientific experts and regulators (Verhagen et al., 2010), this raises questions about how relevant the expert categorisations utilised in the NHCR regulation (European Commisssion [EC], 2006a) are from a consumer perspective. In addition, the presence of a health claim can lead to situations whereby incorrect inferences are made about the product (Roe, Levy & Derby, 1999).

Building on the MSP methodology utilised in Study 2, this study seeks to develop a framework of nutrition and health claims encompassing dimensions derived from consumers, thus providing useful insight into how they make sense of this type of information and how claims may be optimised to enhance appropriate consumer understanding and use. By utilising the Multiple Sort Procedure...
methodology, the specific aims of this study are to elicit the conceptual systems people use to make sense of a range of claims presented to them, thus gaining deeper insight into the way in which those claims may be understood or indeed misunderstood by consumers. Furthermore, this study seeks to investigate how easily consumers are able to align claims to the expert typology utilised by the NHCR regulation (European Commission [EC], 2006a) and propose a framework of nutrition and health claims encompassing dimensions derived directly from consumers.

4.2 Materials and Methods

The study design involved both free and structured sorting of a range of health claim statements presented on cards. The underlying structure of the qualitative data generated by the free sorting was then explored using Multiple Scalogram Analysis (MSA) (Wilson, 2000; Hammond, 1997; Lingoes, 1979; Zuvlun, 1978). The structured sorting data was explored in terms of frequencies and the qualitative data used to facilitate interpretation of the frequencies observed.

Individual face-to-face interviews were conducted using a standardised interview schedule. Participants were given a set of twenty five cards each of which displayed a claim statement and were instructed to free sort the cards into groups so that all the cards in one group were similar to each other in some important way and different from the other groups. They were then asked to repeat this using a different sort rationale if they could. Participants were encouraged to ‘think aloud’ both about the cards and their sorting rationale. Following the free sorting participants were asked to sort the same set of stimuli cards into groups with pre-assigned headings which reflected the NHCR expert typology framework. The interviews were audio recorded and on completion of each of the sorts, the interviewer manually recorded the overall sort rationale used by the participant, the reasons for each grouping of cards and which cards were assigned to each group.

This study received a favourable ethical opinion from the University of Surrey Ethics Committee (Reference: EC/2013/128/FAHS). The Participant information sheet and consent form utilised for the study are attached as Appendix 3A.
4.2.1 Participants

The study was carried out on a total of 100 participants, who shopped for groceries at least occasionally, and comprising of 20 participants from each of the following countries: Germany (DE), the Netherlands (NL), Slovenia (SL), Spain (ES) the United Kingdom (UK). Recruitment quotas were applied for gender, age and highest education level achieved in each country. The resultant sample profiles per country are detailed in Table 4.1.

Table 4.1 Socio-demographic characteristics of participants by country.

<table>
<thead>
<tr>
<th></th>
<th>DE n=20</th>
<th>NL n=20</th>
<th>SL n=20</th>
<th>ES n=20</th>
<th>UK n=20</th>
<th>Total N=100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
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<td>10</td>
<td>10</td>
<td>10</td>
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<td>Female</td>
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</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-34 years</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>35-49 years</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>8</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>50-64 years</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>65+ years</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Highest education</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>Secondary*</td>
<td>16</td>
<td>12</td>
<td>10</td>
<td>12</td>
<td>15</td>
<td>65</td>
</tr>
<tr>
<td>University</td>
<td>4</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>29</td>
</tr>
</tbody>
</table>

* This sub group includes participants who completed further vocational education post-secondary level.

4.2.2 Rationale for the development of the study stimuli

The claim statements to be used as stimuli in the sorting tasks within this study were selected to represent a reasonable range of General Function Claims, Disease Risk Reduction Claims, Nutrition Claims and claims that fall into the General Health Claims category. In the selection process the following criteria were taken into consideration;

- General function claims (13(1) a-c) relating to a number of different nutrients, substances, food or food categories and representing a range of different health
relationships. The wording for these was taken verbatim from the EU Register of Nutrition and Health claims (European Commission [EC], 2006b).

- Disease risk reduction/children’s development and health claims (14(1) a-b) again, where possible, relating to a number of different nutrients, substances, food or food categories and health relationships. The wording for these was taken verbatim from the EU Register of Nutrition and Health claims, (European Commission [EC], 2006b).

- Nutrition Claims for nutrients or ingredients (i.e. nutrient content claims related to Vitamin C, Sodium, Fat, Sugar, and Omega3).

Finally, two claims were included which are classified by some experts as General Health claims because of the health relationship implied by the ingredient over and above that of a simple nutrient content claim, but are considered as nutrient content claims by other experts due to the lack of a stated function or benefit in the claim. These were ‘Contains wholegrain’ and ‘One of your 5 a day’. This is perhaps a category of claims that could be better defined by the legislation and it was felt that it would be extremely useful to see how participants made sense of these particular claims in the context of the other claims included in the stimuli set. However, due to the lack of familiarity with the ‘One of your 5 a day’ claim in some of the study countries, a short explanatory statement was added to the stimuli card; ‘Experts recommend you eat 5 portions of fruit and vegetables every day. That is 5 portions in total, not 5 portions of each’.

The final set of twenty five claim stimuli are shown in Table 4.2 and the stimuli cards used in the study can be seen in Appendix 3B. The maximum number of stimuli that a participant can realistically process within a study of this type is typically between fifteen and twenty five separate elements (Canter et al., 1985, Barnett, 2004) and for this reason a maximum limit for stimuli was set at twenty five.
Table 4.2 Health claim and nutrition claim stimuli.

<table>
<thead>
<tr>
<th>Stimuli card number</th>
<th>EU class</th>
<th>Nutrient, substance, food or food category</th>
<th>Specific nutrient, substance, food or food category</th>
<th>Claim wording on stimuli card*</th>
<th>Health relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13(1)a</td>
<td>Nutrient or substance</td>
<td>Calcium</td>
<td>Calcium is needed for the maintenance of normal bones</td>
<td>Maintenance of normal bones and teeth</td>
</tr>
<tr>
<td>2</td>
<td>13(1)a</td>
<td>Nutrient or substance</td>
<td>Vitamin B12</td>
<td>Vitamin B12 contributes to normal homocysteine metabolism</td>
<td>Contribution to normal homocysteine metabolism</td>
</tr>
<tr>
<td>3</td>
<td>13(1)a</td>
<td>Food or food category</td>
<td>Sodium</td>
<td>Reducing consumption of sodium contributes to the maintenance of normal blood pressure</td>
<td>Maintenance of normal blood pressure</td>
</tr>
<tr>
<td>4</td>
<td>13(1)a</td>
<td>Nutrient or substance</td>
<td>Monounsaturated and/or polyunsaturated fatty acids</td>
<td>Replacing saturated fats with unsaturated fats in the diet contributes to the maintenance of normal blood cholesterol levels [MUFA and PUFA are unsaturated fats]</td>
<td>Replacement of mixtures of saturated fatty acids (SFAs) as present in foods or diets with mixtures of polyunsaturated fatty acids (PUFAs) and maintenance of normal blood LDL-cholesterol concentrations</td>
</tr>
<tr>
<td>5</td>
<td>13(1)a</td>
<td>Nutrient or substance</td>
<td>Live yoghurt cultures</td>
<td>Live cultures in yoghurt or fermented milk improve lactose digestion of the product in individuals who have difficulty digesting lactose</td>
<td>Improved lactose digestion</td>
</tr>
<tr>
<td>6</td>
<td>13(1)a</td>
<td>Food or food category</td>
<td>Walnuts</td>
<td>Walnuts contribute to the improvement of the elasticity of blood vessels</td>
<td>Improvement of endothelium-dependent vasodilation</td>
</tr>
<tr>
<td>7</td>
<td>13(1)b</td>
<td>Nutrient or substance</td>
<td>Zinc</td>
<td>Zinc contributes to normal cognitive function</td>
<td>Cognitive function</td>
</tr>
<tr>
<td>8</td>
<td>13(1)b</td>
<td>Nutrient or substance</td>
<td>Docosahexaenoic acid (DHA)</td>
<td>DHA contributes to maintenance of normal brain function</td>
<td>Maintenance of normal brain function</td>
</tr>
<tr>
<td>9</td>
<td>13(1)b</td>
<td>Nutrient or substance</td>
<td>Pantothenic acid</td>
<td>Pantothenic acid contributes to the reduction of tiredness and fatigue</td>
<td>Reduction of tiredness and fatigue</td>
</tr>
<tr>
<td>Stimuli card number</td>
<td>EU class</td>
<td>Nutrient, substance, food or food category</td>
<td>Specific nutrient, substance, food or food category</td>
<td>Claim wording on stimuli card*</td>
<td>Health relationship</td>
</tr>
<tr>
<td>---------------------</td>
<td>-----------</td>
<td>------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>-------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>10</td>
<td>13(1)c</td>
<td>Food or food category</td>
<td>Meal replacement for weight control</td>
<td>Substituting one daily meal of an energy restricted diet with a meal replacement contributes to the maintenance of weight after weight loss</td>
<td>Maintenance of body weight after weight loss</td>
</tr>
<tr>
<td>11</td>
<td>13(1)c</td>
<td>Nutrient or substance</td>
<td>Glucomannan (konjac mannan)</td>
<td>Glucomannan in the context of an energy restricted diet contributes to weight loss</td>
<td>Reduction of body weight</td>
</tr>
<tr>
<td>12</td>
<td>14(1)a</td>
<td>Food or food category</td>
<td>Sugar-free chewing gum</td>
<td>Sugar-free chewing gum helps reduce tooth demineralisation. Tooth demineralisation is a risk factor in the development of dental caries.</td>
<td>Tooth demineralisation is a risk factor in the development of dental caries.</td>
</tr>
<tr>
<td>13</td>
<td>14(1)a</td>
<td>Nutrient or substance</td>
<td>Barley beta-glucans</td>
<td>Barley beta-glucans has been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease.</td>
<td>High cholesterol is a risk factor in the development of coronary heart disease.</td>
</tr>
<tr>
<td>14</td>
<td>14(1)a</td>
<td>Nutrient or substance</td>
<td>Plant sterols/Plant stanol esters</td>
<td>Plant sterols and plant stanol esters have been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease.</td>
<td>High cholesterol is a risk factor in the development of coronary heart disease.</td>
</tr>
<tr>
<td>15</td>
<td>14(1)b</td>
<td>Nutrient or substance</td>
<td>Docosahexaenoic acid (DHA)</td>
<td>Docosahexaenoic acid (DHA) intake contributes to the normal visual development of infants up to 12 months of age.</td>
<td>Visual development in infants</td>
</tr>
<tr>
<td>16</td>
<td>14(1)b</td>
<td>Nutrient or substance</td>
<td>Calcium and vitamin D</td>
<td>Calcium and vitamin D are needed for normal growth and development of bone in children</td>
<td>Normal growth and development of bone in children</td>
</tr>
<tr>
<td>Stimuli card number</td>
<td>EU class</td>
<td>Nutrient, substance, food or food category</td>
<td>Specific nutrient, substance, food or food category</td>
<td>Claim wording on stimuli card&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Health relationship</td>
</tr>
<tr>
<td>---------------------</td>
<td>----------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>17</td>
<td>14(1)b</td>
<td>Nutrient or substance</td>
<td>Iron</td>
<td>Iron contributes to normal cognitive development of children</td>
<td>Normal cognitive development of children</td>
</tr>
<tr>
<td>18</td>
<td>14(1)b</td>
<td>Nutrient or substance</td>
<td>α-linolenic acid (ALA) &amp; linoleic acid (LA), essential fatty acids</td>
<td>Essential fatty acids are needed for normal growth and development of children.</td>
<td>Normal growth and development of children.</td>
</tr>
<tr>
<td>19</td>
<td>Nutrition claim</td>
<td>Nutrient or substance</td>
<td>Vitamin C</td>
<td>Rich in vitamin C</td>
<td>None specified</td>
</tr>
<tr>
<td>20</td>
<td>Nutrition claim</td>
<td>Food or food category</td>
<td>Sodium</td>
<td>Naturally low in sodium</td>
<td>None specified</td>
</tr>
<tr>
<td>21</td>
<td>Nutrition claim</td>
<td>Nutrient or substance</td>
<td>Fat</td>
<td>Fat free</td>
<td>None specified</td>
</tr>
<tr>
<td>22</td>
<td>Nutrition claim</td>
<td>Nutrient or substance</td>
<td>Sugar</td>
<td>No added sugar</td>
<td>None specified</td>
</tr>
<tr>
<td>23</td>
<td>-</td>
<td>Nutrient or substance</td>
<td>Wholegrain</td>
<td>Contains wholegrain</td>
<td>None specified</td>
</tr>
<tr>
<td>24</td>
<td>Nutrition claim</td>
<td>Nutrient or substance</td>
<td>Omega 3</td>
<td>Source of Omega-3</td>
<td>None specified</td>
</tr>
<tr>
<td>25</td>
<td>-</td>
<td>Nutrient or substance</td>
<td>Fruit/Vegetables</td>
<td>One of your 5 a day (Experts recommend you eat 5 portions of fruit and vegetables every day. That is 5 portions in total, not 5 portions of each)</td>
<td>None specified</td>
</tr>
</tbody>
</table>

<sup>a</sup> See Appendix 3B for the sorting card stimuli referred to in this table.
4.2.3 Data collection

All participants were interviewed individually for the sorting tasks using a standardised interview schedule across the four countries that had been translated into the local language. Throughout the interview, participants were encouraged to ‘think aloud’ and if they fell silent for more than a few seconds were prompted with standardised prompts. The interviews were audio recorded and standardised data collection forms were used to record the free and structured sorting data.

A short warm-up task was employed at the start of the interview to ensure the participant was comfortable with thinking aloud before engaging with the sorting tasks (i.e. the main experiment). This involved identifying claims on a margarine food product given the following definition of a health claim: “Health claims are any messages conveyed in text or images that state, suggest or imply that a relationship exists between a food category, a food or one of its constituents and health”.

**Free sorting:** Following the warm-up task, participants were handed the set of twenty five stimuli cards (see Appendix 3B) and instructed to free sort them into groups according to their similarities/differences using their own personal criteria, up to a maximum of five free sorts each. At the end of each sort the interviewer recorded the groupings, reasons for sort and card numbers in each group on a Card Sort Recording Form (see Appendix 3C) and handed the cards back to the participant for the next sort.

**Structured sorting:** When participants had completed the free sorting, they were asked to sort the same set of stimuli cards into groups with pre-assigned headings (see Table 4.3 for wording of headings) which reflected the NHCR expert typology framework (see section 4.2.4). The structured sort group headings were laid out in front of the participant and once all the cards had been placed, the Interviewer recorded the cards placed under each group heading on the Card Sort recording form (Appendix 3C). Participants were then asked to elaborate on the structured sorting task and group headings and whether they had found anything particularly difficult/easy during the task.

Throughout the sorting activities, the interviewer continually encouraged the participant to ‘think aloud’, but did not engage in any detailed conversation with the participant about the health claims themselves or where they should be placed. Finally, the participant completed the self-report background questionnaire (Appendix 3D) and received a debriefing about the study.
4.2.4 Structured sorting - Expert typology headings

The expert typology headings utilised in the structured sort were derived directly from the current EU regulation 1924/2006 (EC, 2006a) and this resulted in five group headings pertaining to health claims of various types and one group heading pertaining to nutritional claims. A further group heading simply entitled ‘Don’t know’ was provided for use when participants were unable to place a particular stimuli card under any of the other six expert typology headings. The structured sort headings utilised in the study and the stimuli cards that relate to each heading are detailed in Table 4.3. A General Health claim category was not provided since inclusion of this overly simplistic category heading would have diluted the overall sorting study findings as all but a few of the claim stimuli could have been placed under this heading.

Table 4.3 Structured sort headings (expert typology) and associated stimuli cards.

<table>
<thead>
<tr>
<th>Number</th>
<th>Heading wording</th>
<th>Associated stimuli cards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Claims describing or referring to the role of a food or food constituent in the growth, development and functions of the body.</td>
<td>1-6</td>
</tr>
<tr>
<td>2</td>
<td>Claims describing or referring to psychological and/or behavioural functions.</td>
<td>7-9</td>
</tr>
<tr>
<td>3</td>
<td>Claims describing or referring to slimming or weight-control or; a reduction in the sense of hunger, an increase in the sense of satiety, the reduction of the available energy from the diet.</td>
<td>10-11</td>
</tr>
<tr>
<td>4</td>
<td>Claims stating, suggesting or implying that the consumption of a food or food constituent significantly reduces a risk factor in the development of a human disease.</td>
<td>12-14</td>
</tr>
<tr>
<td>5</td>
<td>Claims relating to children’s development and health.</td>
<td>15-18</td>
</tr>
<tr>
<td>6</td>
<td>Claims stating, suggesting or implying that a food has particular beneficial nutritional properties due to; the energy (calorific value) it provides, at a reduced or increased rate, or does not provide and/or the nutrients or other substances it contains, contains in reduced or increased proportions or does not contain.</td>
<td>19-22, 24</td>
</tr>
<tr>
<td>7</td>
<td>Don’t know.</td>
<td></td>
</tr>
</tbody>
</table>
4.2.5 Background measures

Participants were required to self-complete a questionnaire at the end of the interview to provide information on behaviour and attitudinal variables (see Appendix 3D). All were measured on five point Likert scales (1 = Strongly disagree; 5 = Strongly agree) unless otherwise stated below. The questionnaire was developed in English and translated with a number of minor country specific modifications to make it appropriate across all four countries.

General Health Interest (Roininen et al., 1999; Roininen et al., 2001): This was measured by eight items: ‘The healthiness of food has little impact on my food choices’ (R), ‘I am very particular about the healthiness of food I eat’; ‘I eat what I like and I do not worry much about the healthiness of food’ (R), ‘It is important for me that my diet is low in fat’, ‘I always follow a healthy and balanced diet’, ‘It is important for me that my daily diet contains a lot of vitamins and minerals’, ‘The healthiness of snacks makes no difference to me’ (R), ‘I do not avoid foods, even if they may raise my cholesterol’ (R). Scores for items denoted (R) were reversed and the eight items were used to compute a compound score (α = 0.76) to reflect each participant’s interest in healthy eating.

Subjective health claim knowledge: This was measured by three items adapted from Moorman et al. (2004): ‘Compared to most people, I am quite knowledgeable about health claims and symbols’, ‘Compared to most people, I am more confident in using health claims to make a food choice’, ‘I feel confident about my ability to understand health claims on food labels’. These three items were used to compute a compound score (α = 0.74) to reflect each participant’s self-reported health claim knowledge.

Motivation to process health claims: (Moorman, 1990) was measured by two items: ‘I am interested in looking for health claims and symbols on food’, ‘I pay attention to health claims and symbols on food’. These two items were used to compute a compound score (α = 0.82) to reflect each participant’s motivation to process and attend to health claims.

Usage of health claims: This was measured by the item: ‘I often use health claims and symbols on food in general while shopping’ and the relative frequency of
use of text-based or image-based claims when shopping was measured on a five point scale (1 = Never; 5 = Very often).

Processing style: Processing style, useful for understanding how individuals attend to and interpret components of a given message were measured with short versions of the ‘Need for cognition (NFC)’ (Cacioppo et al., 1986) and ‘Faith in Intuition (FI)’ scales (Epstein et al., 1996). Faith in intuition included five items; ‘My initial impressions of things are almost always right’, ‘I trust my initial feelings about things’, ‘When it comes to trusting something, I can usually rely on my gut feelings’, ‘I believe in trusting my hunches’, ‘I can usually feel when something is right or wrong, even if I can’t explain how’. Need for cognition included five items: ‘I don’t like to have to do a lot of thinking’ (R), ‘I try to avoid situations that require thinking in depth about something’ (R), ‘I prefer to do something that challenges my thinking rather than something that requires little thought’, ‘I prefer complex to simple problems’, ‘Thinking hard and for a long time about something gives me little satisfaction’ (R). Scores for items denoted as (R) for the above two measures were reversed and a compound score for each scale was computed. NFC ($\alpha = 0.70$), FI ($\alpha = 0.85$).

4.2.6 Free sort analysis

Multiple Scalogram Analysis (Wilson, 2000; Lingoes 1979; Zvulun, 1978) involves the preparation of a data matrix in which each column represents an individual participant’s sort and each row represents a card, that is, a particular claim. The Multiple Scalogram Analysis (MSA) (Hammond, 1997) provides an overall ‘top’ plot that depicts the relationships between all the cards in that analysis. Each card is a point in geometric space and the closer the points are to each other the more similar they are considered to be. The program requires a ‘coefficient of contiguity’ of at least 0.9 to ensure that the solution being produced is an acceptable fit to the data. Regardless of whether differing numbers of categories were used by the participants during their free sorts, the cards that were most frequently placed together across the sample appear closest together on this top plot.

In addition to this top plot, the MSA output also includes an ‘item’ plot for each sort included in the data matrix. The configuration of the points on these item plots is the same as for the top plot however, this time the points represent the category or group that the card was assigned to by the participant. Using the
category descriptions, group headings and other qualitative data gathered during the sorting interviews, these item plots allow for the reasons that particular cards were grouped together in individual sorts to be overlaid onto the top plot in order to inform its’ interpretation. In this way the researcher is able to partition the top plot on the basis of why particular cards were put together, and offer an interpretation of the categories that have informed the way in which the study participants have sorted the cards (Barnett, 2004).

Plots of the first free sorts for each country were prepared as a starting point for the analysis. Each country was analysed separately enabling exploration of the differences between countries. The resultant top plots are shown and discussed in Section 4.3.4. In parallel to the MSA, a content analysis was conducted to provide an overview of the constructs participants used in their sorts. Overall sort strategies and sort group headings were reviewed to identify meaningful categories within which sorts could be subsumed; these categories were then used in conjunction with the individual constructs to facilitate the interpretation of the MSA plots.

4.2.7 Structured sort analysis

The ability of participants to assign the stimuli cards to the appropriate structured sort heading groups was established via frequencies and the qualitative data used to facilitate interpretation of the frequencies observed. The purpose of this task was to develop an understanding of where there might be differences between how consumers perceive the claims presented to them, compared to experts. In addition, identification of the groups in which participants placed claims, interpreted together with the qualitative data, provides a deeper insight as to why they placed the claims where they did and thus where the potential for misunderstanding may occur.

4.3 Results

4.3.1 Sample description

Overall, 82% of the sample described themselves as being either the main shopper or shopping as frequently as someone else in their household for food products (UK 85%, NL 95%, DE 75%, SL 75% and ES 80%). In terms of their self-reported frequency of use of text or image-based health claims on food products
when shopping, 51% of the sample described themselves as using them either “Quite often” or “Very often” with 48% using them “Sometimes” or “Rarely” and only 1% stating they never used health claims when shopping (see Table 4.4).

There were no significant differences between countries in terms of participants’ self-reported General Health Interest (GHI), Need for Cognition (NFC), Faith in Intuition (FI) or subjective knowledge of health claims. However, post hoc tests revealed a significant difference between Spain and the Netherlands in terms of their motivation to process health claims. Spain reported the highest motivation to process health claims with the Netherlands reporting the lowest, the UK, Germany and Slovenia falling in between.

Table 4.4 Mean scores for background variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>DE</th>
<th>NL</th>
<th>SL</th>
<th>ES</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Health Interest (GHI)</td>
<td>3.19</td>
<td>3.44</td>
<td>3.59</td>
<td>3.46</td>
<td>3.31</td>
</tr>
<tr>
<td>Need for Cognition (NFC)</td>
<td>3.32</td>
<td>4.30</td>
<td>3.68</td>
<td>3.24</td>
<td>3.73</td>
</tr>
<tr>
<td>Faith in Intuition (FI)</td>
<td>3.78</td>
<td>3.64</td>
<td>3.71</td>
<td>3.49</td>
<td>3.56</td>
</tr>
<tr>
<td>Subjective knowledge of health claims</td>
<td>3.17</td>
<td>3.23</td>
<td>3.67</td>
<td>3.52</td>
<td>3.52</td>
</tr>
<tr>
<td>Motivation to process health claims</td>
<td>3.73</td>
<td>3.48*</td>
<td>3.78</td>
<td>4.25*</td>
<td>3.55</td>
</tr>
</tbody>
</table>

* One-way ANOVA, F(4, 95) = 2.957; p = 0.024, all other comparisons non significant.

4.3.2 Constructs utilised by participants in their first free sort

The constructs utilised by the participants in all their free sorts for the category/group labels were subjected to a preliminary qualitative grouping across all five countries and from this an overall frequency table was prepared (Table 4.5) and a table reflecting the frequency of constructs used in the first free sorts per country (Table 4.6). Interview transcripts and overall sort criteria were used to guide interpretations of the group labels with similar meanings. The majority of participants
managed to do at least two sorts, 40% managed 3 sorts and 9% managed to do five sorts. A total of 245 free sorts were recorded across the whole sample (N=100).

Overall, there were a total of 17 categories of constructs used across all the countries and of these, 13 were used in 3 or more countries. The most frequently utilized constructs related to participants’ attempts to sort the cards based on the information contained within the claim, that is [1] Nutrient, health condition or outcome, function and/or purpose of the claim, [2] Types of statements in terms of their complexity, length or levels of information and [3] Relevance of the claim to the participant personally or their ability to see a claim’s relevance to a specific population group.

It is noteworthy that the vast majority of participants found free sorting these types of stimuli difficult and the overall complexity of the health claim domain meant that a number of participants were simply unable to develop their free sorting on a single overall strategy.

4.3.3 First free sort top plots

Top plots of the first free sorts for each country were prepared as a starting point for the analysis. The individual plots were initially interpreted at country level in relation to the constructs used (Table 4.6) and the additional qualitative data gathered and then compared and contrasted between countries. Subsequent to running the MSA analysis on the first free sorts, top plots were generated for the second free sorts for each country. Since the frequency at which new constructs appearing in subsequent free sorts was quite low across the sample (Table 4.5), plots for these did not appear to add any different dimensions to the interpretations already provided by the first free sorts and therefore further analysis at this level was not pursued.

In an attempt to evaluate the effect of eliminating the mixed sorts from the analysis, top plots were prepared which replaced the first free sort for a participant that had performed a mixed sort, with their second free sort if one was available. However, this did not appear to facilitate interpretation any further and this approach was not pursued. Whilst there were a number of first sorts that presented with no dominant construct, particularly in Spain, these tended to be based primarily around a combination of the three highest frequency constructs utilised by other participants in their first sorts. Furthermore, a number of the Spanish participants simply did not
manage to perform a second sort. Their initial mixed sorts were therefore deemed to be of value and retained in the MSA analysis.

Table 4.5 Categories of constructs utilised in free sorting for all countries combined.

<table>
<thead>
<tr>
<th>Sort strategy category/constructs</th>
<th>Free Sort</th>
<th>Total frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Information contained in claim:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nutrient/health condition or outcome/function/purpose/benefits</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>(Includes reference to consequences/risk communication)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Types of statements:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity/length/information levels/specific vs general information/expertise required vs user friendliness</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td><strong>Relevance:</strong> Personal/target groups/appeal</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td><strong>Mixed sort - no dominant construct</strong></td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td><strong>Understanding/confusion</strong></td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td><strong>Natural/artificial:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scientific vs naturally occurring/healthful vs not healthful/processed vs not processed</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td><strong>Importance</strong></td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td><strong>Credibility:</strong> Believability/measurability/substantiation level/trust/agreement</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Food:</strong> Food group, food supplement</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>Familiarity:</strong> Popularity/known or not known</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><strong>Position on pack:</strong> Front vs back</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Effect:</strong> Duration/direction</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Positive vs negative message:</strong></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Warning/Inclusion vs absence</td>
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<td></td>
</tr>
<tr>
<td><strong>Plant vs animal based</strong></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Meal relevance</strong></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Clarity</strong></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Need</strong></td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Free Sorts</strong></td>
<td>100</td>
<td>79</td>
</tr>
</tbody>
</table>
Table 4.6 Categories of constructs utilised in free sorting per country.

<table>
<thead>
<tr>
<th>Sort strategy category/constructs</th>
<th>DE</th>
<th>NL</th>
<th>SL</th>
<th>ES</th>
<th>UK</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information contained in claim: Nutrient/health condition or outcome/function/purpose/benefits (Includes reference to consequences /risk communication)</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Types of statements: Complexity/length/ information levels/specific vs general information/expertise required vs user friendliness</td>
<td>8</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Relevance: Personal/target groups/appeal</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>Mixed sort - no dominant construct</td>
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<td>2</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Understanding/confusion</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Natural/artificial: Scientific vs naturally occurring/healthful vs not healthful/ processed vs not processed</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Importance</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Credibility: Believability/measurability / substantiation level/trust/agreement</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Familiarity: Popularity/known or not known</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Food: Food group, food supplement</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Position on pack: Front vs back</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Effect: Duration/direction</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total Free Sorts</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>
4.3.4 Explanation of the MSA plots

4.3.4.1 MSA Plot – United Kingdom (UK)

By engaging with the qualitative data provided by the UK participants for their sort strategies, the group headings they assigned and what they said about specific cards during their sorting activities, the UK plot (Fig. 4.1) was partitioned into two main groups. The first group, UK1 consisted of cards 19-25, the nutrition claims. The second group, UK2 consisted of all the health claims (1-18). UK2 was then further partitioned into three sub-groups.

![MSA Plot - United Kingdom (UK)](image)

Figure 4.1 MSA Plot – United Kingdom (UK)
See Table 4.2 for details on the claim wording associated with the stimuli card numbers in the above plot.

The partitioning between the main UK1 area and UK2 related to the difference between the types of statements in terms of their simplicity/complexity and information levels, but also to the difference between the two partitioned groups with respect to the presence/absence of a stated function/benefit or purpose. UK1 contained the shorter, more simplistic nutrition claims that did not contain a stated function or benefit and UK2 contained the more complex claims with higher levels of information. UK2 could be further subdivided in terms of the construct of ‘relevance’ whereby the cards in sub-group UK2.2 and UK2.3 appeared to be easily recognisable as being relevant for those on a weight loss diet or for children, but
those in sub-group UK2.1 were described more generally as not personally relevant or participants were unsure for whom they would be relevant.

In addition to the partitioning described above, there also appeared to be a directional element to the overall UK plot in that those cards appearing towards the top the plot were referred to as less understandable than those appearing towards the bottom, regardless of which sub-grouping of UK2 that they were placed in. For example, cards 10, 11, 8, 9 and 15 appearing at the top of the plot tended to contain unfamiliar nutrients or terms such as ‘Glucomannan’, ‘Meal replacement’, ‘Pantothenic acid’ and ‘Docosohexanoic acid (DHA)’ which participants described negatively in terms of understanding. Conversely, claims appearing at the bottom of the UK2 partition contained the more familiar macro and micro nutrients typically found in the nutrition claims and participants appeared to be more comfortable with these types of nutrients which they would likely have had some experience of before. This theme is also the most likely explanation for the distance between cards 15 and 18 from cards 16 and 17 in UK2.3.

“The DHA I mean, I don’t know that one, and there the DHA is on there again. I don’t…. obviously it’s something important but I don’t really understand enough to understand…. what it’s significance is…. but I’d have to go back and put that into Google, because I don’t know what that is.” (Cards 8 and 15, UK)

“I would look at that and think I don’t know what the damn Pantothenic acid is! So I wouldn’t know whether it’s going to do me any harm or good or whatever.” (Card 9, UK)

“I don’t know. I’ve not heard of it so I don’t know.” (Card 9, UK)

Participants’ expressed a lack of understanding/familiarity with the nutrient ‘DHA’ as demonstrated by the quotes above and a lack of familiarity with ‘essential fatty acids’ when compared to the more familiar nutrients such as calcium, vitamin D and iron which were more easily recognisable by the participants as being beneficial for children.

“I didn’t know that they [children] needed fatty acid.” (Card 18, UK)

“Fatty acids for growth and development? Not really.” (Card 18, UK)
A number of participants expressed concerns regarding the credibility of the weight loss claims and many found them difficult to understand or simply didn't agree with them. This explains their positioning towards the top of the plot and possibly also their extended distance from the other clusters within UK2.

"Substitute one meal on an energy restricted diet"? See, I don’t ever think that’s good. A meal replacement. Would that be a meal replacement drink? See, I don’t ever agree with them." (Card 10, UK)

"Substituting one meal a day for an energy… I don’t think that’s good for you. I don’t believe in- well, I wouldn’t do that anyway….substituting one of your meals, unless your physician had told you to do that, I wouldn’t be very happy with that." (Card 10, UK)

"I don’t really understand what that’s trying to tell me…. I am on a diet, but I kind of feel like that might be something that…. not really sure about that... bit suspicious, yes." (Card 11, UK)

A number of participants also appeared to be sceptical about the sugar-free gum health claim (card 12), which may explain its distance from the main cluster of health claims in UK2.1 and its proximity to the weight loss claims in UK2.3 rather than the other health claims in either UK2.1 or UK2.2.

"It’s like they’re trying to find something good for something that isn’t necessarily – do you know what I mean? It’s chewing gum! It’s not like a food thing, you know. Oh yeah, they’re trying to make out its good for your teeth, which is probably true but I wouldn’t expect it on a food type thing." (Card 12, UK)

"I go to the hygienist regularly, and she totally abhors chewing gum of any shape or form. She says it pulls out your fillings, people tend to sit with chewing gum in their mouth, and the stomach acids start to work and it’s expecting food to come down, and none comes down, so the acid’s working overtime and you end up with stomach ache." (Card 12, UK)

“And here is a claim about sugar-free gum, but why do you need to have sugar free gum in the first place is my question.” (Card 12, UK)
In terms of the nutrition claims in UK1, these claims were generally described more favourably because of the simplicity of the statements when compared to the more detailed health claims, although it was recognised by a number of participants that these claims lacked a function/benefit or purpose in the claim statement. It is therefore these two constructs which appear to explain why these claims are separated from those in UK2. However, the UK participants did express some concerns about the credibility of many of the nutrition claims particularly those relating to fat (card 21) and sugar (card 22), but since this cluster of claims is quite compact on the MSA plot this construct did not appear to be reflected in their sorting strategy.

“When they reduce the fat they put up the sugar.” (Card 21, UK)

“I'm a bit dubious about “fat free” because there are different kinds of fat.” (Card 21, UK)

“You could say its fat free because we’ve used a fat free milk, we’ve used skimmed milk and not full fat milk, so they could claim its fat free but the rest of the ingredients could be totally fatty.” (Card 21, UK)

“Cause if it’s low in fat then it’s high in sugar, and if it’s high in sugar it’s low in fat.” (Cards 21 and 22, UK)

“I'd like to believe that was true, I know we’re conned about those things.” (Card 22, UK)

“No added sugar? I’m not sure about that. Does it mean that it's already got a load of sugar but they've not added anymore?” (Card 22, UK)

“On the other hand there could be so much naturally occurring sugar that it's equally as bad!” (Card 22, UK)

4.3.4.2 MSA Plot – Germany (DE)

Overall there is more separation and less defined clustering, when comparing the German MSA plot to the UK plot. However, the qualitative data suggests two main partitions for the German MSA plot (Fig. 4.2). DE2 contains the more detailed health claims and DE1 contains the simpler nutrient claims and the construct of ‘Types of statements’ is again driving the overall positioning of the points on the plot. It was found that DE2 could also be further subdivided in terms of
the construct ‘relevance’, with those claims specifically relevant for children in sub-group DE2.2 and those that were not in sub-group DE2.1.

Figure 4.2 MSA Plot – Germany (DE)
See Table 4.2 for details on the claim wording associated with the stimuli card numbers in the above plot.

The slight distance of card 15 from the other cards in sub-group DE2.2 is again most likely to relate to the presence of the unfamiliar nutrient ‘Docosohexanoic acid (DHA) in the claim. Again when compared to the more familiar nutrients such as calcium, vitamin D and iron, it was less easily recognisable by the German participants as being beneficial for children.

“Because I don’t know what DHA means…. I never heard about it, so I don’t know what to think about it.” (Card 15, DE)

“DHA…no idea.” (Card 15, DE)

“DHA means nothing to me…acid means nothing to me.” (Card 15, DE)

The proximity of card 1 ‘Calcium is needed for the maintenance of normal bones’ to DE2.2 is most likely due to some participants’ recognition that calcium is important for children.

“Calcium is important for growth.” (Card 1, DE)
“Children also need calcium and vitamins for their bones and other things.” (Card 1, DE)

Once again, the distance between card 10, the meal replacement claim, and the remainder of cards in sub-group DE2.1 is most likely explained by some participants’ expressed dislike or disbelief associated with this claim.

“I do not like the idea of meal replacements because I really like to eat. I think of some disgusting barley-based drinks and cannot really make any use of it.” (Card 10, DE)

“This one … no way!” (Card 10, DE)

“That’s nonsense, as well as weight loss drinks, that is made-up. I don’t believe it!” (Card 10, DE)

On the whole, the sugar-free gum claim, card 12, received a more favourable response, but due to its perceived relevance to either weight loss, children or the fact that some participants did not feel that dental caries was in fact a disease, this card is slightly separated from the main cluster of other health claims within DE2.1.

“Sugar-free chewing gum is more for children or teenagers because adults do not chew gums.” (Card 12, DE)

“If you want to lose weight, you should not consume any sugar. A sugar-free chewing gum can help.” (Card 12, DE)

“Caries is not directly a disease. But this one with the sugar-free chewing gum is a kind of advice.” (Card 12, DE)

With respect to the nutrition claims in DE1, there is more distance generally between the cards in this grouping when compared to the UK plot, but particularly for card 25 ‘One of your 5 a day (Experts recommend you eat 5 portions of fruit and vegetables every day. That is 5 portions in total, not 5 portions of each)’ which is closer in proximity to the DE2.1 group than the other nutrition claims. This may in some part be due to the length of text on the claim when compared to the other nutrient claims which tended to be more concise. However, since the main partitioning of the plot relates to the construct of statement types, the qualitative data suggests that it may also be due to the recognition by some participants that for
them this claim implies health perhaps more so than the other nutrition claims included in DE1.

“This information is also easy to understand. It is an indication that it is definitely healthy, because they suggest it.” (Card 25, DE)

“High daily amounts of vegetables and fruits belong also to minerals and nutrients because they contain many vitamins too.” (Card 25, DE)

“Fruits are good for the development and the body because of many vitamins.” (Card 25, DE)

The remaining nutrition claims were in general thought to be more related to the product itself and what it contains;

“Fat free, contains whole grain, no added sugar - everybody can understand it. These are statements which have a meaning. They are short. The statements are striking; they tell you something about the product. In my opinion, they belong on the front of the pack.” (Card 21-24, DE)

“Rich in vitamin C, contains wholegrain, no added sugar, I think that these are some keywords about the content of the product. These are claims about what it contains, not recommendations per se.” (Cards 19-23, DE)

“Vitamin C, no sugar, wholegrain, source of omega-3. These are ingredients, things which a product contains.” (Card 19-24, DE)

There was some confusion regarding the sodium (card 20) and omega 3 (card 24) claim in relation to whether these were in fact positive nutrients or not and a few participants expressed scepticism about the fat and sugar claims (cards 21 & 22) although this was not a dominant theme in the German sample.

4.3.4.3 MSA Plot – The Netherlands (NL)

Similarly to the UK and German plots, overall the Dutch plot reflected two main partitions, however, this time the main partitioning related to the construct of ‘Information contained in the claim’ (Fig. 4.3). Following the pattern of the UK and German plots once again NL2 contained the more detailed health claims with higher levels of information content and NL1 the shorter, more simplistic nutrition claims,
but sorting was driven more by the presence/absence of a stated function/benefit or purpose as the dominant theme.

NL2 could be further subdivided into 3 groups and the construct driving the separation of the cards in NL2 related to the health condition/function or purpose of the claim. The cards in sub-group NL2.2 were easily recognisable by participants as relating to children’s growth and development and those in sub-group NL2.3 appear close together due to their common relationship with blood pressure and heart health. The remaining claims in NL2.1 contained all the other general function and disease risk reduction claims.

![Figure 4.3 MSA Plot – The Netherlands (NL)](image)

See Table 4.2 for details on the claim wording associated with the stimuli card numbers in the above plot.

It is perhaps interesting to reflect at this point on why further separation wasn’t observed between the claims in NL2.1. For example, one might also have expected a cluster relating to weight loss claims or perhaps a cluster relating to psychological or behavioural functions. It would appear that, either due to a lack of familiarity with the stated nutrient, a lack of understanding of the stated function and differences with respect to perceived credibility of the claims in this main grouping, these claims were not consistently sorted by the participants and therefore no clear clustering exists within this sub-group. This perhaps also explains why the claim related to ‘One of your 5 a day’ exists in this group.
“One of your 5 a day – this claim is really different – I don’t understand the relationship” (card 25, NL)

“Those five times a day [fruit and vegetables], I cannot quite place” (card 25, NL)

“One of your 5 a day – that is a general health advice” (card 25, NL)

4.3.4.4 MSA Plot – Slovenia (SL)

Utilising the qualitative data, the Slovenian plot (Fig. 4.4) could again be partitioned into two main groups with SL1 containing the shorter more simplistic nutrition claims and SL2 containing the more detailed health claims. Once again the construct of ‘Types of statements’ appears to dominate the overall positioning of the points on the plot. However, due to the wider variety of sort strategies utilised by the Slovenian participants when compared to the UK, Germany and The Netherlands (see Table 4.6), further partitioning of the claims within SL2 was not possible as no single construct appeared to dominate.

![Figure 4.4 MSA Plot - Slovenia (SL)](image)

See Table 4.2 for details on the claim wording associated with the stimuli card numbers in the above plot.

Although Slovenian participants utilised similar constructs to those in the countries previously discussed, some of them also utilised a sort strategy relating to
the food relevance of the claim, a strategy which was not employed by participants in the other countries in their first free sorts, however this construct did occur in some of the other countries in their subsequent sorts albeit at a relatively low frequency. Overall there appeared to be more of an individualistic approach to categorising the claims in Slovenia than in the UK, Germany or The Netherlands and an increased salience of attempting to relate the claims to a food or food group.

“Sodium? I would position it to the meat group. Each meat has at least a bit of sodium.” (Card 3, SL)

“This acid (DHA) can be probably found in fruits or vegetables” (Card 8, SL)

“Zinc – vegetables contain plenty of it, spinach I think, if I am not mistaken.” (Card 7, SL)

“Omega 3 are in fish.” (Card 24, SL)

Whilst there appears to be two distinct clusters of cards within SL1 on the Slovenian plot, no consistent explanation for this could be found in the qualitative data or sorting strategies and as such no further partitioning between these groups could be applied. It would appear that the distance between these groups may relate to a number of confounding factors including the perception by some that cards 21-23 (i.e. ‘Fat free’, ‘No added sugar’, ‘Contains wholegrain’) are better described as advertising slogans than scientific or corroborated claims and there was some level of scepticism associated with these.

In addition, some Slovenian participants had difficulty understanding the less familiar nutrients in cards 19, 20 and 24 (i.e. ‘Rich in vitamin c’, ‘Naturally low in sodium’, ‘Source of omega-3’) and this again may have contributed to the separation between these two clusters. Despite the lack of sub-partitioning within SL2, there were similarities with the other countries in the way in which some of the Slovenian participants described certain health claims, with those containing unfamiliar or scientific nutrients, substances or functions being less favourably received.

“DHA – I don’t know what this is; it must be more of a technical term.”
(Card 8, SL)

“I don’t know what this [pantothenic] acid means.” (Card 9, SL)
“Glucomanan? I don’t know it! I know glucosamine, for cartilage". (Card 15, SL).

“Docosaxesa…. I don’t know what kind of substance this is.” (Card 15, SL)

“If only I knew what homocysteine metabolism is, I have no idea, first time hearing.” (Card 2, SL)

“Dental caries – I don’t know why, but I don’t think adults have it.” (Card 12, SL)

The Slovenian qualitative data also echoed that seen in the UK sample regarding the sugar-free gum claim.

“Chewing gun is just chewing gum, it is not food.” (Card 12, SL).

“Chewing gum in my opinion is not important for health; this is (my opinion) probably based on the fact that I am not an admirer of chewing gum.” (Card 12, SL)

Similarly to in the Dutch plot, card 25 ‘One of your 5 a day’ appears on the Slovenian plot within the SL2 partition, that is with all of the health claims as opposed to with the nutrition claims. As per the German plot, this may in some part be due to the length of text on the claim when compared to the other nutrient claims. However, again the qualitative data suggests that it may again be due to the recognition by some participants that this claim implies health perhaps more so than the other nutrition claims included in SL1.

“Let put into this group (group named important for health) also 5-a-day regarding that we have “succumbed” to commercials.” (Card 25, SL)

“5 a day, reminds me of healthiness, not being fat, healthy lifestyle...” (Card 25, SL)

4.3.4.5 MSA Plot – Spain (ES)

Though participants across all the countries found free sorting these types of stimuli difficult, which resulted in a number of mixed sorts with no dominant construct, this was most prevalent within the Spanish sample. Here, 7 of the 20
participants’ first free sorts resulted in a mixed sort and of these 7 participants, 4 were unable to do any further sorts.

**Figure 4.5 MSA Plot - Spain (ES)**

See Table 4.2 for details on the claim wording associated with the stimuli card numbers in the above plot.

Similarly to the Slovenian plot, the Spanish plot demonstrated two main partitions (Fig. 4.5) and it is apparent from the close clustering of the cards in ES1 (cards 15-18), the Spanish participants frequently placed these together in their sorting. The qualitative data suggests that this is due to the fact that these claims were easily recognisable as being relevant for children.

For all remaining claims in ES2, no dominant constructs could be applied to partition the group any further, implying that similarly to Slovenia the Spanish participants had more of an individualistic approach to sorting the claim stimuli than seen in the UK, Germany or The Netherlands. This individualistic approach appeared to be driven by their own personal interest in health or the relevance of particular claims to them based on their experiences of having family members with particular food related health conditions.

Despite this, the qualitative data suggests that the Spanish participants were utilising similar constructs to those seen in the other countries (Table 4.6), namely those relating to the information contained in the claim, the types of statements in terms of their complexity/simplicity and also relevance to either themselves or other
specific population groups. In addition, the Spanish participants expressed similar difficulties with understanding or accepting claims which contained unfamiliar nutrients or functions:

“I do not know what homocysteine is.” (Card 2, ES)

“DHA, I do not understand the meaning.” (Card 8, ES)

“Pantothenic acid, I do not understand the meaning.” (Card 9, ES)

“Glucomannan, I do not understand.” (Card 11, ES)

“In the cards, there are strange words that I do not understand at all.”
(general comment, ES)

There was also the perception in the qualitative data that the shorter, more simplistic nutrition claims were easier to understand than the more detailed health claims. The Spanish participants also recognised that they differed in terms of the presence/absence of a stated function or benefit.

“Short information very general.” (Cards 19-24, ES)

“Some cards have short sentences easier to understand.” (Cards 19-24, ES)

“Cards 3, 12 and 16, provide information on benefits.” (ES)

“Information about the benefits for the human health.” (Cards 5, 6, 10 & 12, ES)

“Inform about the substances that the food contains but it does not mention the benefits of the substance for the human health.” (Cards 19,20,24,25, ES)

“This information does not say the benefits it provides.” (Card 25, ES)
4.3.5 Structured sorting into expert group headings

4.3.5.1 Placement of Article 14a and b claims

Across the whole sample (N=100), the majority of participants were able to assign the Article 14a disease risk reduction (cards 13 and 14) and Article 14b children’s development and health claims (cards 15-18) to their appropriate expert typology structured sort groups (Fig. 4.6). Due to the inclusion of the disease risk reduction element of the claim in the claim statement, or the fact that the children’s claims clearly stated that they related to children, on the whole it was clear to participants where these claims should be placed.

However, card 12, ‘Sugar-free chewing gum helps reduce tooth demineralisation. Tooth demineralisation is a risk factor in the development of dental caries’ was an exception within the Article 14a claims, with less than 40% of the total sample assigning this card to its appropriate expert typology group. Some participants were unable to accept sugar-free gum as a food, others did not recognise dental caries as a disease risk factor, despite this being stated in the claim, and therefore these participants experienced difficulty in placing the card. Other participants felt that sugar-free gum most closely related to children and therefore assigned this claim to expert typology Group 5.

“Caries is not directly a disease …this one with the sugar-free chewing gum is a kind of advice.” (Card 12, DE)

“Chewing gun is just chewing gum, it is not food.” (Card 12, SL).

“I will place sugar free chewing gum by the cards about children.” (Card 12, NL)

“Dental caries – I don't know why, but I don't think adults have it." (Card 12, SL)

“I do not know what to do with the sugarless gum.” (Card 12, NL)

“And here is a claim about sugar-free gum, but why do you need to have sugar free gum in the first place is my question." (Card 12, UK)
Figure 4.6 Average frequency (%) of placement in appropriate structured sort groups across all countries.
4.3.5.2 Placement of Article 13 claims

In terms of the Article 13 claims included in the study, the two Article 13c weight control claims (cards 10 and 11) were assigned to their appropriate structured sort group by the majority of participants (Fig. 4.6). Similarly to the claims relating to children, this appeared to be driven by the fact that participants could directly associate these claims with weight control either as a function or as being relevant for a target group (i.e. for people on a weight loss diet) and therefore assigned them appropriately to expert typology Group 3 (see Table 4.3 for Expert Typology group headings).

With the exception of card 1 ‘Calcium is needed for the maintenance of normal bones’, which the majority of participants managed to place appropriately in expert typology Group 1, the remaining Article 13 claims posed more of a challenge for participants with cards 8 and 9 only being assigned to their appropriate group by approximately half the sample and just over 40% of the sample for cards 2 and 7. The qualitative data suggested that some participants were unfamiliar with the meaning of the term ‘cognitive function’ in card 7 and this made it difficult for them to assign this card to its appropriate group. Claims relating to ‘brain function’ in card 8 and ‘tiredness and fatigue’ in card 9 appeared to be more easily recognisable as being related to ‘psychological and/or behavioural functions’.

“I don’t know what ‘cognitive’ means.” (Card 7, DE)

“Zinc contributes to normal cognitive function… cognitive means mind, doesn’t it?” (Card 7, SL).

“If it says: Zinc contributes to the normal cognitive function, then I wonder what they exactly mean with this. Then I ask myself if that is in fact really true?” (Card 7, NL)

“What are cognitive functions? I mean, zinc is important for the body, I know this. But I don’t know what to think about this term, this function.” (Card 7, DE)

A number of participants did not understand or recognise the function ‘homocysteine metabolism’ in card 2 and therefore tended to place this card in the ‘Don’t know’ group (Table 4.7) rather than the appropriate expert typology Group 1.
### Table 4.7 Frequency of cards placed in Structured Sort Group 7 “Don’t know” by country.

<table>
<thead>
<tr>
<th>Card</th>
<th>Claim wording</th>
<th>DE</th>
<th>NL</th>
<th>SL</th>
<th>ES</th>
<th>UK</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>‘Naturally low in sodium’</td>
<td>20</td>
<td>15</td>
<td>15</td>
<td>20</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>25</td>
<td>‘One of your 5 a day’</td>
<td>25</td>
<td>30</td>
<td>5</td>
<td>15</td>
<td>0</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>‘Vitamin B12 contributes to normal homocysteine metabolism’</td>
<td>25</td>
<td>15</td>
<td>5</td>
<td>20</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>24</td>
<td>‘Source of Omega-3’</td>
<td>25</td>
<td>20</td>
<td>5</td>
<td>15</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>7</td>
<td>‘Zinc contributes to normal cognitive function’</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>9</td>
<td>‘Pantothenic acid contributes to the reduction of tiredness and fatigue’</td>
<td>30</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>23</td>
<td>‘Contains wholegrain’</td>
<td>15</td>
<td>15</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>19</td>
<td>‘Rich in vitamin C’</td>
<td>10</td>
<td>15</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>‘DHA contributes to maintenance of normal brain function’</td>
<td>20</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>12</td>
<td>Sugar-free chewing gum helps reduce tooth demineralisation. Tooth demineralisation is a risk factor in the development of dental caries.</td>
<td>10</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>22</td>
<td>‘No added sugar’</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>‘Reducing consumption of sodium contributes to the maintenance of normal blood pressure’</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>10</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>‘Live cultures in yoghurt or fermented milk improve lactose digestion of the product in individuals who have difficulty digesting lactose’</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>21</td>
<td>‘Fat free’</td>
<td>10</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>‘Replacing saturated fats with unsaturated fats in the diet contributes to the maintenance of normal blood cholesterol levels [MUFA and PUFA are unsaturated fats]’</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>11</td>
<td>‘Glucomannan in the context of an energy restricted diet contributes to weight loss’</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>15</td>
<td>‘Docosahexaenoic acid (DHA) intake contributes to the normal visual development of infants up to 12 months of age’</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>13</td>
<td>‘Barley beta-glucans has been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease’</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>‘Plant sterols and plant stanol esters have been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease’</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
</tbody>
</table>

*Cards 1, 6, 10, 16, 17 & 18 were not placed in the “Don’t know” by any participant.*

Of the remaining Article 13a claims, ‘Reducing consumption of sodium contributes to the maintenance of normal blood pressure’ (card 3), and ‘Replacing saturated fats with unsaturated fats in the diet contributes to the maintenance of normal blood cholesterol levels’ (card 4), were almost as frequently placed in Group
4, the disease risk reduction group, as in the appropriate Group 1 general function claims group heading. This suggests that despite these claims only referring to maintenance of normal blood cholesterol they were being perceived as more relevant to the disease risk reduction group.

“Consumption of sodium… It helps to reduce a disease for people with high blood pressure.” (Card 3, DE)

“A lot of people are concerned about their blood pressure” (card 3, NL)

“If you use too much salt, it raises your blood pressure.” (Card 3, SL)

“The salt one, reducing salt, I know that’s supposed to be really good for you because it helps reduce your blood pressure.” (Card 3, UK)

“Improvement of the overall condition by unsaturated fats.” (Card 4, DE)

The claim regarding live cultures improving lactose digestion, card 5 was only placed in the appropriate expert typology Group 1, by 39% of the total sample. Some participants experienced difficulty placing this card as either they did not understand the claim or they did not recognise it as being relevant to them so put it in the ‘Don’t know’ Group 7. Others felt that lactose intolerance was some form of disease and therefore placed it in Group 4.

“I do not really understand what is said here” (card 5, NL)

“I don’t have lactose intolerance. I don’t know where it belongs” (card 5, DE)

“Live cultures improve digestion – well, I do not believe this, and we have never learnt about this in school. This must be yoghurt commercial.” (Card 5, SL)

“This is about a kind of disease” (card 5, NL)

“This is a strange claim. It is for people who are sick.” (Card 5, NL)

Conversely, other participants placed card 5 in Group 6 in recognition of the beneficial properties of milk/yoghurt for them, their belief that this claim isn’t related to disease and that those affected simply needed to eliminate it from their diet.
“In my opinion, lactose intolerance is not a huge disease...There are no risks, because either you are able to consume the product or not. I’m not sure about where to put it and I’m not that familiar with it.” (Card 5, DE)

“Lactose is only an issue if you really have to deal with that.” (Card 5, NL)

“Yoghurt is important for me.” (Card 5, DE)

“If I have problems with lactose I simply won’t eat food which contains lactose...I don’t understand this.” (Card 5, DE)

4.3.5.3 Placement of nutrition claims overall

In terms of the nutrition claims (cards 19–24), it can be seen from Figure 4.6 that these cards were placed in the appropriate expert typology group (Group 6) by a relatively low number of participants (average 42%) when compared to the frequency of the more detailed Article 14a disease risk reduction claims or Article 14b children’s claims. Nutrition claims were also generally less frequently placed in their appropriate expert typology groups when compared to some of the Article 13 general function claims, particularly those relating to psychological/behavioural functions (Art. 13b) and those relating to weight loss/satiety (Art. 13c). If the majority of participants could relatively easily place the Article 13 and Article 14 claims in their appropriate groups it raises the question why they were less able to do this for the nutrition claims?

4.3.5.4 Placement of nutrition claims by country.

By exploring in more detail which groups participants did place these nutrition claims in per country (Figs. 4.7 to 4.12), combined with the qualitative data they provided, it was possible to develop a deeper understanding of how this particular group of claims were perceived;

‘Rich in vitamin C’ (Card 19): When not assigned to the appropriate expert typology Group 6, card 19 ‘Rich in vitamin C’ was assigned by just over a third of participants in The Netherlands, Germany and Slovenia and a fifth of participants in the UK and Spain to expert typology Group 1 (Fig. 4.7), indicating that across all
countries a number of participants perceived this claim to be a general function claim. However, a small number of participants from each country assigned this claim to expert typology Group 5 (Children’s development and health), although this was more pronounced in Spain. This reflected the salience of the construct ‘Relevance’ seen in the previous free sorting task whereby these participants perceived the importance of vitamin C for children as the main driver for categorising the claim and placed it in the Article 14b typology group. A number of participants from the UK and Slovenia also placed this claim in Group 4, indicating that they perceived this claim to be more appropriately categorised as a disease risk reduction claim. A small number of Slovenian participants placed this card in Group 3 perceiving it to be most relevant for weight control in some way possibly due to vitamin C’s connection with fresh fruits and vegetables in the context of a healthy diet.

Figure 4.7 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 19 ‘Rich in vitamin C’.
Expert typology groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.
‘Naturally low in sodium’ (Card 20): With regards to card 20 ‘Naturally low in sodium’, was on average only placed in the appropriate expert typology Group 6 by just under 50% of the total sample; a quarter of participants in the UK and The Netherlands perceived this claim to be either a general function claim and placed it in Group 1 (Fig 4.8). Across all the countries a number of participants perceived this claim to be a disease risk reduction claim by placing it in Group 4. With this claim there was increased use of Group 7 ‘Don't know’ (Table 4.7).

Figure 4.8 Frequency of placement of nutrition claims under the various structured sort group headings per country– Card 20 ‘Naturally low in sodium’.

Expert typography groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.

Throughout the study, a number of participants expressed a certain amount of confusion and lack of familiarity with ‘sodium’ as a nutrient and this may have impacted on their ability to place this card in the structured sorting task. Reflecting on the free sorting task, this reinforces the importance of familiarity with the nutrient in a claim if consumers are going to be able to make sense of it. Whilst many people are familiar with the term ‘salt’, referring to ‘sodium’ appears to be confusing for some.

“Sodium is good for the heart” (DE)

“Sodium? What does it mean?”(SL)
“Naturally low in sodium. Means nothing to me, again it’s just a chemical I know nothing about.” (UK)

“I still don’t know where to place the sodium. Where is sodium found” (NL)

‘Fat free’ (Card 21): In terms of card 21 ‘Fat free’, when not placed in expert taxonomy Group 6, this card was assigned on average by 38% of participants in the Netherlands, Germany Slovenia and Spain to Group 3 (i.e. General function claims referring to slimming or weight control) (Fig. 4.9).

![Figure 4.9 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 21 ‘Fat free’](image)

**Figure 4.9 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 21 ‘Fat free’**.

Expert typology groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.

‘No added sugar’ (Card 22): In terms of card 22 ‘No added sugar’ this card was most frequently placed in Group 3 when not assigned to Group 6, again indicating that a number of participants across all the countries perceived this claim to be a general function claim associated with slimming or weight control (Fig. 4.10). A small number of participants perceived this claim to be a disease risk reduction claim or a claim of specific relevance to children.
Figure 4.10 Frequency of placement of nutrition claims under the various structured sort group headings per country—Card 22 ‘No added sugar’.

Expert typology groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.

‘Source of omega-3’ (Card 24): The structured sorting of card 24 ‘Source of omega-3’ demonstrated an even wider variety of opinions regarding the appropriate group heading for this claim (Fig. 4.11). Whilst the majority categorised this claim as being a nutrition claim assigning it to Group 6, a number of participants assigned this claim to Group 1. This was more pronounced in the Netherlands, Slovenia and the UK than in Germany or Spain. Some participants in the UK, Slovenia and one in the Netherlands categorised this claim as Group 2 using knowledge from previous experience of the link between Omega-3 and brain function to elaborate on the information given. A small number of participants assigned this card to Group 5 based on their perception of its importance for children’s development demonstrating again the impact of ‘Relevance’ as a construct for consumers when making sense of these types of claims.
Figure 4.11 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 24 ‘Source of omega-3’.
Expert typology groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.

‘Contains wholegrain’ and ‘One of your 5 a day’ (Cards 23 and 25): In terms of cards 23 ‘Contains wholegrain’ and card 25 ‘One of your 5 a day’ (Figs 4.12 & 4.13) participants appeared to be more likely to attribute the ‘One of your 5 a day’ claim as a general function claim (group 1) than they were for the ‘Contains wholegrain’ claim. In particular, in Spain, ‘Contains wholegrain’ was more likely to be placed in Group 3 (General function claims; Slimming, weight control and satiety) indicating that they perceived this claim to relate in some way to dieting. In contrast, ‘One of your 5 a day’ was more likely to be placed in group 5 (Children’s health and Development claims) than the ‘Contains wholegrain’ claim in Spain and Slovenia suggesting a perceived importance for children’s health and development with this particular claim.
Figure 4.12 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 23 ‘Contains wholegrain’.

Expert typology groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.

Figure 4.13 Frequency of placement of nutrition claims under the various structured sort group headings per country – Card 25 ‘One of your 5 a day’.

Expert typology groups: 1= Art. 13.1a General function, 2= Art.13.1b Psychological and or behavioural functions, 3= Art. 13.1c Slimming, weight control and satiety, 4= Art 14.1a Disease risk reduction, 5= Art. 14.1b Children’s health and development, 6= Nutrition claims, 7= Don’t know.
4.3.5.5 Reflecting on the expert typology group headings / structured sorting task.

Overall, participants indicated that they found the structured sort task easier than the free sorting task. This is perhaps not surprising since they were not required to generate their own sorting strategies or grouping and also because by this time participants had engaged with the claim stimuli in the free sorting task and were more familiar with them. However, a small number of participants indicated that they found it more difficult than free sorting due to the constraints of the pre-defined categories or the complexity of many of the structured sorting group heading descriptions.

On the whole it was the definition for Group 6, the nutrition claims group, that posed the greatest difficulty for participants to interpret. In addition participants found it difficult to distinguish between the general function claims referring to the role of a food or food constituent in the growth, development and functions of the body (i.e. Group 1) and the nutrition claims group (i.e. Group 6). This was clearly reflected in their lack of ability to place the nutrition claims appropriately in Group 6 and the tendency for some participants to place the nutrition claims in Group 1 (see previous section 4.3.5.4).

“Group 6 is difficult to understand; sorting was ok, but the expert terms were too difficult.” (DE)

“The description for group 6 was difficult to interpret.” (UK)

“The description of group 6 was very complex/difficult to understand. This task was quite easy because it were the same (stimuli) cards as before so I already knew them.” (NL)

“Placing into group 6 was hard since if you take a little different look it would be possible to place almost all cards from group 6 into group 1. With group 4 I had problem because I had to decide whether it suggests an illness or not.” (SL)

“The task is very difficult because it takes time to understand the differences between the groups. Group 1 and group 6 are very similar. I could not understand some words. It was very difficult to classify.” (ES)

“I was more indecisive regarding groups 1 and 6, could be that I was a little confused by description given by number 6 which is rather large,
so that I was getting disorderly. Description of group 3 was also extensive, but was easily understandable.” (SL)

“Group 6 is too complex - even in retrospect I'm not sure I understand it properly.” (UK)

Participants typically found it easier to understand the structured sort heading groups relating to disease risk reduction claims (Group 4), children’s development and health (Group 5) and general function claims related to slimming and weight control (Group 3) and this again was reflected in participant’s ability to place the appropriate claims in these groups (Fig 4.6).

“Groups 6 and 1 are confusing; groups 2, 3, 4 and 5 are easier.” (UK)

“For instance cards with development of disease were rather easy, as well as cards about weight control and children.” (SL)

“The categories to do with children and losing weight were the easiest, category 6 was difficult to understand and vague enough that you could almost put anything in there you couldn't think where else to put.” (UK)

“This task seems to me as the logical continuation of what we have been doing before. For me the most difficult was group 6; I had to read it a couple of times to grasp the meaning. The easiest was the group with children. Some groups are similar, so a single card could be placed in one or another group.” (SL)

Some participants expressed difficulty with Group 2, claims describing or referring to psychological and/or behavioural functions. In addition, participants indicated that many of the claim stimuli could in their opinion be placed in more than one group.

“However these groups can “jump” from one to another; for instance development of body and development of child. This is connected: if you do something right when you are young it will result in your older age – if your diet was the right one. And of course it is true also opposite. I did not have any hard problems to sort; sentences are
written in such way that it is possible to find the right answer. Only into
groups 6 I didn’t place any cards, but probably I could – I already
mention that cards are “jumping.”” (SL)

“Some cards could have been classified in more than one group. (ES)

“The definition of some of the groups are really similar.” (ES)

“Some cards could be placed in 2 groups, which made it difficult. For
example the card about walnuts could belong to more than one group.
The group with children was easy to me.” (NL)

4.3.6 Factors impacting consumer acceptance of health and nutrition claims.

The results from this study suggest that consumers’ ability to process health
and nutrition claims is impacted by a number of factors, but primarily whether the
nutrient or substance is recognisable to them as being relevant or important to food
or health in some way. When a claim refers to an unfamiliar nutrient they appear to
find the claim less acceptable, understandable or credible.

“Doco-something, I’ve never heard of it” “I don’t understand this so if
they would advertise with it I wouldn’t be convinced “(NL)

“They’re statements that are true but I worry about what they mean by
barley beta-glucans and plant steroids and plant sterols. I have no idea
what they are, they could be plant fibres, plant sterols, plant steroids,
I’m struggling to think what they might be.” (UK)

“There are health claims which I cannot understand. I am not a
biologist, who would know all these nutrients/substances.” (SL)

“I’ve no idea what vitamin B12 does, and if it was important enough I’d
probably have heard something about it.” (UK)

“Plant sterols and plant stanol esters also belong to the second
category. You may have noticed that I am not a chemist and do not
know all these terms.” (DE)

“I don’t know anything about that, so I kind of think unless I did I
wouldn’t really be very interested in it.” (UK)
Also of importance in terms of consumer understanding and acceptance of health and nutrition claims, is whether the claim is recognisable as being relevant for them as an individual, or for other specific population groups, and this construct was clearly reflected in the free sort strategies utilised by many of the participants across all the countries.

“Does not concern me.” (DE)

“This is not healthy for me, but for other people it is healthy.” (NL)

“Cholesterol level is for older people.” (DE)

“Card 1, I do not know where to classify but it is also important for kids.” (ES)

“This would be for adults at work and sports.” (SL)

“I know that, because I also suffer from a high blood pressure.” (DE)

“Decrease of tiredness, that is appealing because I’m tired.” (NL)

“I’m not interested in cholesterol because I feel there is no danger for me yet.” (SL)

It was also recognised by many participants in both their free sorting strategies and the qualitative data they provided, that some of the claims presented to them lacked a stated benefit, function or effect whilst other claims did include this information and in some cases linked the nutrient with a disease.

“The ingredient is mentioned here but also there is an effect of each ingredient mentioned.” (various cards, DE)

“No added sugar or fat free, or rich in vitamin C, or source of Omega-3, contains wholegrain or naturally low in sodium, one of your 5 a day…. It is assumed, that the consumer knows their effects.” (DE)

“This information does not say the benefits it provides.” (Card 25, ES)

“The card about walnuts refers to how the product improves something.” (Card 6, NL)

“.... provide information on benefits.” (various cards, ES)
“Of course, you could say something like: little sugar is good for diabetics. But that fact has not been mentioned in this claim.” (Card 22, DE)

“One can recognize diseases here.” (card 12, DE)

However, it would appear to be less important for consumers if the stated function or benefit is omitted from a claim when the nutrient or substance in the claim is familiar to them, as they demonstrated that they are able to activate knowledge from previous experience to elaborate on the information given and decide based on this whether they perceive the claim to be beneficial to health, relevant for them or even credible. This process known as ‘spreading activation’ suggests that claim statements have the ability to promote inferences that go beyond what is actually stated (Collins & Loftus, 1975; Anderson, 1983) although these inferences are not necessarily always correct.

“I don’t really understand these but can relate them to existing knowledge enough to take seriously, though I don’t think they’re relevant to me personally.” (SL)

“I recently started to use vitamin B12 because someone pointed out to me that it works really well against Parkinson disease.” (NL)

“The salt one, reducing salt, I know that’s supposed to be really good for you because it helps reduce your blood pressure.” (UK)

“Contains wholegrain – if you eat that regularly, the risk of getting diseases is decreased.” (DE)

“Walnuts are good for the nerves.” (NL)

“Wholegrain, it is good for weight loss.” (ES)

“Omega 3 is for brain, I mean not really for a brain, it is to some extent connected with problems in the stomach and problems with thought. I don’t know how to say... also fatigue. it is all connected.” (SL).

“Sodium is good for the heart.” (DE)

“I’ve heard this somewhere that too much calcium in the body may not affect your bone structure, but it might affect your stomach and that, you know, having too much calcium.” (UK).
One might suggest therefore, that inclusion of a stated function or benefit in the claim when an unfamiliar nutrient is present may help consumers to process claims, or perhaps even minimise any potential incorrect inferences being made by consumers when a nutrient is familiar. However, our results demonstrate that by increasing the perceived level of complexity of the claim, by lengthening the text or including more scientific language, there is the potential to make the claim less acceptable overall for many of the participants.

“The short and clear claims I find most appealing. I have to think really hard about the other claims” (NL)

“Scientific gobbledygook! This is something that’s beyond understanding in terms of bamboozling us with science. I worry about words I don’t understand that I haven’t come across.” (UK)

“I believe that on these cards (cards 4 & 14) they could reduce the amount of information written”. (SL)

In addition, a number of participants across all the countries indicated that they would be unlikely to engage with the more detailed, complex claims when shopping.

“Such long texts are obstructive. After all I want to go shopping and not reading novels.” (DE)

“If there is a lot of writing someone who is the customer in the shop will not read it, because he does not have patience to read.” (SL)

Conversely, a number of participants expressed the desire for more information, or perhaps better clarity, with respect to the nutrition claims, particularly those related to fat and sugar.

“If you find on card sentence “without fat” it does not tell you a lot; it could be good or bad for your health.” (SL)
"We know that vitamin C is healthy, but the claim does not say it is healthy. But vitamin C is healthy. This claim does not say that it is good or bad." (NL)

"Fat free or no added sugar is not necessarily health-improving." (DE)

"Source Omega 3 (card 24), what does it mean? If you eat everything you will have enough omega 3." (ES)

"It's more complicated, just "fat free" is a bland statement." (UK)

Despite the shorter less complex nutrient claims being generally described more favourably in terms of complexity, due to the lack of a stated function or benefit these claims were described by some as more likely to be promotional recommendations which invoked acceptance and credibility issues, particularly in the UK and this was also echoed in some of the other countries.

"I'd like to believe that was true, I know we're conned about those things." (UK)

"This is just a promotion to make us buy [the product]" (SL)

"It is interesting to me that when I eat an orange it is rich in vitamin C. But if that is stated on a package I'm not sure if that's really true. These things have to be stated on products in order to make them sell, it seems." (NL)

"If I want to eat fruits, I do it my way. I don’t care what this claim says, because that is too constraining. You could tell me as much as you want e.g. that you could reach a low cholesterol level by using the product. I don’t care. Though, I believe immediately what card 25 suggests. That is more some kind of an advertising slogan." (DE)

4.4 Discussion

4.4.1 Consumer derived typology for nutrition and health claims.

Our results suggest that depending on the associative networks that consumers have previously formed regarding familiar nutrients and their relationship with health, consumers may not consciously differentiate between a nutrition claim
and a health claim in the way that regulatory experts do. This is in line with previous research (Williams, 2005; Leathwood et al., 2007; Verbeke, Scholderer & Lähteenmäki, 2009; Verhagen et al., 2010; Grunert, Scholderer & Rogeaux, 2011) however, the value of our research is that the MSP methodology utilised provides rich qualitative data across a wide range of claims allowing for the explanation as to why this might occur and where there is the greatest potential for consumer misunderstanding.

Our free sorting results suggest that when categorising claims, consumers do not appear to differentiate between Article 13a General function claims relating to growth development and functions of the body, and Article 14 Disease risk reduction claims in the way that regulatory experts do although, in the structured sorting they were more likely to place the disease risk reduction claims under the appropriate expert typology group than they were for the Article 13a General Function claims. From a consumer perspective, a typology for health claims that does not also encompass nutrition claims would appear to make little sense since it is this category of claims which posed the greatest difficulty for consumers and would appear to have the greatest potential to invoke spreading activation (Collins & Loftus, 1975; Anderson, 1983).

Driven by how participants across the five countries categorised and made sense of the various nutrition and health claims that were presented to them in this study, a typology based on 3 key dimensions is proposed: [1] Familiarity with the nutrient, substance or food stated in the claim, [2] Statement type in terms of its simplicity/complexity, [3] Relevance of the claim, either personally or for a stated population group.

**Familiarity with the nutrient, substance or food stated in the claim:** It has been suggested that consumer perceptions of health claims are often driven by prior beliefs about a food product or nutrient rather than by the information provided within a claim (Sims, 1999). Whether a claim contains a stated benefit or function appears to be of less importance to the consumer if they are familiar with the nutrient or functional ingredient since they appear to be able to draw on an associative network of stored knowledge and associations (Solomon, 1996) which they then use to make sense of the claim. It would appear from the way in which some of the claims were assigned by participants in the structured sorting task this spreading activation (Collins & Loftus, 1975; Anderson, 1983) can also lead to associations being made between a claim and a general function or the reduction of
disease risk even when these were not stated in the claim. Therefore consumer understanding or misunderstanding of nutrition and health claims, whilst impacted by a number of factors, appears to be impacted primarily by their familiarity with the nutrient or substance within the claim.

“There is additional information is nonsense … because everybody knows that calcium is good for bones.”

Statement type in terms of its simplicity/complexity: In line with previous research (Williams, 2005; Siró et al., 2008) our results also demonstrate that consumers perceive short and simple claims more favourably, are unlikely to engage with detailed information on the product packaging whilst shopping and, are unlikely to perceive information associated with an unfamiliar nutrient positively, regardless of how detailed it is. In addition, expression of the more detailed general function claims or disease risk reduction claims utilising ‘scientific’ or ‘regulatory’ language is a problem for many consumers. Therefore their pre-formed associative networks are unlikely to be formed or corrected by increasing the level or scientific basis of the information placed on the food packaging in the form of a complex claim statement.

Relevance of the claim, either personally or for a stated population group: In terms of consumers’ ability to assign claims to the expert typology from the NHCR within our study, it would appear that this is facilitated when the claim is deemed to be personally relevant by the consumer. Previous research has suggested that motivation to process a claim into meaningful understanding is an important factor (Grunert et al., 2011) as is how easily consumers can link the information in the claim to that which they have previously stored in their memory (Nocella & Kennedy, 2012). In addition Dean et al., (2011) demonstrated that relevance has a strong influence on perceptions of personal benefit and willingness to buy products with health claims, therefore, relevance would appear to be key factor in influencing consumer understanding and also whether a claim is perceived favourably or not.
4.4.2 Policy implications

By considering the various nutrition and health claims according to the proposed 3 key consumer derived dimensions, regulatory bodies concerned with appropriate consumer understanding of health claims, and stakeholders concerned with promoting consumer acceptance of health claims, can perhaps gain a deeper insight into this domain from a consumer perspective.

In terms of promoting consumer acceptance of health and nutrition claims, any claim classified as 1a/2a/3a by the proposed typology (Table 4.8) is likely to be the most favourably received by consumers in that it refers to a familiar nutrient, substance or food for which the consumer has previous knowledge to draw upon, is simple i.e. states the claim in a nutrient content format only and, it resonates with the consumer because they perceive it to be personally relevant. In contrast, claims classified as 1b/2b/3c by this typology are likely to be the least favourably received by consumers in that they contain an unfamiliar nutrient, are complex and not easily attributable in terms of relevance to oneself or a specific population group. This readily explains why the claim on card 8, ‘DHA contributes to normal brain function’ was so poorly perceived by our study participants.

Table 4.8 Typology dimensions for nutrition and health claims

<table>
<thead>
<tr>
<th>Dimension</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Familiarity with nutrient, substance or food</td>
<td>Familiar</td>
<td>Unfamiliar</td>
</tr>
<tr>
<td>2</td>
<td>Statement type</td>
<td>Simple – refers to nutrient, substance or food only (i.e. nutrient content)</td>
<td>Complex – refers to both nutrient, substance or food and benefit</td>
</tr>
<tr>
<td>3</td>
<td>Relevance</td>
<td>Personally relevant</td>
<td>Population group relevance stated</td>
</tr>
</tbody>
</table>

Whilst claims classified by this typology as 1a/2a/3a are the most likely to be positively perceived by consumers it should be recognised that from a regulatory perspective, they also have the greatest potential to promote the process of spreading activation and possibly even the generation of incorrect inferences in consumers. The degree to which this may occur is obviously dependent on the
associative networks that a consumer has previously established in relation to a particular nutrient.

4.5 Conclusions

Since two of the three main constructs identified in this research i.e. familiarity and relevance, are constructs impacted by individual differences, different consumers are likely to receive the same claims differently based on their established networks and beliefs. The results of this study suggest that there is a need for regulators to consider providing resource(s) to support consumers to establish/re-establish appropriate networks and beliefs associated with the more familiar nutrients/substances thus helping them to understand and derive the appropriate meaning from the types and wording of health claims that are now appearing on pack.

Similarly, for new functional ingredients or less familiar nutrients, where associative networks have not been previously formed, there is an opportunity to educate the consumer appropriately thus making claims for these functional ingredients potentially more acceptable to consumers (Siro et al., 2008). Interestingly, within our study a small number of participants, when faced with an unfamiliar nutrient or benefit, spontaneously expressed the desire to search for information in order to educate themselves citing ‘Google’ as their route to accessing this information.

"Now the Vitamin B12 topic appears again, I don't know anything about the metabolism of homocysteine, but I will Google it at home."

"Haven't the faintest idea what that means, other than that it's going to help my cholesterol, but what MUFA and PUFA is, I haven't the foggiest idea. It seems to be a completely complicated statement, but should I go onto Google and find out for real?"
CHAPTER 5

STUDY 4: Guiding healthier food choice: Systematic comparison of four front-of-pack labelling systems and their effect on judgements of product healthiness.

5.1 Introduction and aims

Despite the extensive qualitative and quantitative research on FOP labels which has typically compared the performance of the different schemes in relation to each other and measured various dimensions of liking, understanding and use, to my knowledge none of these studies have systematically explored the effect of the interpretive elements of the prevalent FOP labelling schemes on consumer perceptions of healthiness over and above that of a basic FOP label containing energy and nutritional information alone.

This study seeks to establish the extent to which the various FOP labelling elements impact on consumer understanding of the relative healthiness of foods presented to them. The inclusion of a hypothetical basic FOP label into a repeated measures design across a range of food categories and portion sizes would facilitate exploration of the extent to which consumer perceptions of healthiness are directly impacted by the interpretative elements of the FOP labelling schemes. Furthermore, comparing the subjective healthiness ratings derived from consumers to an objective healthiness score within the study design, would facilitate identification of the optimal FOP system, that is, the schemes that results in perceived healthiness ratings closest to an objective healthiness rating than for the FOP basic label.

5.2 Materials and Methods

Perceptions of relative, as well as within-category, healthfulness of foods were collected using an experimental design including both between and within subjects factors. Perceived healthiness ratings for the different food stimuli presented were collected from participants via Computer Assisted Personal Interviews (CAPI). Recruitment of participants and the administration of the interviews was performed by the market research agency GfK. Data on food shopping habits in the categories of interest, gender, education and socio-economic status were also collected.
5.2.1 Participants

The sample consisted of 2068 participants from four European countries: 525 in Germany (DE), 500 in Poland (PL) and 530 in Turkey (TK) and 513 in the United Kingdom (UK). The UK has been shown to have a high prevalence of FOP labelling at around 63%, whereas Turkey has a low prevalence (2%), with Germany and Poland falling somewhere in between (genannt Bonsmann et al., 2010).

All participants had some responsibility for their household grocery shopping and were regular purchasers of at least two of the test food categories: pizza, yoghurts and biscuits. Quotas were applied for gender and education and exclusions for colour-vision deficiencies although post-hoc tests revealed some differences between the country samples in term of gender, education levels, age and socio-economic status (Table 5.1).

The study was conducted in accordance with the University of Surrey’s ethical procedures.

5.2.2 Design

The design has both within and between subjects factors. Each participant provided healthiness ratings across 9 foods (3 pizzas, 3 yoghurts, 3 biscuits), firstly in a baseline label (BL) format and then in one of the test FOP system formats. Participants were randomly assigned to one of 8 groups meaning they rated all three food categories and all 3 variants within each food category, but only one test FOP system and one portion size throughout. This resulted in each participant providing 18 subjective healthiness ratings in total.

The within-subjects factors are: Food (pizzas, yoghurts, biscuits), Healthiness of the food (high health, medium health, low health) and the repeated measurements firstly with the BL label format and then with one of the test FOP system formats. The between subjects factors were: FOP System (GDA, TL, HB, HL), Portion Size (typical portion size, 50% reduction on typical portion) and Country (UK, Germany, Poland, Turkey).
Table 5.1 Socio-demographic characteristics of participants by country

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>UK (n = 513)</th>
<th>Germany (n = 525)</th>
<th>Poland (n = 500)</th>
<th>Turkey (n = 530)</th>
<th>Total (N = 2068)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td><strong>Gender</strong> a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>70.8</td>
<td>72.4</td>
<td>90.0</td>
<td>60.4</td>
<td>73.2</td>
</tr>
<tr>
<td>Male</td>
<td>29.2</td>
<td>27.6</td>
<td>10.0</td>
<td>39.6</td>
<td>26.8</td>
</tr>
<tr>
<td><strong>Education Level</strong> b</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>38.4</td>
<td>53.1</td>
<td>46.8</td>
<td>35.7</td>
<td>43.5</td>
</tr>
<tr>
<td>Middle</td>
<td>35.1</td>
<td>28.6</td>
<td>37.6</td>
<td>48.5</td>
<td>37.5</td>
</tr>
<tr>
<td>High</td>
<td>26.1</td>
<td>17.7</td>
<td>15.6</td>
<td>15.8</td>
<td>18.8</td>
</tr>
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<td>.6</td>
<td>0</td>
<td>0</td>
<td>.2</td>
</tr>
<tr>
<td><strong>Age</strong> c</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 – 24 years</td>
<td>9.0</td>
<td>5.7</td>
<td>5.6</td>
<td>21.1</td>
<td>10.4</td>
</tr>
<tr>
<td>25 – 34 years</td>
<td>19.1</td>
<td>11.6</td>
<td>12.6</td>
<td>29.4</td>
<td>18.3</td>
</tr>
<tr>
<td>35 – 44 years</td>
<td>20.3</td>
<td>18.1</td>
<td>21.4</td>
<td>20.2</td>
<td>20.0</td>
</tr>
<tr>
<td>45 – 54 years</td>
<td>18.1</td>
<td>21.0</td>
<td>20.0</td>
<td>15.5</td>
<td>18.6</td>
</tr>
<tr>
<td>55 – 65 years</td>
<td>17.5</td>
<td>28.4</td>
<td>32.4</td>
<td>12.1</td>
<td>22.5</td>
</tr>
<tr>
<td>65+ years</td>
<td>15.8</td>
<td>14.7</td>
<td>8.0</td>
<td>1.7</td>
<td>10.0</td>
</tr>
<tr>
<td>Undisclosed</td>
<td>.2</td>
<td>.6</td>
<td>0</td>
<td>0</td>
<td>.2</td>
</tr>
<tr>
<td><strong>Socio-economic status</strong> d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>44.8</td>
<td>41.0</td>
<td>25.8</td>
<td>26.8</td>
<td>34.6</td>
</tr>
<tr>
<td>Group 2</td>
<td>10.5</td>
<td>7.0</td>
<td>9.0</td>
<td>22.1</td>
<td>12.2</td>
</tr>
<tr>
<td>Group 3</td>
<td>10.3</td>
<td>16.8</td>
<td>11.6</td>
<td>14.0</td>
<td>13.2</td>
</tr>
<tr>
<td>Group 4</td>
<td>17.9</td>
<td>14.9</td>
<td>35.4</td>
<td>26.4</td>
<td>23.5</td>
</tr>
<tr>
<td>Undisclosed</td>
<td>16.4</td>
<td>20.4</td>
<td>18.2</td>
<td>10.8</td>
<td>16.4</td>
</tr>
</tbody>
</table>

\(a \chi^2 = 117.99, \text{df} = 3, p < .001, \phi = .24.\)

\(b\) Low: secondary school (to age 15/16 yrs) or below; Middle: secondary school/college (to age 17/18 yrs); High: university, graduate and post graduate. \(\chi^2 = 77.53, \text{df} = 9, p < .001, \phi = .19.\)

\(c\) \(\chi^2 = 273.70, \text{df} = 15, p < .001, \phi = .36.\)

\(d\) Group 1: managerial and professional occupations and intermediate occupations; group 2: small employers and own account workers; group 3: supervisory and technical operations; group 4: semi-routine and routine operations. \(\chi^2 = 182.35, \text{df} = 12, p < .001, \phi = .30.\)

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5.2.3 Development of the study stimuli

Since the purpose of the study was to test the added value of the most prevalent FOP schemes over and above the provision of numerical nutritional information alone as an FOP label, a basic label (BL) was developed. It contained numerical information on energy in calories and the nutrient content in grams (per portion) for four key nutrients; sugar, fat, saturated fat and salt. To create the labels representing the four test FOP systems, percentage Guideline Daily Amounts
(GDA), Traffic Lights (TL), Health Logos (HL), or a hybrid of percentage Guideline Daily amounts + Traffic Lights (HB) were overlaid onto the basic label (see Fig. 5.1 for examples).

Figure 5.1 Examples of the basic label and four test FOP label systems: a) Basic Label (BL), b) Traffic Light label (TL), c) Guideline Daily Amounts Label (GDA), d) Guideline Daily Amounts + Traffic Lights Label (HB), e) Health Logo Label (HL)
5.2.3.1 Rationale for the selection of food categories

The experiment included nine foods, representing three food categories and three levels of healthiness within each food category: high health (i.e. healthiest), medium health and low health (i.e. least healthy). When selecting the food categories to include, it was necessary to consider the different food cultures in the participating countries and identify categories that were familiar in all four. Three food categories: pizza, yoghurts and biscuits were therefore chosen as they satisfied this primary criterion. They also represented a wide range of portion sizes; biscuits are typically a snack food which tends to be presented in small portions or units, whereas for a meal centre type product, such as pizza, portions are larger, with yoghurts falling somewhere in between. In addition, it was considered that consumers’ healthiness ratings may be impacted by their perceptions about positive aspects or healthiness perceptions of a given food category (e.g. calcium in dairy products) and the inclusion of three different food categories within the design allowed us to assess the impact of the four test FOP systems across the different food types one of which is more typically perceived as being healthy, that is yoghurts, as opposed to biscuits or pizza which are seen to be more indulgent foods.

5.2.3.2 Rationale for selection of portion sizes

Following a review of the typical portion sizes on the market for each of the three chosen food categories, a typical portion was set: pizza 200g, yoghurts 150g and biscuits 18g. The second portion condition tested was then set as a 50% reduction on this typical portion condition to see if health inferences were impacted by a reduction in portion size under any of the label conditions.

5.2.3.3 Mapping the objective healthiness of the foods

To facilitate the final food stimuli selection within each food category, it was necessary to map the relative healthiness of the foods both within and across the food categories. This was achieved by application of the SSAg/1 nutrient profiling algorithm, one of the approaches considered in the work to support the UK Food Standards Agency initiatives to address which foods should be advertised to children (Rayner & Stockley, 2004), although it was not ultimately used for that
purpose. However, this algorithm has been used in previous published research where an objective healthiness score was required to map directly onto the energy and risk nutrients communicated in the nutrition labels being tested (Jones & Richardson, 2007). SSaG/1 scores start at zero for the healthiest foods, and increase in units of 1 per 10% increase in GDA of the energy, saturated fat, sugar (non-milk extrinsic) and salt contained in 100g of a food and are therefore easily calculated from the nutritional information typically provided on pack.

Our use of the SSaG/1 algorithm should not be taken to suggest that it is the best possible model for nutrient profiling as a whole, the relative merits of the various models are explored elsewhere (e.g. Scarborough et al., 2013). Nonetheless, it was considered to be the most appropriate objective scoring model for this study. This is because it results in an absolute score for each food based only on energy and the main risk nutrients alone, without taking into consideration any positive aspects of the food, such as levels of micronutrients or fibre. Since the participants in this study were only provided with FOP labels and not the entire food pack on which to base their healthiness ratings, it was important to use an objective healthiness score that reflected the information provided to them. Though it could be argued that health logo systems do take positive nutrients into consideration in their algorithms, these are not communicated to the consumer in the FOP label and therefore in reality the impact on health perceptions is based on whether the consumer trusts the expert decision communicated by the logo.

The calculated SSaG/1 scores for each of the foods are detailed in Table 5.2. The final three food variants representing different levels of healthiness within each food category were selected by reviewing the nutritional values of real foods on the market and selecting those that represented a realistic upper, lower and mid-range within each category.
Table 5.2 Nutritional profile of label stimuli

<table>
<thead>
<tr>
<th>Food category</th>
<th>Healthiness of the food variant</th>
<th>Objective Health Score (SSAg1)</th>
<th>Portion size (g)</th>
<th>Calories (Kcal)</th>
<th>Sugar</th>
<th>Fat</th>
<th>Sat Fat</th>
<th>Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza</td>
<td>High*</td>
<td>2</td>
<td>200</td>
<td>430</td>
<td>9.4</td>
<td>8.8</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>215</td>
<td>4.7</td>
<td>4.4</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Med*</td>
<td>4</td>
<td>200</td>
<td>516</td>
<td>15.4</td>
<td>15.0</td>
<td>6.4</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>258</td>
<td>7.7</td>
<td>7.5</td>
<td>3.2</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>6</td>
<td>200</td>
<td>604</td>
<td>4.8</td>
<td>32.6</td>
<td>18.6</td>
<td>2.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td>302</td>
<td>2.4</td>
<td>16.3</td>
<td>9.3</td>
<td>1.30</td>
</tr>
<tr>
<td>Biscuits</td>
<td>High*</td>
<td>5</td>
<td>18</td>
<td>77</td>
<td>3.7</td>
<td>1.6</td>
<td>0.6</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>38</td>
<td>1.7</td>
<td>0.8</td>
<td>0.3</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>Med</td>
<td>9</td>
<td>18</td>
<td>81</td>
<td>3.8</td>
<td>2.8</td>
<td>1.2</td>
<td>0.30</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>41</td>
<td>1.9</td>
<td>1.4</td>
<td>0.6</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>12</td>
<td>18</td>
<td>96</td>
<td>4.5</td>
<td>6.1</td>
<td>3.6</td>
<td>0.05</td>
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<tr>
<td></td>
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<td></td>
<td>9</td>
<td>48</td>
<td>2.3</td>
<td>3.1</td>
<td>1.8</td>
<td>0.03</td>
</tr>
<tr>
<td>Yoghurts</td>
<td>High*</td>
<td>0</td>
<td>150</td>
<td>105</td>
<td>11.7</td>
<td>2.3</td>
<td>1.4</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>75</td>
<td>53</td>
<td>5.9</td>
<td>1.1</td>
<td>0.7</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>Med</td>
<td>2</td>
<td>150</td>
<td>201</td>
<td>18.3</td>
<td>12.0</td>
<td>7.8</td>
<td>0.20</td>
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<tr>
<td></td>
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<td></td>
<td>75</td>
<td>101</td>
<td>9.2</td>
<td>6.0</td>
<td>3.9</td>
<td>0.10</td>
</tr>
<tr>
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<td>Low</td>
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<td>150</td>
<td>239</td>
<td>16.1</td>
<td>17.0</td>
<td>12.0</td>
<td>0.20</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>75</td>
<td>119</td>
<td>8.0</td>
<td>8.5</td>
<td>6.0</td>
<td>0.10</td>
</tr>
</tbody>
</table>

* Foods eligible to display a health logo on the test FOP labels.

Once the nine foods had been selected, the TLs were applied to the nutritional values per portion based on the thresholds in the ‘Front of Pack Traffic Light Technical Guidance’ document from the Food Standards Agency (FSA, 2007). The percentage GDA values were simply calculated per portion condition from published GDA criteria (IGD, 1998). Application of the health logo (HL) was based on criteria defined by the Choices International Foundation (Choices International Foundation, 2008) which specifies threshold values that a food must meet to display the logo. The specific criteria and threshold values vary between different product groups; for example in the case of pizza, defined as a main course by the Choices International approach, the energy per serving, content of saturated fatty acids, trans fatty acids, sodium and added sugar must be lower than the threshold values set. In addition the fibre content should be higher than the threshold value set for main courses. However for biscuits, though threshold values are set for energy and the same risk nutrients, they are at different levels than for the main course product.
group and there are no thresholds set for fibre. Similarly for yoghurts, although the criteria for this product group does not include thresholds for energy either.

Only 4 out of the nine foods were eligible to display a health logo to supplement the numerical nutrition information on the test FOP labels, these included the highest health variants of the yoghurt and biscuit categories and both the highest and medium health variants of the pizza category.

5.2.4 Data collection

The labelling stimuli were presented to the participants and responses recorded. Initially, participants were required to provide subjective healthiness ratings for each of three product variants in a single food category shown in a BL format. They were then exposed to the same three foods in the appropriate test FOP system format assigned to their group and they rated the healthiness of the foods again. This sequence was repeated for the remaining two food categories (see Fig. 5.2). Participants were always exposed to groups of three stimulus labels of the same product category at any one time. However, the order in which the three food variants appeared on the screens was randomised. In addition, the sequence of the food categories shown was randomised across the sample. Each participant rated foods from all three food categories, but only in one portion condition and one test FOP label condition resulting in a total of 18 subjective healthiness ratings per participant.
Figure 5.2. Flowchart of stimuli sequence within a subject. * FOP system and portion were manipulated between participants and so any given participant saw only one portion size throughout and one type of FOP system. All participants saw the same basic (BL) labels. ** Order in which the foods were shown and the order in which the 3 labels appeared on each screen were fully randomised however participants were always shown the appropriate basic label set before being shown the corresponding set of FOP labels.
5.2.5 Measures

Perceived healthiness ratings were collected on a 15-point scale; these types of healthiness ratings have been successfully employed in other labelling studies (Jones & Richardson, 2007; Byrd-Bredbenner, Alfieri & Kiefer, 2000). Participants were asked to rate the foods on a scale of 1 being least healthy and 15 being most healthy in the study. In contrast, the SSAg/1 objective health score scale starts at zero for the healthiest foods and foods with higher scores are considered less healthy via this algorithm. For ease of comparison of the dependent variable (DV1) to the objective health score in the analysis, participant’s healthiness ratings were reversed and rescaled by 1 unit to anchor at zero (DV1). Thus when interpreting the results of this study, lower numbers represent healthier foods and higher numbers represent less healthy foods for both the dependent variable DV1 and the SSAg/1 score.

An additional dependent variable (DV2) was generated by calculating the difference between DV1 and the objective health score for each of the foods. This variable represents the distance or ‘error’ of the participants’ subjective healthiness ratings compared to the objective score for that particular food. Positive error scores would indicate that participants were underestimating the healthiness of a food (i.e. perceiving the food to be less healthy than it was objectively) and negative error scores would indicate that participants were overestimating the healthiness of the food (i.e. perceiving the food to be more healthy than it was objectively). Error scores of zero would indicate that participants were rating the foods as per the objective health score.

5.2.6 Statistical analysis

Initially a mixed measures ANOVA was performed in SPSS version 19.0 (IBM, 2010) using the participants’ subjective healthiness ratings as the dependent variable (DV1). The level of significance was set at $p < .05$. Greenhouse-Geisser corrections were utilised to correct for the violation of the sphericity assumption where appropriate throughout the analysis (Jennings & Wood, 1976).

A significant main effect for FOP in this ANOVA would indicate that the provision of the FOP labelling system impacts on the subjective healthiness ratings for the foods compared to the BL situation where only energy information and nutrient information in grams was provided. A significant interaction between FOP
and System (FOP*SYSTEM) would indicate that the different FOP labelling systems had a differential impact on the subjective healthiness ratings for the foods.

A further ANOVA, this time utilising DV2 (error score) as the dependent variable was then performed to identify any potentially significant effects of the different FOP labelling systems in terms of their impact on the distance of participants’ subjective ratings from an objective healthiness score across the different conditions.

5.3 Results

The means and 95% confidence intervals for the DV1 and DV2 main effects are provided in Table 5.3 for the sample as a whole, and per country. Overall, this analysis yielded 64 main effects and interactions for the two dependent variables and whilst all the between-subjects factors and interactions are reported in Table 5.4 for both DV1 and DV2, for the sake of brevity only a subset of the within-subjects factors and interactions have been included. A complete table of results is available in Appendix 4.

It should also be noted that given the large sample size, even small effects will be significant and it was therefore important to consider the effect size in the analysis and interpretation of outcomes. Therefore, observed significance with an effect size of $\eta_p^2 < .005$ was not considered to be of any substantive interest although some are discussed below for clarification and context purposes.

5.3.1 Utilising DV1 (participants’ perceived healthiness ratings) as the dependent variable

Whilst a significant main effect was observed for the presence of the FOP labelling systems (FOP), the very weak effect size demonstrates that the FOP labels shown to the participants had little effect on the perceived healthiness ratings of the foods over and above provision of the numerical information alone in the basic label (BL) format. The lack of a significant interaction for FOP*System, that is between the presence of one of the FOP systems and the different systems shown, demonstrates that all four test labelling systems; GDA, TL, HL and HB performed similarly to each other.
For the between subjects factors, a significant country effect was found (Country) with participants from Turkey and Poland rating the foods as slightly healthier overall compared to participants from the UK and Germany. Despite the significant portion effect observed (Portion), the small effect size demonstrates that presenting foods in the two different portion sizes had little effect on participants’ ratings overall.

In terms of the within subjects factors, a much larger significant effect was observed for the different healthiness levels of the foods (Healthiness) demonstrating that participants were clearly able to differentiate between foods presented with differing levels of healthiness within a food category in their ratings, regardless of which label format they were shown. The three way interaction FOP*Healthiness*System indicates that the different FOP systems when applied, had only small differential effects on the ratings across the different foods at the various levels of healthiness (Fig. 5.3).

The significant effect observed for the food category (Food) demonstrates that participants’ ratings did differ between the three food categories, with pizza being rated as least healthy followed by yoghurts and biscuits (Table 5.3; Table 5.4). The significant two-way interaction Food*Healthiness demonstrates that this effect varied across the levels of healthiness (Fig. 5.4). The significant two-way Food*FOP interaction and the significant three-way Food*FOP* System interaction, demonstrate that participants’ ratings were differentially impacted across the food categories by the application of the FOP systems and that the different FOP systems had a differential impact across the food categories when compared to the basic label (BL) ratings. This observed effect varied across countries as demonstrated by the Food*FOP*System*Country interaction although for all three interactions the effect sizes were again quite small.
Table 5.3 Means and 95% Confidence Intervals for subjective healthiness ratings (DV1) and error scores (DV2)

<table>
<thead>
<tr>
<th>DV1 (Healthiness ratings)</th>
<th>All countries</th>
<th>UK</th>
<th>Germany</th>
<th>Poland</th>
<th>Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larger</td>
<td>7.68</td>
<td>8.26</td>
<td>7.96</td>
<td>7.17</td>
<td>7.33</td>
</tr>
<tr>
<td>Healthiness</td>
<td>4.89</td>
<td>5.46</td>
<td>7.74</td>
<td>4.76</td>
<td>44.5</td>
</tr>
<tr>
<td>High</td>
<td>5.79</td>
<td>8.31</td>
<td>8.21</td>
<td>7.49</td>
<td>7.15</td>
</tr>
<tr>
<td>Low</td>
<td>9.75</td>
<td>10.31</td>
<td>10.18</td>
<td>9.24</td>
<td>9.27</td>
</tr>
<tr>
<td>Food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>8.24</td>
<td>8.77</td>
<td>8.36</td>
<td>7.96</td>
<td>7.89</td>
</tr>
<tr>
<td>Yoghurt</td>
<td>7.00</td>
<td>7.78</td>
<td>7.25</td>
<td>6.55</td>
<td>6.44</td>
</tr>
<tr>
<td>Biscuits</td>
<td>7.18</td>
<td>7.62</td>
<td>7.53</td>
<td>6.98</td>
<td>6.59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DV2 (Error scores)</th>
<th>All countries</th>
<th>UK</th>
<th>Germany</th>
<th>Poland</th>
<th>Turkey</th>
</tr>
</thead>
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<tr>
<td>Portion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larger</td>
<td>2.9</td>
<td>3.48</td>
<td>3.18</td>
<td>2.39</td>
<td>2.55</td>
</tr>
<tr>
<td>Healthiness</td>
<td>2.55</td>
<td>3.21</td>
<td>2.41</td>
<td>2.42</td>
<td>2.16</td>
</tr>
<tr>
<td>High</td>
<td>2.79</td>
<td>3.31</td>
<td>3.21</td>
<td>2.49</td>
<td>2.15</td>
</tr>
<tr>
<td>Low</td>
<td>2.75</td>
<td>3.31</td>
<td>3.18</td>
<td>2.24</td>
<td>2.67</td>
</tr>
<tr>
<td>Food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td>4.24</td>
<td>4.77</td>
<td>4.36</td>
<td>3.96</td>
<td>3.89</td>
</tr>
<tr>
<td>Yoghurt</td>
<td>5.34</td>
<td>6.11</td>
<td>5.58</td>
<td>4.89</td>
<td>4.77</td>
</tr>
<tr>
<td>Biscuits</td>
<td>-1.49</td>
<td>-1.05</td>
<td>-1.14</td>
<td>-1.69</td>
<td>-2.08</td>
</tr>
</tbody>
</table>

119
Figure 5.3. FOP*Healthiness*System interaction utilising DV1 (Mean healthiness ratings). $F(5.9, 3989.5) = 7.17, p \leq .001, \eta^2 = .010$. Within the different healthiness variant groups the following statistically significant differences were observed: High health variant: BL vs. HL ($p \leq .001$), GDA vs. HL ($p = .014$). Medium health variant: BL vs. TL ($p = .013$), BL vs. HL ($p = .005$), BL vs. HB ($p = .023$), GDA vs. TL ($p \leq .001$), GDA vs. HB ($p = .004$), TL vs. HL ($p \leq .001$), HL vs. HB ($p \leq .001$). Low health variant: BL vs. HB ($p = .013$).
Table 5.4 Repeated measures ANOVA results for subjective healthiness ratings (DV1) and error scores (DV2)*

<table>
<thead>
<tr>
<th></th>
<th>DV1</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>DV2</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>df</td>
<td>F</td>
<td>$\eta^2$</td>
<td>$p$</td>
<td>$F$</td>
<td>$\eta^2$</td>
<td>$p$</td>
<td></td>
</tr>
<tr>
<td><strong>Between Subjects factors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portion</td>
<td>1, 2036</td>
<td>30.02</td>
<td>.015</td>
<td>≤ .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Country</td>
<td>3, 2036</td>
<td>45.68</td>
<td>.063</td>
<td>≤ .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Within subjects factors and interactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food</td>
<td>2, 3986.1</td>
<td>308.22</td>
<td>.131</td>
<td>≤ .001</td>
<td>9183.23</td>
<td>.819</td>
<td>≤ .001</td>
<td></td>
</tr>
<tr>
<td>FOP</td>
<td>1, 2036</td>
<td>6.02</td>
<td>.003</td>
<td>.014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthiness</td>
<td>1.3, 2603.5</td>
<td>2856.59</td>
<td>.584</td>
<td>≤ .001</td>
<td>7.89</td>
<td>.004</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>FOP * System</td>
<td>3, 2036</td>
<td>2.22</td>
<td>.003</td>
<td>.084</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food * FOP</td>
<td>2, 4047.3</td>
<td>68.27</td>
<td>.032</td>
<td>≤ .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food * FOP * System</td>
<td>6, 4047.3</td>
<td>16.20</td>
<td>.023</td>
<td>≤ .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food * FOP * System</td>
<td>17.9, 4047.3</td>
<td>2.96</td>
<td>.013</td>
<td>≤ .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food * Healthiness</td>
<td>3.7, 7542.3</td>
<td>1308.30</td>
<td>.050</td>
<td>≤ .001</td>
<td>106.54</td>
<td>.391</td>
<td>≤ .001</td>
<td></td>
</tr>
<tr>
<td>FOP * Healthiness</td>
<td>5.9, 3989.5</td>
<td>7.17</td>
<td>.010</td>
<td>≤ .001</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* For the sake of brevity only a subset of the results are presented in this table. A complete table of results are provided as Appendix 4. Results for DV2 are only shown where the values differ from those of DV1.
Figure 5.4 Food*Healthiness interaction utilising DV1 (Mean healthiness ratings). $F(3.7, 7542.3) = 1308.30, p \leq .001, \eta^2 = .050$
5.3.2 Utilising DV2 (error scores) as the dependent variable

Utilising the error scores as the dependent variable in the same analytical approach as above revealed further insight into how participants rated the various foods at the differing levels of healthiness. Results are shown in Table 5.4 for those cases where they differed from DV1. Of the within subject factors, by far the largest effect was seen for the food categories (Food) indicating that the distance of participants’ ratings from the objective scores (i.e. error scores for each food), varied across the different food categories regardless of which label format they were shown.

In addition, utilising DV2 a larger effect size was observed in the two-way interaction Food*Healthiness than was observed for DV1. This demonstrates that the degree of healthiness of the foods influenced the distance of participants’ ratings from the objective score (Fig. 5.5), with the healthiness ratings for the low health variant in each category being further from the objective score than for the high health variant, although the extent of this varied across the different food categories (Table 5.3).

Overall, participants tended to underestimate the healthiness of the pizzas and yoghurts and overestimate the healthiness of the biscuits with their subjective healthiness ratings. However, further exploration of the three-way interaction Food*FOP*System demonstrated that when the FOP systems were present, the overestimation of the healthiness of the biscuits appeared to be slightly reduced which is a promising outcome (Fig. 5.6). The underestimation of the healthiness of the pizzas and yoghurts were also reduced.
Figure 5.5 Food*Healthiness interaction utilising DV2 (Mean error scores). $F(3.7, 7542.3) = 106.54, p \leq .001, \eta^2 = .391$
Figure 5.6 Food*FOP*System interaction utilising DV2 (Mean error scores). $F(6, 4047.3) = 16.20$, $p \leq .001$, $\eta^2 = .02$
5.4 Discussion

The results of this study suggest that although the FOP systems tested can result in some small improvements to objective understanding across different foods, portion sizes and levels of healthiness, there was little difference observed over the provision of an FOP label containing basic numerical nutritional information alone or between the various systems under these conditions. Therefore the hypothesis that one of the FOP systems would out-perform the basic label did not hold.

In the study, participants were able to differentiate between the healthiest, middle health and least healthy variants within each of the food categories in their ratings with both the basic label and any of the test FOP labels. Therefore, the results suggest that any structured and legible presentation of key nutrient and energy information as an FOP label may be sufficient to enable consumers to detect the healthier alternative within a food category should they wish to do so, or perhaps are forced to do so within an experimental environment. However, it should be noted that in this study participants were making their decisions of healthiness between the foods within one FOP labelling system. In reality, the presence of multiple FOP systems in the marketplace would make the task of comparing foods more difficult.

The results of this study are in line with those of previous research (Grunert & Fernández-Celemin, 2010; Malam et al., 2009), which found that the vast majority of people can successfully identify healthier products using any of the prominent labelling formats. The novel aspect of our research is the direct systematic comparison of the FOP systems using the same food categories with foods at differing levels of health across different countries, the comparison of these to the provision of numerical nutrition information alone as the FOP label and comparison to an objective health score.

Despite only testing three food categories in this study, results suggest that people may rate different food categories differently. However, the tendency of the participants to underestimate the healthiness of pizza and yogurt and to overestimate the healthiness of biscuits in their subjective healthiness ratings may in fact be affected more by the portion size/reference amount (portion effect) in which the food is being presented, rather than any pre-conceived ideas about the relative healthiness of the different food categories. For example, in comparison to the pizza presented as either 200g or 100g, the biscuit was relatively small at 18g or 9g. The
numerical values for energy and the four nutrients on the label for biscuits would therefore have been small in magnitude and potentially perceived as being healthier than they objectively are. It is interesting to note that when the FOP systems were present there appeared to be some impact, albeit small, on this possible portion effect in the biscuits which is a promising outcome. Further research exploring the effect of reference amounts utilised in FOP nutrition labelling and their influence on evaluation of product healthfulness have reinforced the finding that pre-conceived ideas about the relative healthiness of the different food categories do not appear to have had a strong influence on healthiness ratings. However, consumers do appear to factor the reference amount, that is, the quantity of food for which the nutritional information is being presented, into their judgements of healthfulness. (Raats et al. 2015).

5.5 Conclusions

Under experimental conditions, results suggest that any structured and legible presentation of key nutrient and energy information on the FOP may be sufficient to enable consumers to detect a healthier alternative within a food category when provided with foods with distinctly different levels of healthiness. However, in real life settings, personal factors and context must also be considered (Barker, Lawrence & Robinson, 2012) and often take precedence over health considerations in driving choice. Whilst FOP labels have the potential to facilitate healthier choices, in reality they can only do so when the motivation and intention to shop more healthily has been established.

When considering the implications of these results on future FOP labelling policy, one must bear in mind that although basic nutritional information alone might be sufficient to enable consumers to detect the healthier alternative from a limited choice set when specifically asked to do so under experimental conditions, in the real world it may not be. It is known that most consumers do not have the motivation or the time to process nutritional information when they are shopping (Gerrior, 2010; van Herpen & van Trijp, 2011). The additional elements of Traffic Light colour, Guideline Daily Amounts or the presence of a health logo may have a greater impact in engaging consumers with the nutritional implications of their food. Overall the results from this study suggest that one may be more likely to identify the optimal FOP labelling scheme in real world studies than in studies which involve
forced exposure under experimental conditions. Future research should therefore focus on a given FOP scheme's potential to engage consumers' attention, motivate them towards healthier food choice and effect behavioural change within real world shopping environments.
CHAPTER 6
GENERAL DISCUSSION

6.1 Overview.

Food composition data, front-of-pack nutrition labelling and nutrition and health claims are fundamental to the development of appropriate policy, regulation and public health interventions (e.g. mandatory nutrition labelling) aimed at reducing the burden of diet-related chronic disease. The overarching aim of this thesis was to explore whether the communication of healthier food choice, through the provision of FOP nutrition labelling and nutrition and health claims, can be enhanced by the development of consumer derived frameworks of these domains, a greater understanding of the degree to which the different FOP labelling schemes impact on consumer health inferences and an improved approach to the sharing of food composition data between stakeholders.

The findings of the studies within this thesis are summarised and discussed below in terms of their contributions to theory, methodology and practice.

6.2 Improved approach to the sharing of food composition data between stakeholders.

Results from Study 1 suggest that the food industry may have an inherent need and, in some cases desire, to share nutritional composition data within its own supply chain and also with external customers and stakeholders. The research in this thesis highlights that, for the majority of food manufacturers, food composition data for their own products are embedded in their Enterprise Resource Planning (ERP) software alongside all their other critical business data including that on manufacturing, logistics and finance. Extracting information on products from these systems to share with researchers, policy makers and other interested stakeholders is a resource intensive task fraught with incompatibility issues. This suggests that in order to find a solution, it is necessary to look outside the typical routes for food composition data transfer and instead look more widely at how the food supply chain manages transfer of other types of technical data on their products. By utilising the
systems that already exist within the supply chain it is envisaged that the barriers associated with data sharing might be more easily overcome.

Since Study 1 (Hodgkins et al., 2010) was performed, the opportunities for utilising recent advances made by the GS1 Global Data Synchronization Network (GS1) have been further explored by the EuroFIR consortium and an initiative was accepted by the European Committee for Standardisation (CEN). This resulted in the setting up of a ‘Project committee – Food composition data' (CEN/TC 387) led by the Swedish Standards Institute (SIS). The committee consisted of a core group of experts, one of which being GS1-Sweden, with the aim of providing a framework that facilitates the compilation of high quality data on the identification and description of foods, food components and compositional values (Becker, 2010). The output of this committee has resulted in the successful delivery of a ratified European Standard ‘EN 16104:2012 Food data - Structure and interchange format’ in December 2012 (EN, 2012). It is now likely that with sustained engagement with the GS1 organisation, there will be further standardisation between the pre-existing GS1 Food and Beverage extension and the European Standard, which is the required precursor to facilitate future data transfer via this approach.

With the continued effort of all stakeholders, the vision that food composition data on processed foods will be accessible ‘at the push of a button’ by national database managers, regulatory bodies and other key stakeholders may become the reality, if and when, access to the central registry and/or synchronized GS1 data pools can be successfully negotiated. Furthermore, it is encouraging to note that this approach appears to have also stimulated efforts towards wider harmonisation between food composition data and consumption data. Consumption data interchange formats are now being developed based on the work and experiences from the food composition data standardisation efforts (Pakkala et al., 2014). Bearing in mind the fast paced developments in mobile technologies for consumers to manage their own health and diet (Lowe, Fraser & Souza-Monteiro, 2015), harmonisation of food composition data with food consumption data, in terms of data collection and interchange, will become increasingly important, if this consumer derived data is to be useful for future research into food behaviour.

6.3 A consumer derived framework (typology) of FOP labelling.

It has been generally accepted that simplified or more aggregated FOP labels may be the optimal approach (Lupton et al., 2010) as they are considered to
be quick to use and more easily understood (Feunekes et al., 2008). However, data from Study 2 suggests that aggregation, to the extent whereby FOP labels are expressed in the form of a simple visual nutrition/health claim logo without any underlying nutritional information being displayed, can in fact lead to less positive evaluations of these labels by consumers.

The findings from Study 2 therefore make a theoretical contribution to the FOP labelling domain by proposing a consumer derived typology based on a dimension of ‘directiveness’, which may lead to a better understanding of why some FOP schemes may be more effective than others in particular situations and for particular consumers. In addition this typology sheds further light on why TL schemes may be considered better at facilitating more healthful food choices than GDA schemes (Lobstein & Davies 2008; Thorndike et al., 2012; Hawley et al., 2012; van Herpen, Hieke & van Trijp, 2014a) and are rated higher for liking and comprehension and credibility than HL schemes (Feunekes et al., 2008). Essentially, TL labels, by nature of the interpretative colours included on the risk nutrients, can afford the consumer with the option to engage with either the underlying nutritional information, or to utilise colour cues to make a decision on how healthy the product is. However, although the consumer is being given a greater degree of guidance by the TL labels than perhaps by GDA labels, TL labels in most situations do not communicate an overall product decision in the directive sense, other than when the risk nutrients are all green or alternatively all red. Therefore, the inclusion of a health logo to this type of FOP label may in fact still add value particularly for consumers with low involvement, lack of time or overloaded cognitive resources.

Re-iterating that to be effective, the ‘ideal’ FOP labelling scheme should appeal to the widest audience across the widest set of shopping situations, from a policy perspective, the findings from Study 2 suggest the solution may lie in moving away from current thinking. That is, rather than FOP labelling schemes utilising either an aggregated or disaggregated approach, we should perhaps look to develop FOP labels that consist of both directive, semi-directive and non-directive elements (Hodgkins et al., 2012).

This approach could afford the consumer with the option to engage in either heuristic processing, when for example they are shopping in a hurry by utilising the directive element, or perhaps engage in a more systematic processing of the FOP label if, for example, they are following a weight loss diet or have other diet related
motivations, such as reducing the amount of sugar they eat, and as such may be better guided by the semi and non-directive elements. Furthermore, the development of FOP labels which comprise of both directive and non-directive elements, and which clearly communicate both the presence and absence of the directive logo element, would overcome the issue whereby foods deemed to be unhealthy do not display any FOP label to guide consumers in comparative decision making at point of sale.

In terms of facilitating future research, Königstorfer and Gröppel-Klein (2012) performed a study that built on the findings of Study 2 and which aimed to test this type of hypothetical FOP label in a real-store setting using eye-tracking. They found that, though overall attention to the label was only slightly increased, the healthfulness of choices made by shoppers with a lower degree of self-control (i.e. weaker in self-regulatory processes with regard to thoughts, emotions, impulsive behaviors) were increased. Since this is a segment of the population that FOP labels should ideally be helping, this initial result is considered to be encouraging for further development and testing of this potentially enhanced approach to FOP nutrition labelling. A further study, using mobile eye tracking technology during a simulated shopping trip found that FOP labels, which included the combination of a directive logo and semi-directive TL colours, resulted in consumers choosing more healthful snacks when compared to presentation of TL colours only (Koenigstorfer et al., 2013). It is clear therefore, that there is potential for the development of optimised FOP labels informed by the construct of directiveness.

In addition to the above research conducted in response to the findings of Study 2, the consumer derived typology described within this thesis has already been recognised within other expert typology frameworks. Van Der Bend et al.’s (2014) recent revision of their visual model to compare existing front-of-pack nutrient profiling schemes now includes reference to the constructs of ‘directive’, ‘semi-directive’ and ‘non-directive’ as set down in Study 2, in their ‘Funnel model’ classification of FOP labelling schemes. It is hoped that this convergence of consumer derived and expert typologies will continue to inform future research design and debate on the optimal FOP labelling scheme to adopt.

6.4 FOP labelling schemes; towards an optimal approach.

The results from Study 4 demonstrate that consumers can differentiate between foods with differing levels of health with even the basic FOP label, which
only included numerical information. This is in line with previous research which found that the majority of people can identify healthier products using the various labelling schemes (Grunert & Fernandez-Celemin, 2010; Malam et al. 2009). Whilst some small effects on healthiness ratings were observed when comparing the FOP schemes to the baseline label, particularly in the foods at the middle health level, overall no significant difference between the various FOP schemes themselves was observed.

The outcome of this study proposes a methodological contribution to the study of FOP labelling by reflecting the difficulties that have been experienced in the past when attempting to identify the optimal FOP labelling scheme in lab based empirical studies. That is because when prompted to, most consumers can use FOP labels to choose a healthier product. Since previous research has suggested that motivation and attention are the main barriers to FOP label use (Grunert et al., 2012), the optimal FOP scheme must be that which can most readily engage consumers and motivate them to make healthier choices in real world environments.

Reflecting on the findings from Study 2, which proposes that the development of FOP labels that include both directive, semi and non-directive elements may be more effective in engaging consumers with the health implications of their food, research should perhaps shift focus away from lab based studies onto testing the effect of this potentially optimised label in more ecologically valid environments.

6.5 A consumer derived framework (typology) of nutrition and health claims.

The results from Study 3 suggest that both the associative networks and beliefs that consumers have previously developed in relation to nutrients/substances, and their relationship with health outcomes, are key drivers to the way in which health claims are interpreted and understood. They also provide further evidence that consumers do not consciously differentiate between a nutrition claim and a health claim in the way that regulatory experts envision they should do. Particularly, when nutrients/substances in the claim are familiar and personally relevant there is the potential for consumers to ‘upgrade’ the former for the latter simply based on their network and prior beliefs, as opposed to what is actually stated in the claim.
From a regulatory point of view, if the actual format of the claim, that is, whether it is a detailed risk reduction claim or a simple nutrition claim, is of less importance to the consumer when they have a pre-formed associative network for the nutrient or substance in the claim, it is then imperative that the associative networks consumers draw upon are correct and well-informed.

The results from Study 3 are in line with previous research (Williams, 2005; Siró et al., 2008; Verhagen et al., 2010) which demonstrates that consumers perceive short and simple claims more favourably, are unlikely to engage with detailed information on the product packaging whilst shopping and, are unlikely to perceive information associated with an unfamiliar nutrient positively, regardless of how detailed it is. In addition, they suggest that expression of the more detailed general function claims or disease risk reduction claims utilising ‘scientific’ or ‘regulatory’ language is a problem for many consumers. Therefore, these associative networks are unlikely to be formed or corrected by increasing the level or scientific basis of the information placed on the food packaging in the form of a complex claim statement. It is also important to recognise at this point, that the removal of a claim from the packaging of a product or product category is unlikely, in itself, to result in consumers spontaneously readdressing their pre-formed associative networks regarding the benefits of that product or product category. For example, in the UK, it has been suggested that yoghurt sales have not been significantly impacted as a result of the removal of digestive health claims due to successful repositioning in terms of positive lifestyle and general wellbeing. However, it has also been suggested that this could be due, in some part, to an ‘echo chamber’ of embedded digestive health benefits within consumers previously formed associative networks (Arthur, 2014).

Furthermore, how aware are consumers of the relative recent changes to the health claims legislation? It is fair to suggest that there has not been any comprehensive or structured communication to consumers on the differences between the various levels of health claims that are now permitted/not permitted and what they really mean. Regulatory bodies and those stakeholders concerned with fostering appropriate understanding of health claims in consumers should therefore consider employing strategies to impact on this awareness in consumers, and also on the associative networks consumers have previously made, around particular nutrients in the nutrition and health claim domain.
For more familiar nutrients or functional ingredients where strong associative networks have been previously formed, but the claims are no longer legally allowed by the regulations, there is a need to re-educate the consumer appropriately. Similarly, for new functional ingredients, or less familiar nutrients, where associative networks have not been previously formed, there is an opportunity to educate the consumer appropriately, thus making claims for these functional ingredients potentially more acceptable to consumers (Siro et al., 2008).

When products containing relatively unfamiliar nutrients or new functional ingredients are developed it has been previously recognised that these need to be supported by an effective communication strategy to inform consumers of their function and benefits (Siro et al., 2008). In the commercial world, establishing associative networks in relevant consumer groups is a fundamental part of an effective product marketing strategy. These strategies are usually delivered in the form of magazine editorials, television advertising and more recently social media and other consumer resources accessed via the internet. Once established, the associative networks formed in consumers’ minds by these mass marketing strategies are then triggered via short and consumer tailored statements on the product packaging at point of purchase.

It is interesting to note at this point that to parallel the above commercial efforts to promote new products displaying health claims, there appears to be no authoritative information or educational resource that is independent from industry for consumers to easily draw upon. The existing EU legislation and/or the scientific literature is of little use to the lay consumer in helping them to form new, or even correct their existing associative networks for the nutrients, functions and benefits within the health claims arena both past and present. Since two of the three main constructs identified in the proposed typology, familiarity and relevance, are constructs with individual differences, the situation is further complicated by the fact that different consumers are likely to receive the same claims differently based on their established network and beliefs.

The results from Study 3 make both a theoretical contribution to the health claim domain by proposing ‘familiarity’, ‘statement type’ and ‘relevance’ as important dimensions on which consumer understanding may be further explored and enhanced. Furthermore, this study makes a practical contribution by suggesting that there is a need for policy makers/regulators to consider providing resource(s) to support and educate consumers to establish/re-establish appropriate networks and
beliefs in the health claim domain. Ultimately it is hoped that this will help consumers to better understand and derive the appropriate meaning from the types and wording of health claims that are now appearing on pack and to eliminate the inappropriate meanings that may have been previously formed.

6.6 The MSP methodology

The findings from Studies 2 and 3 within this thesis demonstrate that the Multiple Sort Procedure may be a valuable, yet under utilised methodology for exploring the way in which consumers make sense of the various pieces of information communicated to them to facilitate healthier food choices. The ability of the MSP methodology to inform the development of consumer derived typologies of a particular type of information or domain, can provides researchers and policy makers with a deeper understanding of the relevant psychological phenomena associated with that domain from a consumer perspective and as such makes an important methodological contribution to the food information provision/consumer understanding domain.

If consumer understanding is defined as a consumer’s ability to derive appropriate meaning from the information provided to them, the way in which MSP allows for consumer derived dimensions to be directly compared to expert dimensions facilitates the identification of areas where there is the potential for misunderstanding between what is expected to be communicated from a regulatory perspective and what is actually perceived by the consumer. Furthermore, the inherent flexibility of this methodology, in that one could apply it to almost any set of stimuli, be they text based or image based, or even a mixture of the two, makes it particularly relevant and useful in the food domain where health cues are frequently presented on pack as both text and symbols.

Since the regulations governing the use of FOP labelling and nutrition and health claims refer to the fundamental need for these to be understood by the average consumer (European Commission [EC], 2011), the results in this thesis suggest that the MSP methodology holds great potential to satisfy this need in future research.
6.7 Limitations

Whilst the research in this thesis suggests a number of important recommendations for improving the communication of healthier food choice for consumers it should be recognised that in Studies 2, 3 and 4, in order to maintain an appropriate degree of experimental control, a number of limitations exist.

Studies 2 and 3 were not concerned with testing the effectiveness of FOP labels or nutrition and health claims in driving product choice, their purpose was to elicit semi-structured qualitative data to gain a deeper understanding of how consumers describe and differentiate the various FOP labels and nutrition and health claims. Therefore, as exploratory studies based on forced exposure, it should be noted that participants may have been more likely to be sceptical of the labels shown to them than they would be in a real-world shopping setting, since this often does not involve careful inspection of the labels or claims present on pack. In addition, the participants were not required to use the labels or claims in any real way to facilitate a product choice and many of the labelling systems and claims were unfamiliar to them. However, the value of the type of information gathered from these studies is that it is difficult to capture, and is often missed, in larger empirical studies on outcome measures of final product choice.

In addition, the stimuli used in Studies 2, 3 and 4 were stripped of any contextual factors such as brand or packaging imagery which are known to impact on consumer perceptions and choice. Indeed, Klepacz et al., (2015) have recently shown that when product packaging imagery includes images related to health, it can lead to the false recollection of a health claim being present. For the purposes of developing consumer derived typologies which reflected dimensions relating specifically to FOP labelling and nutrition and health claims present it was necessary to exclude these possible confounding factors from the study designs. However, future research could easily build on the study designs within this thesis to explore more fully these important contextual factors, and their impact on communication of appropriate healthier food choices.

In Study 4, the focus was on establishing the extent to which the interpretative elements of the different FOP labelling schemes impact on healthiness perceptions, and not on any affective evaluation of these different schemes which may impact on consumer acceptance or potential use of the schemes for product choice. In the real world, the additional elements of TL, GDAs or the presence of a HL may have a greater impact in gaining attention (Koenigstorfer et al., 2013) and
engaging consumers with the nutritional implications of their food. In study 4, it should also be noted that participants were making their decisions of healthiness between the foods within one FOP labelling system, the presence of multiple FOP systems in the marketplace would, in reality, make the task of comparing foods more difficult.

Finally, in Study 1, the sample comprised of the UK food industry and one might argue that to propose a pan-European solution to effective sharing of food composition data a sample including a greater number of European countries would be necessary. However, the sample captured a high proportion of companies with a global market whose responses reflected a multinational perspective by virtue of their product development, manufacturing operations and product portfolios spanning multiple countries across Europe and beyond.

6.8 Opportunities for future research

Future research could further explore consumer understanding of combinations of FOP labelling and nutrition and health claims by building on the MSP methodology and study designs described within this thesis. This would provide greater insight into the interactions between these types of information from a consumer perspective. Further research is also needed to explore the way in which consumer understanding of FOP labelling and nutrition and health claims may be impacted by contextual factors in more ecologically valid environments. Whilst, testing in the real world is constrained by the limitations on experimental manipulation of the information on pack to the extent needed to compare and contrasts various labelling schemes, differing presentations of claims or combinations thereof, this could perhaps be more easily achieved by using experimental mediums such as ‘virtual supermarkets’ (van Herpen et al., 2014b).

Looking more broadly, future research should also focus on developing a greater understanding of the psychological and contextual factors which impact on the motivation and opportunity to use the health related information, be it FOP labelling or health and nutrition claims, on food packaging in real world shopping settings. This will facilitate identification of the optimal FOP system and most effective mode of communication.
Simply providing nutritional information in the form of FOP labelling or claims alone does not appear to have had the desired effect of promoting widespread healthier food choices (Vyth et al., 2011; Sacks, Rayner & Swinburn, 2009). Whilst FOP labels and nutrition and health claims have the potential to facilitate healthier choices, even when enhanced in accordance with the recommendations from the studies within this thesis, they can only do so when the motivation and intention to shop more healthily has been established.

In reality, this may only happen when these tools, that is FOP labelling and nutrition and health claims, are routinely and appropriately used in decision-making by consumers (Weil et al., 2005). In real life settings, motivation, personal factors and context (Barker, Lawrence & Robinson, 2012) taste and price (Glanz et al., 1998; Lalor et al., 2011) have a greater impact on choice. Therefore, there is a need for the development of interventions that will support the desired outcome, whereby consumers are motivated to use FOP labels to aid healthier choice decisions when they shop.

It is interesting to note at this point that a significant effect in achieving healthier purchases was observed when an intervention in a hospital cafeteria introduced an overall product level TL labelling scheme. However, in that study, the label introduction was supported by signage at the point of purchase and a dietitian on hand to answer customers’ labelling queries in the first two weeks of the study period. The effect was then further enhanced by a second phase which involved manipulation of the choice architecture at point of sale to place healthier ‘green’ labelled products at eye-level (Thorndike et al., 2012). Clearly, the presence of the FOP labelling scheme was an important factor in the study design, but the intervention was most likely driven by the support the dietitian gave to the consumers and the way in which the environment was manipulated to facilitate the desired behaviour change. This demonstrates that utilising a more comprehensive behaviour change approach, rather than just label provision alone, can be effective in increasing healthier food choices. The concept of environmental manipulation or ‘nudging’ (Marteau et al., 2011) has also been shown to be effective in another recent study where extension of the choice architecture to a wider range of healthier options increased healthier food choices (Aschemann-Witzel et al., 2013).

In other detrimental health behaviour arenas, such as smoking or alcohol consumption, experience has shown that at an individual level, long-term behavioural change is difficult to achieve and often requires intensive interventions.
incorporating essential conditions such as capability opportunity and motivation (Michie, van Stralen & West, 2011). In contrast, at a public health level there is some evidence of effective behaviour change resulting from a mass marketing approach (Wakefield, Loken & Hornik, 2010), an example of this being the Australian ‘Sunsmart’ campaign (Dobbinson, Wakefield & Jamsen, 2008). Similarly, some success has been achieved in the area of smoking cessation whereby interventions have combined mass marketing, environmental manipulation supported by the implementation of regulations which ban smoking in public places or the workplace and interventions which have helped to support the behaviour change at an individual level.

The combined findings of the studies contained within this thesis, therefore suggest a need for greater emphasis on research into the development of effective public level mass marketing interventions, possibly supported by complementary environmental manipulations and individual level interventions, to encourage more effective use of FOP labelling and nutrition and health claims by consumers. Indeed, work in this area is already underway with a randomised control trial being performed with UK shoppers to increase the use of TL food labelling in a real store environment (Scarborough et al., 2015). The study aims to explore whether the effect of FOP nutrition labelling can be amplified with the provision of procedural information on how to use TL labelling, and tailored feedback on previous shopping habits to impact on motivation. The intervention is being delivered remotely via the Web and primary outcomes will be based on real shopping data from store card records, pre and post intervention, rather than on intention to purchase or purchases under forced experimental conditions. The development of this type of intervention is an important precursor to the development of any public level mass marketing intervention to enhance healthier food choice.

6.9 Conclusions

The research conducted within this thesis proposes both an optimised approach to the sharing of food composition data and an optimised approach to FOP labelling. In addition, it demonstrates that the development of consumer derived typologies for FOP labelling and nutrition and health claims can lead to a deeper understanding of these domains from a consumer perspective. They can also greatly inform future research and policy implications relating to enhancing communication of healthier food choice. Furthermore, it proposes the use of the
MSP as a valuable methodology for researchers and regulators to further explore where there is potential for mismatch or misunderstanding between what the regulators hope to achieve in terms of healthier food choice and what consumers themselves may in fact perceive or understand.


Center for Science in the Public Interest (2009) ‘Food Labelling Chaos: The case for Reform’. Available at:


front-of-pack food labelling systems for the Australian grocery market’, *Health Promotion International*, 24 (2), pp. 120-129.


Swedish National Food Administration, Danish Veterinary and Food Administration, Norwegian Directorate of Health and Norwegian Food Safety Authority (2012). Design manual for the Keyhole logo - prepacked food and generic marketing. [Online]. Available at: http://www.livsmedelsverket.se/globalassets/produktion-handel-kontroll/livsmedelsinformation-markning-


Sources of and access to food composition data

1. Which food composition data sources do you use and how do you access them (select ALL formats that apply)?

<table>
<thead>
<tr>
<th>Data source 1:</th>
<th>☐ hard copy tables</th>
<th>☐ computer readable file format</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ commercial nutrition analysis software</td>
<td>☐ internet site</td>
</tr>
<tr>
<td></td>
<td>☐ in-house nutrition analysis software</td>
<td>☐ other, namely</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data source 2:</th>
<th>☐ hard copy tables</th>
<th>☐ computer readable file format</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ commercial nutrition analysis software</td>
<td>☐ internet site</td>
</tr>
<tr>
<td></td>
<td>☐ in-house nutrition analysis software</td>
<td>☐ other, namely</td>
</tr>
</tbody>
</table>

Please provide any further comments you would like to make with regard to the above question:

Please provide your response here:
Uses of food composition data

2. In which of the following areas do you use food composition data? (Please mark ALL the items that apply to your situation)

- [ ] New product development
- [ ] Quality assurance
- [ ] Nutrition labelling
- [ ] Product marketing and claims
- [ ] Customer information e.g. leaflets, website, care lines etc
- [ ] Competitive product analysis
- [ ] Other, please specify

3. How frequently do you use food composition data to:

   i) estimate / compare the nutrient content of foods?

   - [ ] Very frequently
   - [ ] Frequently
   - [ ] Sometimes
   - [ ] Rarely
   - [ ] Never

   ii) verify self-generated values?

   - [ ] Very frequently
   - [ ] Frequently
   - [ ] Sometimes
   - [ ] Rarely
   - [ ] Never

   iii) derive missing values for a dataset?

   - [ ] Very frequently
   - [ ] Frequently
   - [ ] Sometimes
   - [ ] Rarely
   - [ ] Never

   iv) analyse recipes and menus?

   - [ ] Very frequently
   - [ ] Frequently
   - [ ] Sometimes
   - [ ] Rarely
   - [ ] Never
v) Create customer interface tools? (e.g. web based diet analysis tools etc)

☐ Very frequently  ☐ Frequently  ☐ Sometimes  ☐ Rarely  ☐ Never

v) Other, please specify

4. Please provide three typical examples of how you use food composition data and which data you use in each case.

For example: Food labelling – we use food composition data derived from food analyses undertaken in our own laboratory on fatty acids to label, e.g. spreads. The various fatty acids types are not being distinguished in McCance and Widdowson’s tables.

<table>
<thead>
<tr>
<th>Example 1:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Example 2:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Example 3:</th>
</tr>
</thead>
</table>
**Provision of nutrient composition information for your company's products**

5. Do you provide (or have you provided in the past) nutrient composition information for your company's products to any of the following:

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>National/official food composition datasets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National government (e.g. PSA, DEFRA, MAFF, DH)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Trade organisations</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Other (e.g. Media, Slimming organisations etc)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

If yes for any of the above: Please enter details as follows:

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Purpose</th>
<th>Information provided</th>
<th>When/how often</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>To whom do you / did you provide the information</td>
<td>What is / was the information used for</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. macronutrient / micronutrient content per 100 g</td>
<td></td>
</tr>
</tbody>
</table>

If no: Please provide up to three reasons why you do not / have not provided this type of information

| Reason | |
|--------||
| Reason 1: | |
| Reason 2: | |
| Reason 3: | |
6 Can you envisage providing nutrient composition information for your company’s products to national government, official food composition dataset compilers or trade organisations in the future?

☐ Yes
☐ No

*If yes:* What difficulties / barriers does your company face when providing this information?

1: 

2: 

3: 

*If no:* Please provide up to three reasons why not

Reason 1: 

Reason 2: 

Reason 3: 

7 Within your company, do you have easy access to an electronic dataset of the nutrient composition of your company’s products?

☐ Yes
☐ No

*Please detail any comments you would like to make on the above question here:*
8. Would it be beneficial for you to have access to an electronic dataset of the nutrient composition of your company's products?

☐ Yes
☐ No

Please detail any comments you would like to make on the above question here:

9. Can you envisage working with EuroFIR in the future, to develop a framework for providing wider access to an electronic dataset of the nutrient composition of your company's products?

☐ Yes
☐ No

Please detail any comments you would like to make on the above question here:
**EuroFIR - European Food Information Resource**

The European Food Information Resource network (EuroFIR, [www.eurofir.net](http://www.eurofir.net)) aims to

- Develop an internet portal allowing access to comprehensive and validated European food composition data from a range of online European databases.
- Provide new data especially for traditional & ethnic foods, composite foods and bioactive compounds with anticipated health benefits.
- Establish a European training programme, quality framework (CEN) including standardization of procedures for the generation and use of food composition data, and accredited analytic laboratories.

10 In addition to the above, what should EuroFIR provide in order for it to be useful to you?

   For example:
   - ability to search for a specific nutrient across comparable datasets
   - choices on reporting formats e.g. providing mean/median, ranges etc
   - procedures for calculation of composite foods from ingredients

Please provide your response here:

---

**Background Information**

11 What is your principal function/role? (please tick one box only)

- [ ] Product development
- [ ] Quality assurance
- [ ] Production
- [ ] Regulatory affairs
- [ ] Nutritionist
- [ ] Other, please specify

Please provide your detailed response here:
12 Please provide the following information about your company:

<table>
<thead>
<tr>
<th>Company name</th>
<th></th>
</tr>
</thead>
</table>

| Product ranges / key brands |   |

13 Please tick the description which best describes your company sector:

- [ ] Primary production
- [ ] Manufacturing
- [ ] Retailing
- [ ] Catering
- [ ] Distribution

14 Please tick the description which best describes your company's market:

- [ ] Global
- [ ] Pan-European
- [ ] Single market

15 Please tick the description which best describes your company's annual turnover (£ thousand):

- [ ] 0 – 49
- [ ] 50 – 99
- [ ] 100 – 249
- [ ] 250 – 499
- [ ] 500 – 999
- [ ] 1000 – 4999
- [ ] 5000+

Thank you for taking the time to complete this questionnaire!

If you would like to make any comments about this questionnaire or the EuroFIR project in general, please do so here:

[Blank space for comments]
Appendix 2A
Study 2 – Participant Information Sheet and Consent Form

Food Labelling Study
Information Sheet for Participants

Food labels are a source of information about the food we eat and we are carrying out this study to enquire about your views on food labelling.

Participation in this research is voluntary. If you do agree to take part, you will be asked to give a short interview with one of the researchers and during this interview they will ask you to perform a number of sorting exercises using cards displaying food labelling images. The researcher will seek your permission to record the interview to help with later analysis. You will also be asked to complete a short questionnaire to provide some information about you and your food habits.

Finally, you will be invited to take a questionnaire home with you to complete and post back to us at your earliest convenience by way of a pre-paid envelope.

We anticipate that the interview will take approximately 1 hour to complete. You will be free to stop the interview and withdraw from the study at any point. In consideration for completing the interview you will receive £25 however if you withdraw before completion of the interview payment will be at the discretion of the interviewer and may be less than £25. In consideration for successfully returning your questionnaire completed at home, you will receive an additional £10 voucher.

All information that you provide will be treated in the strictest confidence. Data will be stored securely and handled in accordance with the Data Protection Act, 1998. Your name will not be used in any reports or publications that may arise from this study.

Contact details for the researcher should you need to get in touch are:

Chao Hodgkins
Research Fellow
Food, Consumer Behaviour and Health Research Centre
University of Surrey, Stag Hill, Guildford, Surrey GU2 7XH
Tel: 01483 686891
Email: c.hodgkins@surrey.ac.uk
Food Labelling Study
Consent Form

• I the undersigned voluntarily agree to take part in the study on food labeling. I understand that participating in this research involves being interviewed on tape by a researcher from the University of Surrey.

• I have been given a full explanation by the investigators of the nature, purpose, location and likely duration of the study, and of what I will be expected to do. I have been given the opportunity to ask questions on all aspects of the study and have understood the advice and information given as a result.

• I understand that all personal data relating to participants is held and processed in the strictest confidence, and in accordance with the Data Protection Act (1998) and that I will not be named or identifiable in any report issuing from this study.

• I understand that I am free to withdraw from the study at any time without needing to justify my decision.

• I acknowledge that in consideration for completing the study I shall receive the sum of £25 I recognise that the sum would be lean, and at the discretion of the Principal Investigator, if I withdraw before completion of the study.

• I understand that I will be asked if I am willing to take a questionnaire at the end of the interview to complete at home and that in consideration for successfully returning the completed questionnaire I shall receive an additional £10 voucher.

• I confirm that I have read and understood the above and freely consent to participating in this study. I have been given adequate time to consider my participation and agree to comply with the instructions and restrictions of the study.

Name of volunteer (BLOCK CAPITALS) ....................................................

Signed...........................................................................................................

Date ...........................................................................................................

Name of interviewer (BLOCK CAPITALS) CHARO HODGKINS

Signed...........................................................................................................

Date ...........................................................................................................
Appendix 2B
Study 2 – FOP Label stimuli cards

The image utilised here was a representation of the Swedish keyhole logo see;

Explanation: Government system for identifying products that are healthiest within a product category

The image utilised here was a representation of the 'Guiding stars' logo represented as a three star rated food see;

Explanation: Food retailer system for identifying how healthy products are within a product category by giving them one (Good), two (Better) or three stars (Best)

The image utilised here was a representation of the 'Curser Nutritonnel' logo see;

Explanation: Heart Foundation system for identifying products that are 'heart healthy' within a product category

Explanation: Food industry system for identifying products that are healthiest within a product category

Each serving contains ...

<table>
<thead>
<tr>
<th>Calories</th>
<th>Sugar (g)</th>
<th>Fat (g)</th>
<th>Saturates (g)</th>
<th>Salt (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>618</td>
<td>11.4</td>
<td>35.5</td>
<td>16.1</td>
<td>1.9</td>
</tr>
<tr>
<td>30.9%</td>
<td>12.7%</td>
<td>60.7%</td>
<td>86.5%</td>
<td>31.6%</td>
</tr>
</tbody>
</table>

of your guideline daily amount

Each serving contains ...

<table>
<thead>
<tr>
<th>kcal</th>
<th>Fat (g)</th>
<th>Saturates (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>618</td>
<td>11.4</td>
<td>16.1</td>
</tr>
<tr>
<td>30.9%</td>
<td>12.7%</td>
<td>86.5%</td>
</tr>
</tbody>
</table>

of your guideline daily amount

Per serving

<table>
<thead>
<tr>
<th>Calories</th>
<th>Fat (g)</th>
<th>Saturates (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>618</td>
<td>11.4</td>
<td>16.1</td>
</tr>
<tr>
<td>30.9%</td>
<td>12.7%</td>
<td>86.5%</td>
</tr>
<tr>
<td>of an adult's GDA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Each serving contains...

<table>
<thead>
<tr>
<th></th>
<th>Calories</th>
<th>Sugar</th>
<th>Fat</th>
<th>Saturates</th>
<th>Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>MED</td>
<td>618</td>
<td>11.4g</td>
<td>35.5g</td>
<td>16.1g</td>
<td>1.9g</td>
</tr>
</tbody>
</table>

Low calorie

Low sugar

Low fat

Low saturated fat
Low salt
Appendix 2C
Study 2 - Multiple Sort Data Recording Form

Free Sort 1 (FS1)

Overall reason for sort (Criteria used?)

Why did they sort in this way?

Please record the category or group names (labels), a brief description of what the label names mean to the respondent (description of label) and which cards were assigned to each category/group:

<table>
<thead>
<tr>
<th>FS1.1</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sub total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.2</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sub total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.3</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sub total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.4</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sub total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.5</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sub total</td>
</tr>
</tbody>
</table>
Free Sort 2 (FS2)

Overall reason for sort (Criteria used?)

Why did they sort in this way?

Please record the category or group names (labels), a brief description of what the label names mean to the respondent (description of label) and which cards were assigned to each category/group:

FS2.1

<table>
<thead>
<tr>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sub total:

FS2.2

<table>
<thead>
<tr>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sub total:

FS2.3

<table>
<thead>
<tr>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sub total:

FS2.4

<table>
<thead>
<tr>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sub total:
<table>
<thead>
<tr>
<th>FS2.5</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FS2.6</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FS2.7</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total</th>
</tr>
</thead>
</table>

Free Sort 3 (FS3) etc....
Appendix 3A
Study 3 – Participant Information Sheet and Consent Form

Food Labelling Study
Information Sheet for Participants

Thank you for expressing an interest in participating in this research study. This research study is run by the University of Surrey, UK and is part of a European wide project which aims to investigate how food labelling influences consumer purchasing and consumption behaviour.

If you do agree to take part, you will be asked to give a short interview with one of the researchers and during this interview they will ask you to perform a number of sorting exercises using cards displaying food labelling information. The researcher will seek your permission to record the interview to help with later analysis. You will also be asked to complete a short questionnaire on your health and choice of foods.

We anticipate that the interview will take approximately 1 hour to complete. In consideration for completing the interview you will receive £40 however if you withdraw before completion of the interview payment will be at the discretion of the interviewer and may be less than £40.

All information that you provide will be treated in the strictest confidence. Data, including the audio recordings of the discussions and any transcripts made from them, will be stored securely and handled in accordance with the Data Protection Act, 1998. Your name will not be used in any reports or publications that may arise from the study.

Participation in the research is voluntary. You will be free to withdraw from the study at any point. If after completion you decide to withdraw use of your data you can do so by contacting the researcher, whose details are given below.

This study has been reviewed and received a favourable opinion from the University of Surrey Ethics Committee.

Contact details for the researcher should you need to get in touch are:

Dr Matthew Peacock
Research Fellow
Food, Consumer Behaviour and Health Research Centre
School of Psychology
University of Surrey, Stag Hill, Guildford, Surrey GU2 7XH
Email: m.peacock@surrey.ac.uk
Tel: 01483 682919
Consent Form

- I, the undersigned, voluntarily agree to take part in the study on food labeling which involves a recorded interview with a researcher from the University of Surrey.

- I have read and understood the Information Sheet provided. I have been given a full explanation by the investigators of the nature, purpose, location and likely duration of the study, and of what I will be expected to do. I have been given the opportunity to ask questions on all aspects of the study and have understood the advice and information given as a result.

- I agree to comply with any instruction given to me during the study and to co-operate fully with the investigators. I shall inform them immediately if I suffer any deterioration of any kind in my health or well-being, or experience any unexpected or unusual symptoms.

- I consent to my personal data, as outlined in the accompanying information sheet, being used for this study and other research. I understand that all personal data relating to volunteers is held and processed in the strictest confidence, and in accordance with the Data Protection Act (1998). I agree that I will not seek to restrict the use of the results of the study on the understanding that my anonymity is preserved.

- I understand that I am free to withdraw from the study at any time without needing to justify my decision and without prejudice.

- I acknowledge that in consideration for completing the study I shall receive the sum of £40. I recognise that the sum would be less, and at the discretion of the Principal Investigator, if I withdraw before completion of the study.

- I confirm that I have read and understood the above and freely consent to participating in this study. I have been given adequate time to consider my participation and agree to comply with the instructions and restrictions of the study.

Name of volunteer (BLOCK CAPITALS)  ..............................................................

Signed  ..............................................................

Date  ..............................................................

Name of interviewer (BLOCK CAPITALS)  ..............................................................

Signed  ..............................................................

Date  ..............................................................
### Appendix 3B

**Study 3 - Claim stimuli cards**

<table>
<thead>
<tr>
<th>Front of card</th>
<th>Back of card</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Calcium is needed for the maintenance of normal bones.</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Vitamin B12 contributes to normal homocysteine metabolism.</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Reducing consumption of sodium contributes to the maintenance of normal blood pressure.</strong></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Replacing saturated fats with unsaturated fats in the diet contributes to the maintenance of normal blood cholesterol levels [MUFA and PUFA are unsaturated fats].</td>
</tr>
<tr>
<td><strong>5</strong></td>
<td>Live cultures in yoghurt or fermented milk improve lactose digestion of the product in individuals who have difficulty digesting lactose.</td>
</tr>
<tr>
<td><strong>6</strong></td>
<td>Walnuts contribute to the improvement of the elasticity of blood vessels.</td>
</tr>
<tr>
<td><strong>7</strong></td>
<td>Zinc contributes to normal cognitive function.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>DHA contributes to maintenance of normal brain function.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pantothenic acid contributes to the reduction of tiredness and fatigue.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Substituting one daily meal of an energy restricted diet with a meal replacement contributes to the maintenance of weight after weight loss.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Glucomannan in the context of an energy restricted diet contributes to weight loss.</strong></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Sugar-free chewing gum helps reduce tooth demineralisation. Tooth demineralisation is a risk factor in the development of dental caries.</td>
</tr>
<tr>
<td>13</td>
<td>Barley beta-glucan has been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease.</td>
</tr>
<tr>
<td>14</td>
<td>Plant sterols and plant stanol esters have been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease.</td>
</tr>
<tr>
<td>15</td>
<td>Docosahexaenoic acid (DHA) intake contributes to the normal visual development of infants up to 12 months of age.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>16</td>
<td>Calcium and vitamin D are needed for normal growth and development of bone in children.</td>
</tr>
<tr>
<td>17</td>
<td>Iron contributes to normal cognitive development of children.</td>
</tr>
<tr>
<td>18</td>
<td>Essential fatty acids are needed for normal growth and development of children.</td>
</tr>
<tr>
<td>19</td>
<td>Rich in vitamin C.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>---</td>
</tr>
<tr>
<td>Naturally low in sodium.</td>
<td>20</td>
</tr>
<tr>
<td>Fat free.</td>
<td>21</td>
</tr>
<tr>
<td>No added sugar.</td>
<td>22</td>
</tr>
<tr>
<td>Contains wholegrain.</td>
<td>23</td>
</tr>
<tr>
<td>Source of Omega-3</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td></td>
</tr>
<tr>
<td>One of your 5 a day.</td>
<td></td>
</tr>
</tbody>
</table>

(Experts recommend you eat 5 portions of fruit and vegetables every day. That is 5 portions in total, not 5 portions of each)
Appendix 3C
Study 3 - Multiple Sort data recording form (Free and Structured Sorts)

Free Sort 1 (FS1)

Overall reason for sort (Criteria used?)

Why did they sort in this way?

Please record the category or group names (labels), a brief description of what the label names mean to the respondent (description of label) and which cards were assigned to each category/group:

<table>
<thead>
<tr>
<th>FS1.1</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.2</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.3</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.4</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.5</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FS1.6</td>
<td>Label name</td>
<td>Description of label</td>
<td>Card numbers</td>
<td>Sub total :</td>
</tr>
<tr>
<td>-------</td>
<td>------------</td>
<td>----------------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FS1.7</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
</table>

**Free Sort 2 (FS2)**

**Overall reason for sort (Criteria used?)**

**Why did they sort in this way?**

Please record the category or group names (labels), a brief description of what the label names mean to the respondent (description of label) and which cards were assigned to each category/group:

<table>
<thead>
<tr>
<th>FS2.1</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FS2.2</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FS2.3</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>FS2.4</th>
<th>Label name</th>
<th>Description of label</th>
<th>Card numbers</th>
<th>Sub total :</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS2.5</td>
<td>Label name</td>
<td>Description of label</td>
<td>Card numbers</td>
<td>Sub total :</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>----------------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>FS2.6</td>
<td>Label name</td>
<td>Description of label</td>
<td>Card numbers</td>
<td>Sub total :</td>
</tr>
<tr>
<td>FS2.7</td>
<td>Label name</td>
<td>Description of label</td>
<td>Card numbers</td>
<td>Sub total :</td>
</tr>
</tbody>
</table>

**Free Sort 3 (FS3) etc....**
Structured sort (SS1)  
Participant Id: ___________________

Overall how did they feel about this task? Did they find anything particularly difficult/easy?

Please record which cards were placed under each structured sort group heading.

<table>
<thead>
<tr>
<th>Group</th>
<th>Stimuli cards placed in group</th>
<th>Sub total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>SS1.1</td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>SS1.2</td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>SS1.3</td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td>SS1.4</td>
<td></td>
</tr>
<tr>
<td>Group 5</td>
<td>SS1.5</td>
<td></td>
</tr>
<tr>
<td>Group 6</td>
<td>SS1.6</td>
<td></td>
</tr>
<tr>
<td>Group 7</td>
<td>SS1.7</td>
<td></td>
</tr>
</tbody>
</table>

Total (25)
Appendix 3D
Study 3 – Background Questionnaire

Questionnaire

Participant Id: ____________________

[Q1] Are you?
   ◦ Male
   ◦ Female

[Q2] Please indicate your age by selecting one of the following:
   ◦ 18 to 34 yrs
   ◦ 35 to 48 yrs
   ◦ 50 to 64 yrs
   ◦ 65 yrs and over

[Q3] What is the highest level of education you have obtained?
   ◦ Primary or unfinished lower secondary education
   ◦ Secondary education
   ◦ Higher secondary education (to 17/18 yrs)
   ◦ University beyond (18 years and older)

[Q4] Do you do most of the shopping for food products in your household?
   ◦ Yes
   ◦ No
   ◦ As frequently as someone else in my household

[Q5] Are you currently on diet or following any health regime (e.g. fitness / weight control programme)?
   ◦ Yes
   ◦ No
[Q6] Do you or people close to you (e.g., family members) have any of the following health problems?

<table>
<thead>
<tr>
<th>Health Problem</th>
<th>Myself</th>
<th></th>
<th>Someone in my family</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight / Obesity</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Cardiovascular / Heart disease</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Hypertension</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Irritable bowel syndrome (IBS) or other digestive problems</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Diabetes</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Cancers (any type)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>High blood cholesterol levels</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Osteoporosis or other bone problems</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Other chronic diseases</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

[Q7] To what extent do you either agree or disagree with each of the following statements about your interest in healthy eating?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The healthiness of food has little impact on my food choices</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I am very particular about the healthiness of food I eat</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I eat what I like and I do not worry much about the healthiness of food</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>It is important for me that my diet is low in fat</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I always follow a healthy and balanced diet</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>It is important for me that my daily diet contains a lot of vitamins and minerals</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>The healthiness of snacks makes no difference to me</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I do not avoid foods, even if they may raise my cholesterol</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
### Q8
To what extent do you either agree or disagree with each of the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I don’t like to have to do a lot of thinking</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I try to avoid situations that require thinking in depth about something</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I prefer to do something that challenges my thinking rather than something that requires little thought</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I prefer complex to simple problems</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Thinking hard and for a long time about something gives me little satisfaction</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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</tbody>
</table>

### Q9
To what extent do you either agree or disagree with each of the following statements?

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<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is necessary for me to know the exact content of food products</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I do not need to know exactly how much energy, fat or other nutrients a product contains</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>It bothers me if exact nutritional and health-related information is not available in food product</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I am happy with general labels about nutrient content e.g. low-fat, without the need to know the exact amount</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

### Q10
To what extent do you either agree or disagree with each of the following statements?

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<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My initial impressions of things are almost always right</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I trust my initial feelings about things</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>When it comes to trusting something, I can usually rely on my ‘gut feelings’</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I believe in trusting my hunches’</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>I can usually feel when something is right or wrong, even if I can’t explain how</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
**Definition:**

“Health claims are any messages conveyed in text or images that state, suggest or imply that a relationship exists between a food category, a food or one of its constituents and health.”

---

**Q11.** To what extent do you either agree or disagree with each of the following statements about health claims defined above?

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<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am interested in looking for health claims on food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I pay attention to health claims on food</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I often use health claims on food while shopping</td>
<td></td>
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**Q12.** How often do you use the following information on the food labels when you go food shopping?

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<th>Information</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Quite often</th>
<th>Very often</th>
</tr>
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<tbody>
<tr>
<td>Text based health claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Image based health claims</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

---

**Q13.** To what extent do you either agree or disagree with each of the following statements about your knowledge of health claims?

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<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compared to most people, I am quite knowledgeable about health claims</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Compared to most people, I am more confident in using health claims to make a food choice</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>I feel confident about my ability to understand health claims on food labels</td>
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</table>

---

Thank you for your time.
Appendix 4

Study 4 - All factors and interactions (ANOVA Table). Repeated measures ANOVA results for subjective healthiness ratings (DV1) and error scores (DV2)

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<th>DV2*</th>
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<td>System</td>
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</tr>
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### Within subjects factors and interactions

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*Results for DV2 are only shown where the values differ from those of DV1.
AUTHOR PUBLICATIONS

First author;


Co-author;

Scarborough, P., Matthews, A., Eyles, H., Kaur, A., Hodgkins, C., Raats, M.M. and Rayner, M. (2015) ‘Reds are more important than greens: how UK supermarket shoppers use the different information on a traffic light nutrition


