

FOOD BEHAVIOURS The International Evidence

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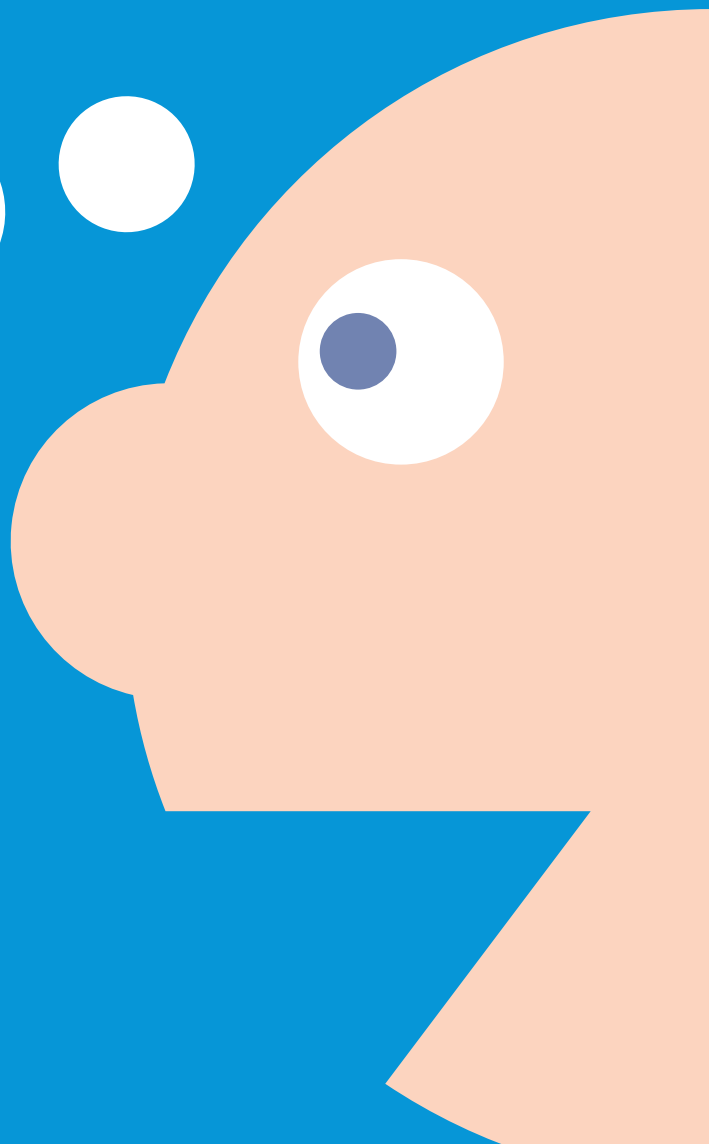
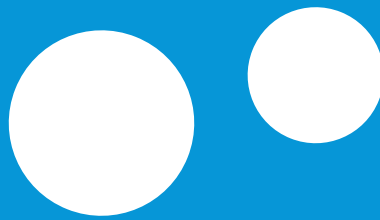


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Abbreviations

BSE	Bovine Spongiform Encephalopathy
EU	European Union
FSA	Food Standards Agency
FSAI	Food Safety Authority of Ireland
GM	Genetic Modification
HBM	Health Belief Model
HPA	Health Promotion Agency
HSE	Health Service Executive
IOI	Island of Ireland
NI	Northern Ireland
NSFC	North South Food Consumption
PHA	Public Health Agency
ROI	Republic of Ireland
SLAN	Survey of Lifestyle, Attitudes and Nutrition in Ireland
UK	United Kingdom
USA	United States of America

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Glossary

Affect Heuristics: It is one of the ways in which human beings show bias in making a decision, which may cause them to take action that is contrary to logic or self-interest.

Attitude ambivalence: Attitude ambivalence is one of the dimensions of attitude. Ambivalence of an attitude refers to the ratio of positive and negative evaluations that make up that attitude. The ambivalence of an attitude increases as the positive and negative evaluations get more and more equal.

Cognitive dissonance: Cognitive dissonance is a theory of social psychology in which an uncomfortable feeling is caused by holding conflicting ideas simultaneously. People may change their beliefs, attitudes and actions but in turn reduce their dissonance by justifying, blaming and denying the change that they have made.

Extroversion: A model of personality in which one is energised by the outer world and takes pleasure in being involved in large social gatherings. An extrovert is outgoing, enthusiastic and talkative and is generally a person who may act before they think.

Food neophobia: Food neophobia is an eating disorder sometimes referred to as the "fussy eating" disorder. It encompasses children's avoidance of, and reluctance to taste, unfamiliar food. As the word 'neo', means 'new', and the word 'phobia' means fear, it quite literally means a fear of trying new things.

Food trajectory: Trajectories are persistent thoughts, feelings, strategies, and actions over one's lifespan, which fundamentally influence the development of his or her personal system for making food choices.

Example: A person may grow up with the family tradition of eating a salad at every evening meal and continue that trajectory for much or all of his or her life.

Health fatalism: Fatalism is a doctrine that describes how all things are subject to fate and take place by inevitable necessity. Therefore health fatalism describes how one's health is subject to fate, is predetermined and how we are powerless to change health outcomes.

Hedonic: Hedonic relates to characterising, or pertaining to pleasure. Hedonism is a school of thought which argues that pleasure is the only intrinsic good. This is often used as a justification for evaluating actions in terms of how much pleasure and how little pain (i.e. suffering) they produce.

Example: A hedonic model of wages might correspond to the idea that there are compensating differentials - that workers would get higher wages for jobs that were more unpleasant.

Heuristics: Refers to experience-based techniques and intelligent guesswork for problem solving, learning, and discovery rather than pre-established formulas. Heuristic methods are used to speed up the process of finding a good enough solution, where an exhaustive search is impractical. Examples of this method include using a "rule of thumb", an educated guess, an intuitive judgment, trial and error or common sense.

Infra-structural changes: Changes in infrastructure (Physical: buildings, roads and water supplies, or Organisational: underlying bases or foundations for organisations or communities) which may be needed for the functioning of a community or society.

Locus of control: Is a behavioural term which refers to the extent to which individuals believe that they can control events that affect them. Individuals with a high internal locus of control believe that events result primarily from their own behaviour and actions. Those with a low internal locus of control believe that powerful others, fate, or chance primarily determine events.

Nanotechnology: Nanotechnology (sometimes shortened to "nanotech") is the study of manipulating matter on an atomic and molecular scale with dimensions of the nanoscale ranging from 1 to 100 nanometres (nm). In its original sense, nanotechnology refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete, high performance products such as many new materials and devices with a vast range of applications, such as in medicine, electronics, biomaterials and energy production.

Neuroticism: Neuroticism is a fundamental personality trait in the study of psychology. It is an enduring tendency to experience negative emotional states. Individuals who score high on neuroticism are more likely than the average to experience such feelings as anxiety, anger, guilt and depressed mood, and respond poorly to environmental stress.

Postpartum: Postpartum refers to the period of time immediately after delivery of a baby and extending for about six weeks. Postpartum refers to the mother whereas postnatal refers to the baby.

Pro-social behaviour: Pro-social behaviour is caring about the welfare and rights of others, feeling concern and empathy for them along with involvement in voluntary actions that are intended to help or benefit another individual or group of individuals. Pro-social behaviour refers to the consequence of doer's actions rather than the motivations behind those actions.

Psychometric: Psychometrics is the field of study concerned with the theory and technique of educational measurement and psychological measurement, which includes the measurement of knowledge, abilities, attitudes and personality traits. The field is primarily concerned with the construction and validation of measurement instruments, such as questionnaires, tests and personality assessments.

Resilience: Resilience in psychology is the positive capacity of people to cope with stress and keep their cool when problems or setbacks occur. This coping may result in the individual "bouncing back" to a previous state of normal functioning, or using the experience of exposure to adversity to function better than expected. Resilience is most commonly understood as a process, and not a trait of an individual. Most research now shows that resilience is the result of individuals interacting with their environments and the processes that either promote well-being or protect them against the overwhelming influence of risk factors. Closely related with resilience are the terms "hardiness", "resourcefulness" and "mental toughness".

Satiety: The feeling or state of being fed or gratified to or beyond capacity or satisfaction. It can be described as an absence of hunger.

Social cognitive theory: Social cognitive theory is a learning theory that is used in psychology to understand, predict and change human behaviour. It is based on the idea that people learn by watching others, as well as being influenced by certain aspects such as the environment, individual situations, expectations and individual self-control, amongst many others factors.

Introduction

1.1 Background

In the past, **safefood's** consumer focused reviews (CFRs) have focused on key food chains including chicken, finfish, fruit and vegetables, milk, beef and pork. The reviews aimed to address consumer concerns surrounding food safety, production methods and nutritional issues related to key foods, with a view to communicating directly to consumers on those issues. More recently, there has been a shift in emphasis by **safefood** to address broader issues of consumer concern, such as food origin.

The aim of the current CFR is different from previous reports. Instead of addressing key consumer food concerns, it focuses on understanding consumer food behaviour. Its primary aim is to inform the research, policies and practices of all those working towards changing consumer food safety and dietary behaviour on the island of Ireland and to ensure that communication with consumers is both evidence-based and effective.

safefood is an all-island body charged with conducting research, facilitating cross-jurisdictional working and promoting food safety and healthy eating messages to consumers, primarily at a population level. This is done through mass communication including print, radio, television and the web. **safefood** also collaborates with a variety of partners to promote better healthy eating and food safety practices on a community level or in specific settings, including schools, colleges, workplaces and community groups. While the principles of health promotion are used to guide our work, the nature of **safefood's** work means that a social marketing framework is most appropriate in many cases and this is reflected in the scope and focus of this report.

Equally, for the purposes of the report, **safefood** has identified key priority areas. The food safety section (Part 1) focuses on consumer food safety behaviour, in particular, domestic food safety behaviour. However, other aspects of food safety such as technological and chemical risks are also featured in the document because of how they can affect consumer behaviour. The report does not address the practices of those working in the food processing or catering sectors.

The nutritional issues include obesity, high fat and saturated fat intakes, high salt intakes, frequency of sugar consumption, low fruit and vegetable intakes and low intakes of complex carbohydrates. The organisation is also particularly concerned with poverty as an important environmental influence on food choice and food behaviour. **safefood** acknowledges that the public health issues that are the focus of this report are not exhaustive. Clinical issues, for example malnutrition in the elderly or nutrition for patient groups, are not covered here, nor are issues such as breastfeeding, which is currently mainly being addressed by practitioners who have face-to-face contact with new and expectant mothers, and those working in

community support. While **safefood** has identified specific issues on which to focus this report, it is clear that many of the findings may be applicable to a variety of public health issues.

The methods used to compile the report are varied. For the chapters that are primarily literature reviews, extensive online searches were conducted using a variety of scientific literature databases including PubMed, Scientific Citation Index, PSYCINFO, Web of Knowledge (including Web of Science and ISI database), Google Scholar, Science Direct, Business Source Premier and Emerald. Our searches for information on behaviour change on the island of Ireland included literature searches, consultation with experts, both internal and external to **safefood** and searches of the websites of key food and health agencies including the Food Standards Agency, The Food Safety Authority of Ireland, the former Health Promotion Agency and the Departments of Health in NI and in ROI.

The protocols for the original research described in Volume 1, Chapter 3 and Volume 2, Chapter 3 were developed to help address some of the research gaps identified through our search for local information on food behaviour. Both qualitative and quantitative methods were used and are described in detail elsewhere (see Chapter 3). In brief, 12 focus groups were carried out with a variety of different socio-demographic groups, six in food safety and six in nutrition. These aimed to identify key influences, barriers and promoters of food safety and nutrition behaviour. The quantitative survey was carried out using face-to-face interviews in a nationally representative sample of 804 (504 in the Republic of Ireland (ROI) and 300 in Northern Ireland (NI)) and explored knowledge, attitudes, perceptions and behaviours in relation to both food safety and healthy eating.

The report has been developed in four sections. The introductory section provides an overview of the environmental, social and personal factors that can affect food behaviour. Volume 1 outlines the historical context of food safety issues on the island of Ireland (IOI), explains the major current public health issues and describes the available research on influences on food safety behaviour. Volume 2 provides the same information in relation to public health nutrition. Volume 3 relates to behaviour change and explores the development of behaviour change methods, current understanding of best practice and learnings from intervention studies. Recommendations for further research and for communication of changing food behaviour on the IOI have also been developed for each part of the report.

1.2 Terms of reference

The report will:

1. Provide an overview of the current understanding of the environmental, socio-economic and personal factors that influence food behaviour
2. Give an account of the major food safety and public health nutrition issues on the island of Ireland and explain the related behaviours
3. Outline food behaviour research conducted on the island of Ireland and identify research gaps and priorities
4. Examine best practice in changing food behaviour in relation to the key issues identified above and with an emphasis on communication to vulnerable groups
5. Review interventions that have been carried out in relation to key nutrition and food safety behaviours and outline from these factors that may promote successful behaviour change
6. Develop recommendations for further research where knowledge gaps have been identified through the review process
7. Develop recommendations for best practice in food and health communication based on current knowledge.

1 Influences on food-related behaviour

1.1 Introduction

1.2 Culture and wider environment

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1.5 Attitudes, perceptions and beliefs

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References

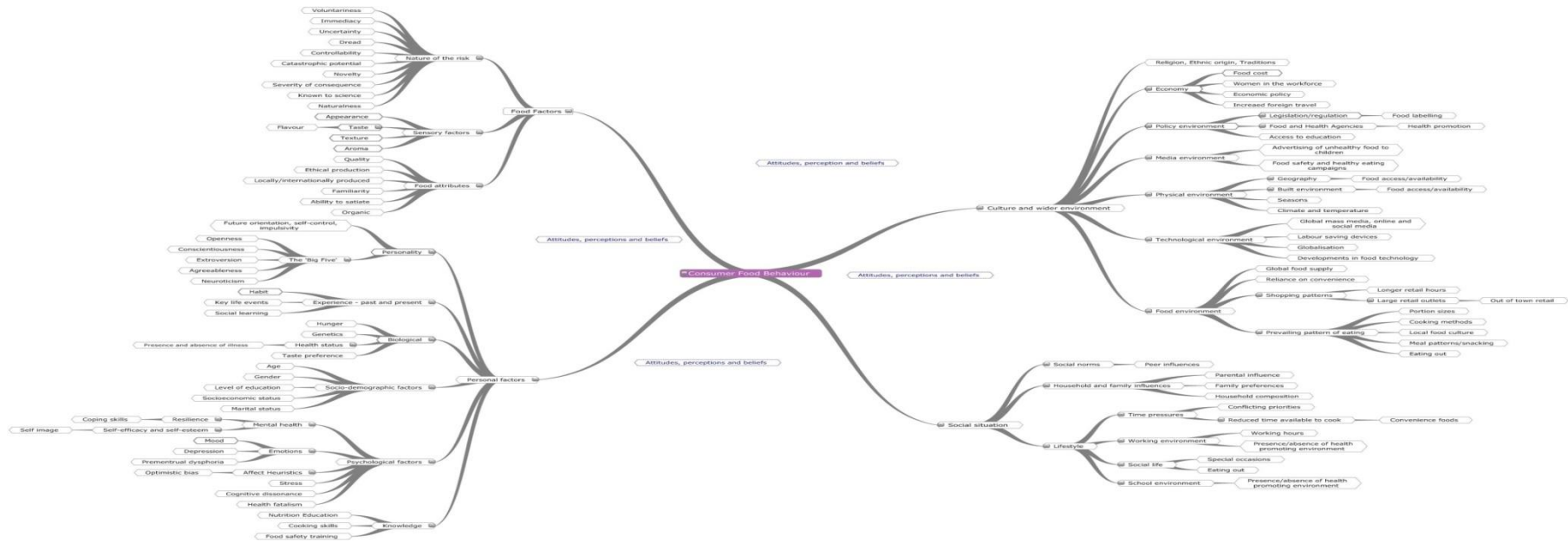
Key findings

- Influences on food behaviour are multi-factorial and include wider environmental, social influences, personal factors, psychological factors and the nature of the food risk (see Figure 1.1).
- Much research has focused on personal influences on food behaviour rather than social or wider environmental influences.
- Nutrition-related behaviour has been investigated to a far greater degree than domestic consumer food safety behaviour.
- The relationship between knowledge, attitudes and perceptions and food-related behaviour remains unclear and may be affected by a variety of factors.
- There are clear socio-demographic differences, particularly gender differences, in food-related behaviour which must inform behaviour change programmes. Men appear to be more at risk.
- An emphasis on positively influencing food behaviour in early childhood is warranted because of the potential for impact on lifetime behaviour.

1.1 Introduction

A great deal of emphasis has been placed on the role of nutrition and food safety knowledge, attitudes, perceptions and beliefs in the selection and handling of food (1). There are many ways to categorise influences on food behaviour but, for the purposes of this review, influences on consumer food behaviour are categorised as; culture and the wider environment, social situation, personal factors and nature of food or food risk (see Figure 1.1). It must be acknowledged here that these influences interact and are difficult to disentangle. Therefore, the aim of this chapter is to describe the influences on food-related behaviour and to highlight its complexity, rather than to quantify each influence. In practical terms, the factors influencing food choice encompass all possible answers to the question '*why do we eat what we do?*' (2). In terms of food safety, this can be extended to '*why do we store, prepare and cook food the way we do?*' Understanding the factors associated with food-related behaviours will help those aiming to change food behaviour to design effective programmes (3-4).

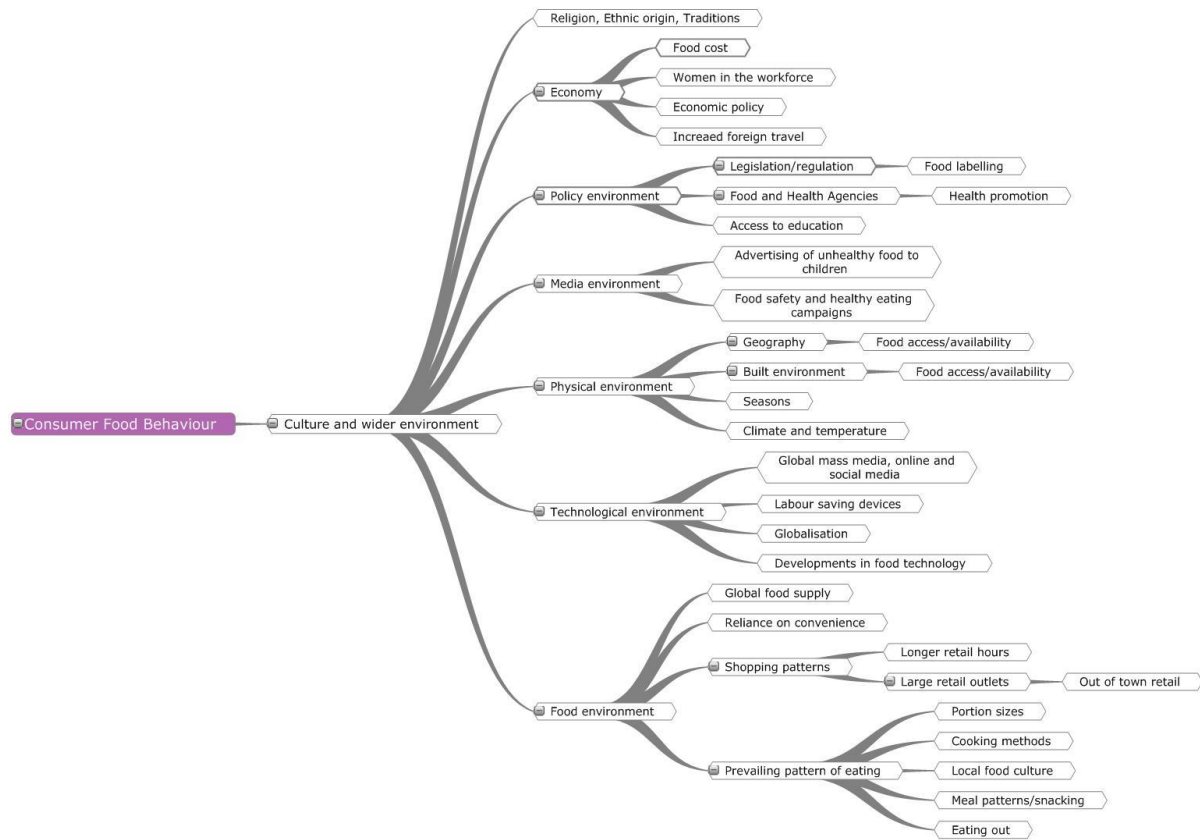
Figure 1.1: Influences on food safety and nutrition behaviour



1.2 Culture and wider environment

While efforts to change food-related behaviour often focus on individuals, health promotion principles have long acknowledged the impact of the wider and social environment (5). In recent years major policy documents, particularly in relation to obesity, have also highlighted wider environmental influences, for example the Foresight report in the United Kingdom (UK) and the Obesity Task Force in the Republic of Ireland (ROI) (6-7). Economic factors, the policy and legislative environment, access to education, location (food access/availability), season, culture, tradition and religion, and the media environment can play a significant role in influencing consumer food behaviour (Figure 1.2). The cultural environment influences a person's attitude, knowledge and experiences in relation to food behaviour and includes the external opportunities and barriers that the environment offers for developing and maintaining healthy behaviours. It is one of the main factors affecting food choice (8) and has a major influence on consumer food behaviour (9-10).

Figure 1.2: Culture and the wider environment



1.2.1 Culture

Cultural values are important predictors of consumers’ opinions about products and issues (11). Cultural and religious influences lead to differences in the habitual consumption of certain foods, portion sizes and meal patterns and to varying traditions of preparation. In certain cases it includes restrictions such as exclusion of meat and milk from the diet (12).

Recent years have brought dramatic changes to our eating culture and patterns, stimulated by changes to the retail environment and food availability, with 24 hour access to food now the norm. The causes of these retail and food developments can be attributed to both supply and demand factors. Changes in food retailing have been driven by the industrialisation of agriculture and commercial forces, but these in turn have been influenced by socio-economic and cultural shifts, such as the growing number of women in employment and increasing car ownership (13). Together, these factors have led to a greater demand for one-stop shopping and a greater willingness to travel to shops viewed as offering better value for money, quality and range of goods (14). Similarly shopping patterns have evolved with a move towards once a week shopping in large supermarkets and access to a wider variety of foods (15).

1.2.2 The physical environment

The physical environment includes factors such as geography, climate and season. Ambient temperature is a key factor with regard to food safety. Geography can affect access to information and facilities, and food availability, which is particularly relevant for food poverty (16). Barriers to fruit and vegetable intake have been studied extensively and provide rich data that may be applicable to healthy eating in general. Socially deprived areas may lack local sources of reasonably priced, good-quality fruit and vegetables, causing a vicious circle of poor demand and supply. People on lower incomes have less access to cars and out-of-town shopping centres, and are less able to carry and transport food in bulk (17). A recent study of 10,364 individuals, based on the SLÁN study and conducted in the ROI, showed that food availability, measured in terms of access to different types of food outlets, did have a small influence on dietary quality. The authors also concluded that this could influence socio-economic inequalities in health (18).

Recent research has also highlighted the built environment and its effect on energy balance. The space in which a person lives can present both opportunities and barriers for physical activity and adherence to dietary recommendations. The built environment encompasses a range of physical and social elements that make up the structure of a community and may influence obesity in particular (19). Within the built environment, individual caloric consumption and dietary quality depends on spatial access to foods of differing type. Caloric expenditure depends on opportunities for physical activity and active transport. The built environment can be partitioned according to these intake and output pathways into the food, land use and transportation, and physical activity environments (20).

1.2.3 The economic environment

The current economic situation highlights the importance of the economic environment in affecting the lifestyles of people on the island of Ireland (IOI). For consumers, increasing unemployment, falling incomes and limited resources may affect their ability to buy healthy foods, and in extreme cases, may mean that they have inadequate facilities for safe food storage and preparation. On the other hand, such changes could give rise to an increase in home cooking and use of leftovers. Competing economic priorities can also affect the government's ability to both invest in food and health research and create health-promoting environments for consumers.

The price of food can be influenced by a wide range of economic factors including supply and demand, production and manufacturing costs, competition, and economic policy such as taxation. Food costs play a significant role in determining eating patterns and health behaviours (21-23). According to Popkin *et al.* (2005) individual food choice is also affected by pricing (24). Both adults and adolescents indicate price as the one of the most influential factors determining food choice (25-28).

1.2.4 The food and health policy environment

From a food and health policy perspective, the establishment of health-promoting bodies with responsibility for food safety and nutrition has the potential to change the wider environment by improving public confidence, promoting awareness, providing information resources and by changing the legislative environment. On the IOI these bodies include the Departments of Health, the Food Standards Agency (FSA), Food Safety Authority of Ireland (FSAI), *safefood*, the Public Health Agency (PHA) and the Health Service Executive (HSE)'s Population Health Directorate and others. Key policy areas relating to food safety and nutrition on the IOI are addressed in Volume 1, Chapter 1 and Volume 2, Chapter 1.

1.2.5 The media environment

The media environment plays a significant role with regard to influencing children's and adults' food-related behaviour. While the media has the potential to positively influence food safety and nutrition behaviour it is also the vehicle for advertising unhealthy foods. Children are becoming consumers at younger ages, and a variety of influences and experiences shapes their consumer habits. Of particular interest and concern are factors that affect their food habits (29). The marketing of energy-dense, nutrient-poor foods that are high in fat, sugar and salt has been shown to affect children's food choices and to be a contributing factor in obesity. The need for restrictions on marketing and advertising has been highlighted in a number of recent international reports (30-33) and there is some evidence of policy development in this area (34).

The rapid rise in the use of social media on both the IOI and globally, and the increase in importance of 'word of mouth' marketing indicates that this medium may become an important influencer of many behaviours, including food-behaviour. As yet, however little is known about the power of social media in influencing food related behaviour. One major EU study is currently examining the use of social media as a means to communicate food risks and benefits to consumers across Europe. The aim of this study is to create a communication toolkit and 'best practice' recommendations to help EU wide organisations improve their communication, information and education services to the public (35).

1.2.6 The technological environment and food supply

Rapid worldwide shifts in technological innovations have affected diet and activity by reducing energy expenditures during leisure, transportation and work. This has been accompanied by a globalisation of

modern food processing, marketing and distribution techniques and global mass media that has dramatically changed the food landscape (36).

Early research on food production methods such as freeze-drying, compression, chemical and biological preservatives, and flexible packaging has evolved into cutting edge research on a variety of novel and emerging food processes including genetic modification and nanotechnology. According to Cardello (2003), in the case of novel foods, or foods that have been processed by novel or emerging technologies, concerns about the nature of the food and/or the nature of the processing technologies that have been used, become paramount considerations for the consumer (37). Changes in food production, processing, distribution and consumption at a global scale have impacts well beyond the direct health and wellbeing of consumers. They have major economical, social and environmental impacts which may affect consumer opinion and behaviour (38).

Technological and infra-structural changes in the food supply chain and the ever expanding trade worldwide have changed the pace and distances from which an enormous variety of foods are brought to the consumer's home (38). For example, according to Bord Bia (2008), consumers in the ROI now spend just over €4 billion (£3.7 billion) or €1,000 (£921) per person annually on imported food, a figure which increased by 50 per cent in the years 2000-2007. This type of large scale and international food production has heightened the necessity for strict regulatory processes for food safety. Reported outbreaks now often require major food recalls and are accompanied by widespread consumer communications programmes.

Over the past decade, convenience has emerged as a key factor in consumer food choices (15). With increasing prosperity and changing social and work conditions, many people are eating out of home more frequently (39). The increase in the number of women in the workforce was found in a study by **safefood** in 2001, to be the main reason for a decline in the time spent in the kitchen. Meal preparation time was then down to twenty minutes (39).

During the 1990s these social changes accompanied significant expansion within the retail sector, and the arrival of new outlet types and retail brands previously unseen in the ROI (15), with similar changes in Northern Ireland (NI). Furthermore, longer shopping hours was established, with retailers opening on public holidays, Sundays, etc.

Over the last few decades, there has been an increase in the demand for better quality and more varied types of food. Disposable income increased through the economic boom, travel to other countries became more common, people ate out more frequently and tastes diversified. New food values emerged such as a desire for healthier foods, organic foods or fair trade food, as key examples. Furthermore, consumer tastes and preferences have also diversified. Consumption of ethnic¹ cuisine has increased in the past decades as a consequence of the growing international trade, migration, tourism and globalisation (41). People's attitudes and perceptions of food from different cultures have changed

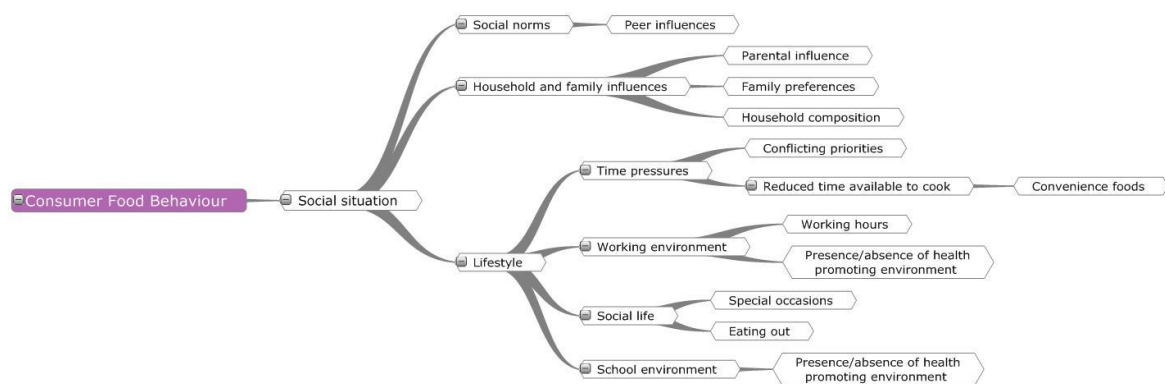
¹ Ethnic foods are those which originate outside of Europe (40) Howitt S. Ethnic Foods: Keynote Market Research. Chartered Institute of Marketing. 1996.

dramatically, resulting in a move from traditional foods to more ethnic varieties (42). There are now, for example, approximately 728 ethnic restaurants on the IOI (677 ROI and 51 NI) (43).

1.3 Social situation

Dietary patterns have shifted remarkably across the globe over the past several decades. The food we eat, the location of eating, the number of eating events, and the people with whom we share our meals have changed (24), as have shopping habits. Social norms, household composition, time availability, family influence and family preferences, time and working hours, and social events are some of the many social factors that can impact or influence consumer food behaviour and are discussed below (Figure 1.3).

Figure 1.3: Social situation



1.3.1 Household or familial influences

At a household or ‘family’ level many factors are known to contribute to dietary behaviour including disposable income and practical constraints within the household such as the availability and adequacy of facilities for preparation, cooking, storage, and the consumption of food. Gender and the knowledge and skills of those purchasing, preparing, storing and serving food are also important (44).

Several studies have examined how household composition may be influential. For example, there is some evidence that those in married situations are more likely to comply with dietary guidelines (45). Family support may be an effective way of increasing healthy food intake (46). However, there is also evidence that body weight in men may increase in marriage (47). From a food safety perspective, those living in a single-person household may exhibit less safe cooking behaviour, as compared to those in households comprised of more people (48-49).

The influence of family on children’s food choices is known to be powerful. Klesges *et al.* (1991) showed that children selected different foods when they were being watched by their parents compared to when they were not (50). Olivera *et al.* (1992) reported a correlation between mothers’ and children’s food

intakes for most nutrients in pre-school children, and suggested targeting changes in parents' diets to try to improve that of the children's. Contento *et al.* (1993) found a relationship between mothers' health motivations and the quality of children's diets, and Brown and Ogden (2004) reported consistent correlations between parents and their children in terms of reported snack food intake, eating motivations and body dissatisfaction (51-53). Parental behaviour and attitudes are therefore central to the process of social learning, with many studies highlighting a positive association between parents' and children's diets. For example, the results from the National Children's Food Survey in the ROI demonstrated that children whose parents show food neophobia, or reluctance to taste unfamiliar foods (54-55), also demonstrated food neophobia themselves (56). However, in some cases there is evidence that mothers' and children's diets are not always in line with each other (57).

1.3.2 Peer influences

In adolescents, who have a greater role in making their own food choices, peer pressure, social acceptability and social norms play a significant role. Peer influence has been found to be correlated with a host of harmful health behaviours (58), including eating less healthy foods (59). Meyer (2008) found a significant positive correlation between peer influence and disordered eating among school children in Utah in the US. Further analyses revealed that peer influence was apparent in both males and females (60). Studies in the US have shown that social norms are associated with perception of body weight (61) and with unhealthy weight loss behaviours (62). Kelly *et al.* (2006) studied what parents think about influences on their children's diets. The authors found that 44 per cent of parents believed that peer pressure influenced a child's demands for healthy food with 60 per cent of parents stating the influence of peers on a child's demands for junk food (63).

1.3.3 Lifestyle

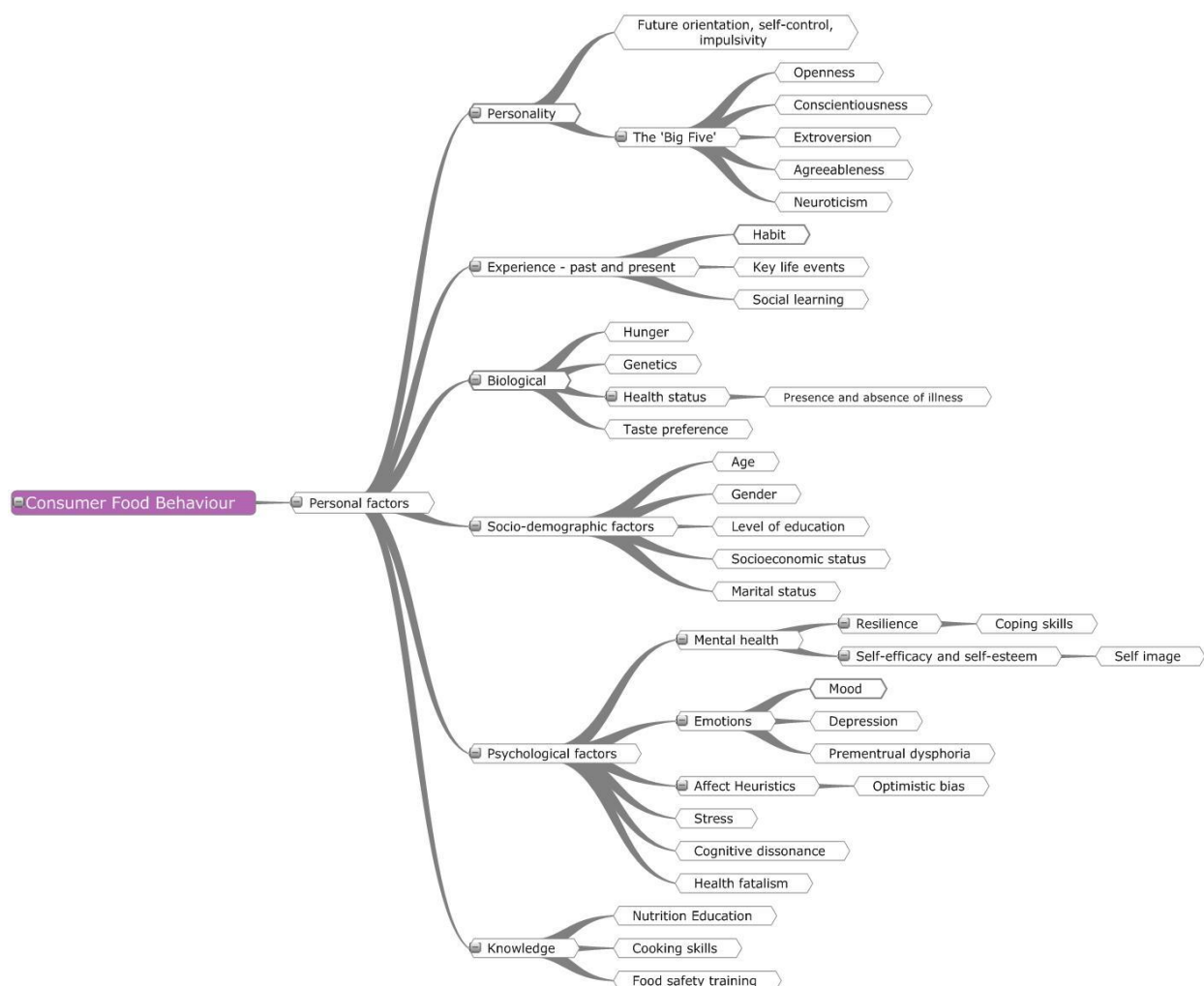
A major change on the IOI in recent years relates to lifestyle. The developments in food technology have brought huge change in the types of food that are available and the way that we buy, prepare and eat food. Economic development has changed the level of disposable income which has led to trends such as eating out more frequently. The North South Food Consumption (NSFC) Survey showed that 24 per cent of energy (calories) from food is now eaten outside the home (64). Increased working hours has meant that time available for food preparation is limited. In the European Union (EU) and in the ROI, irregular working hours and a busy lifestyle have been identified as key barriers to healthy eating (25). Bolton *et al.* (2005) also identified a range of food safety barriers in consumers in the ROI which included time constraints (65). For adolescents, the international literature has shown that convenience is a key factor. Jenkins and Horner (2005) carried out a review of the key influences upon adolescents' eating behaviours. Convenience was identified as a barrier, along with food availability, parental influences (cultural, religious), media, cost and lack of concern about eating healthy (66). Newmark-Sztainer *et al.* (1999) found similar results (67).

Beyond the home and family setting, social occasions also influence the way that people eat. There is evidence to suggest that people eat more food when in a group situation (68-69). The types of foods that we eat for social celebrations such as Christmas, Easter and birthdays also tend to be high in energy.

1.4 Personal factors

Figure 1.1 illustrates the wide variety of personal factors that can affect food-related behaviour. These are broadly categorised as personality traits, biological, socio-demographic and psychological factors, knowledge and experience, and resulting attitudes, perceptions and beliefs (Figure 1.4).

Figure 1.4: Personal factors



1.4.1 Biological

Genetics

Studies of monozygotic and dizygotic twins indicate genetic variation in food-related behaviours, including energy and macronutrient intakes. Studies have shown that the intakes of biological relatives were more closely related than adoptive relatives, and intakes of monozygotic (identical) twins are more closely related than dizygotic (non identical) twins. The findings are supported by experimental and molecular genetic studies in animals and humans (70). These studies suggested that several peripheral and central pathways, hormones and receptors thought to be involved in the regulation of calorie, fat and carbohydrate intakes, possess considerable gene sequence variation. For example, mutations in three genes causing obesity have been also associated with overeating, while five chromosomal regions have been reported to be linked with eating-disorders (71). Much work remains to be done in this area, but there is clear indication that genetics play a strong role in determining some aspects of food behaviour.

Hunger and sensory properties

The key driver for eating is of course hunger, but what we choose to eat is not determined solely by physiological or nutritional needs (72). Biological signals related to satiety and regulation of energy balance are clearly important but exist among a wide set of factors influencing voluntary decisions of what, when, and how much is eaten (73-75). People eat for both pleasure and as a biological necessity. This must be recognised if we are to begin to understand food choices and how to influence and promote dietary change (76). Some chemical and physical properties of food are perceived by the person in terms of sensory attributes, for example, flavour, texture or appearance, and tastes and preferences are important predictors of food choice (77-78). Certain expectations relating to the food such as perceived quality, familiarity and feeling of fullness may also be important.

Neumark-Sztainer *et al.* (1999) studied adolescents' eating patterns and found that food choices were influenced primarily by hunger and food cravings, food appeal, and amount of time available to eat (67). Research carried out by Stewart and Tinsley (1995) found that the influences on food choice that appear to be the strongest for working young adults are appearance of food and taste (79). EU data has shown that taste is an important self-reported influence on food choice, particularly for young males (80).

Health status

In general, people who have experienced, or are currently experiencing, dietary-related illness practice better food safety. If someone has experienced a negative outcome of poor food behaviour (for example

food poisoning, or a high cholesterol level) or someone known to them has done so, this also tends to crystallise the salience of the behaviour (81-82).

1.4.2 Socio-demographic factors

Consumers' attitudes towards food safety and healthy eating often differ according to demographic and socio-economic factors such as age, gender, educational level and economic status (83). These factors are outlined below.

Age

Age is an important factor in determining food-related behaviour for several reasons. The biological differences in children and young people in relation to the importance of sensory properties and factors such as neophobia have already been described. Equally, older persons may experience reduced appetite, early satiety, reduced sensory perception and the physical effects of poor dentition or medication (84).

The importance of health also seems to change with age. A pan EU study of adults aged 15 years and older showed that older individuals, females and more educated participants were more likely than others to select 'trying to eat healthy' as having a major influence (85). For young people, risk taking may be an inherent part of their youth (86). The concept of long-term health may be intangible and immediate effects can be more pertinent factors. For example, young EU consumers regarded 'convenience' as an important influence on food choice (80).

Studies conducted in adults have indicated that food safety knowledge tends to increase with age and practice; females have higher scores than males, and younger respondents show the greatest need for additional food safety education (87-90). Sanlier (2009) revealed that there is a significantly meaningful difference between food safety knowledge and food preparation practices of young and adult consumers (in favour of adult consumers) (91).

Era

The time in which an individual is born can also dictate attitudes to food and gender roles in the household. Other influences include developments in nutritional science, food science and technology, information technology and the resulting changes in the food environment in which people grow up and live (92). Children born in the 1990s eat very differently from children born in the 1950s (93), have different exposure to nutrition education and may live in households where both parents are working and time pressures are increased.

Gender

Gender differences in health behaviours have been reported in many studies but causal mechanisms have not been established. A pan-EU survey showed that women were more likely than men to report avoiding high-fat foods, eating fruit and fibre-rich foods and limiting salt (to a lesser extent) in almost all of the 15 countries surveyed. Women were also more likely to be dieting and attached greater importance to healthy eating (80) while for males, especially young males, 'taste' of food was regarded as important. Those who actively sought out nutrition information also tended to be females between 35-54 years of age and had at least secondary level education (80). Gender differences in food choices, therefore, appear to be partly attributable to women's greater weight control involvement and partly to their stronger beliefs in healthy eating.

In relation to food risk perception, Dosman *et al.* (2001) examined the influence of socio-economic characteristics on the risk perceptions of three food safety health-risk issues: pesticides on food, food bacteria, and food additives (94). In addition to variables such as household income, number of children, and age, gender was the most robust determinant of an individual's perception of the risk of the issue in question. Women perceived greater risk than men. The authors suggested that this may be explained by the fact that women were still responsible for the majority of food preparation and purchases.

Kennedy *et al.* (2005) demonstrated that consumers could be segmented successfully based on their food safety knowledge and reported practice (95). The authors identified three groups of consumers based on the knowledge factors, i.e. conscientious, cavalier and careful food handlers. Members of the cavalier food handler group were more likely to be male and engaged in less hygienic food handling practices (95). McCarthy *et al.* (2007) also identified an 'At-Risk' segment with less than ideal food safety practices and significantly lower knowledge about food safety and food science issues. Members were again more likely to be male (96).

Educational status

While studies indicate that the level of education can influence dietary behaviour positively in adults (97), research suggests that for domestic food safety practices, highly educated people may be less safe in terms of their cooking skills. For example, highly educated people may be more involved in work outside the home and less likely to cook routinely or eat at home. Arguably, factors such as this may lead to more careless cooking practices (98). Fischer and Frewer (2008) suggested that less formally educated women might need less information about safe cooking practices, as they already cook more safely than do other groups within the population (99). In addition, highly educated people may have a higher internal locus of control (100), may exhibit less trait worry (101), and may be more optimistic about their ability to perform a given task (102).

Socio-economic status

The economy and price have been discussed previously as wider environmental influences. An extensive body of research confirms the relationship between socio-economic deprivation and health inequality and poorer health outcomes (103). Among EU consumers, 'price' was one of the top three perceived influences on food choice (25) and was particularly important for low income groups such as unemployed or retired participants. Elkenberry (2004) reported that the most frequently cited barriers to healthy eating were time and financial considerations among a low income Minnesota community (46). Nestle and colleagues (1998) also reported that economic considerations may serve as barriers to meeting dietary recommendations (104). This suggests that interventions focusing on quick and easy, healthy, less-expensive food preparation or selection of more convenient yet inexpensive, healthy food may help overcome the most common barriers in this population. In relation to food safety knowledge and behaviour, the relationship with socio-economic status is unclear with studies showing equivocal results (95-96).

1.4.3 Personality

The Big Five

Personality traits may guide people to behave in characteristic ways across many situations (105). The 'Big Five' model is often used to describe personality (105). Factors include openness, conscientiousness, extroversion, agreeableness and neuroticism (emotional stability). Several studies have examined the relationship between these personality dimensions, health behaviours and attitudes (106). Lemos-Giráldez showed that conscientiousness and agreeableness were particularly noteworthy as predictors of health behaviours, cognitive attitudes and tendencies in a student population. Personality type has also been shown to be associated with self-regulation (106).

Time orientation, self-control and impulsivity

A further element of personality that has been related to poorer health-related behaviour is time orientation. Those without future orientation expectations for the future and thoughtfulness about the future as defined by Nurmi (1991) (107) have poorer health behaviours and tend to have lower socio-economic status (108-109). Other authors have examined traits such as self-control and impulsivity and the conflict between these two aspects of behaviour (110). Self-control involves elements such as reasoned attitudes, behavioural intentions and restraint. However, a preconceived plan may fail in the face of temptation and this may result in a hedonic or impulsive response. Many health behaviour models are based on the premise of reasoned action (111-113). Impulsivity may be further influenced by alcohol consumption, mood and habituation (110). Much remains to be investigated in relation to personality and food-related behaviour but initial research suggests that elements of personality can influence food-related behaviour and willingness to take risks.

1.4.4 Psychological factors

Many psychological factors have been investigated in relation to attitudes, perceptions and behaviour with regard to both food safety and nutrition-related behaviours. Fischer and Frewer (2008) investigated the role of psychological determinants in consumer behaviour regarding food preparation in the home environment. The authors found that self-esteem, perception of vulnerability and affect heuristics such as optimistic bias may all influence how risk messages are accepted, and whether an individual is likely to change related risk behaviour (49). Further evidence relating to these factors and others is outlined below.

Self-efficacy

The relationship between self-efficacy and health behaviour has been investigated since the 1960s. Self-efficacy is the belief in your own ability to successfully perform a specific behaviour. It has been included in several models of health behaviour as an important predictor of behaviour change. Social cognitive theory proposes that a range of personal cognitive factors can help to predict health behaviour and behaviour change, including eating behaviours, in adults (114-117). Of these cognitions, the most important are observational learning, expectations and self-efficacy (112). Confidence and self-efficacy have been reported as a barrier to fruit and vegetable consumption in a large US study of adults (118). A study of 1,438 young adults aged 18 to 24 years in the United States of America (USA) also identified confidence in buying, preparing and eating fruit and vegetables among men as a key barrier to healthy eating (119). In the EU, participants in a pan EU survey reported 'lack of willpower' as one of the top five barriers to changing their food behaviour(25).

Stress, depression, mood and emotions

Psychological stress is a common feature of modern life and can modify food choice (120). Psychological characteristics such as restrained or emotional eating, depression and premenstrual mood changes predict the tendency to choose high-density foods/low-energy foods when stressed (121). Moods and emotions are also considered as influences on food choice. For example, Patel *et al.* (2001) showed that both positive and negative moods increased food consumption (69), Epel *et al.* (2001) showed that increases in negative mood in response to events or situations that caused stress were significantly related to greater food consumption (122). Food cravings also appear to be associated with mood (123).

Optimistic bias

'Optimistic bias' occurs where people tend to ignore information about health risks because they perceive their own health risks to be lower than those of an 'at risk' member of the population. This type of bias has been observed in connection with high fat diets, in relation to personal risk, risk for other people and to society (124), and could constitute an important barrier to behaviour change.

Cognitive dissonance

Perhaps related to optimistic bias is a desire to overcome cognitive dissonance. Cognitive dissonance is an uncomfortable feeling caused by holding two contradictory opinions, beliefs or items of knowledge simultaneously. The theory of cognitive dissonance proposes that people will reduce dissonance by changing their attitudes, beliefs, and behaviours, or by justifying or rationalising them (125). A good example is the mismatch between smoking and the understanding that smoking is bad for your health. The mismatch sometimes can result in a person giving up smoking, or alternatively a person will rationalise their choice 'my grandfather smoked 20 a day until he was 95 and he didn't get cancer'. Both optimistic bias and the rationalisation of cognitive dissonance may present mental coping mechanisms for dealing with the threat of consequences of our health behaviours.

Health fatalism

Health fatalism, which is a belief that health is determined by external factors and that people have little or no control over their own health, also may result in individuals failing to address health issues or to adopt preventative behaviours. Health fatalism has been linked to self efficacy (126). There is evidence of health fatalism in minority ethnic groups that has led to health disparities ((127), (128-130). Recently Kearney *et al.* (2008) have shown that fatalism increased with declining education and social class status in older EU adults. Health fatalism was associated with poorer dietary habits including lower fruit and

vegetable, breakfast cereal and fish intakes, along with higher intakes of potatoes and potato products, particularly among disadvantaged women on the IOI (131).

Resilience

More recently, resilience has been investigated in relation to food and health behaviours. Resilience is described as the capacity of people to cope with stress and adversity. It also includes the ability to 'bounce back' after a disruption and the ability to use exposure to stress to provide resistance to future negative events. Resilient individuals possess personal attributes such as an internal locus of control, pro-social behaviour, empathy, positive self-image, optimism and the ability to organise daily responsibilities. These attributes help individuals to cope during stressful times (132). Although more often studied in relation to neglected and marginalised children and those who had experienced extreme adversity (133), resilience has recently been studied in relation to obesity. Early results from the Lippene study have shown a relationship between resilience and waist circumference in older EU adults (134), perhaps indicating that building resilience may help protect against obesity.

1.4.5 Past behaviour, experience and habit

Despite the complexity of personal factors that can affect food behaviour, past behaviour, habit and hedonic appreciation are usually better predictors of actual food choice behaviour than psychological constructs like attitudes and intentions (135). With regard to food safety influences, habit and past experience have also been suggested as possible reasons for unsafe food behaviour. According to Fischer and Frewer (2008), people with responsibility for food preparation tend to prepare food often over a period of many years (136). This pattern of repetitious behaviour fits Aarts and Dijksterhuis' (2000) main criterion for habit formation: "when a behaviour has been performed many times in the past, future behaviour becomes increasingly under control of an automatised process" (137). Although habitual cooks may exhibit bad habits regarding food-preparation practices, in general, a positive relationship between habit and safe cooking is anticipated, as frequent exposure to a hazardous situation should lead to effective and efficient action adjustments.

A life course approach to food choice suggests that life time experience and the totality of the changing temporal, social and historical contexts of our lives shape the way that we eat (138). While an individual's food trajectory may be fairly stable, major life events can act as key turning points or cause more subtle transitions. For example, stressful events such as exams can either increase or decrease energy intake in the short term (139). Widowhood has been associated with weight loss, eating more meals alone, more ready-made meals per week, fewer snacks and homemade meals, and less enjoyment (140). Postpartum weight gain in mothers was reported in women who felt they had increased access to food or reduced opportunity to exercise as a result of the pregnancy (141).

1.4.6 Knowledge

Consumer knowledge is an important construct in understanding consumer behaviours such as information search (142) and information processing (143-144). Furthermore, in the Health Belief Model (HBM), a psychological model that attempts to explain and predict health behaviours, knowledge is a key element. Many studies have reported a positive association between nutrition knowledge and healthy food behaviour (145-148). Some of the outcomes of nutrition education interventions include increased fruit and vegetable intake (149-150) and increased breakfast consumption (151). Wardle *et al.* (2000) (145) investigated the relationship between knowledge and intake of fat, fruit and vegetables using a well-validated measure of nutrition knowledge. The study involved 1,040 adults. Knowledge was significantly associated with healthy eating. Powers *et al.* (2005) (152) also suggested that an increased knowledge of nutrition may lead to improvements in food selection and consumption behaviours, at least over the short term. However, limited changes in behaviour over the long term verified the difficulty in changing human behaviour (153).

With regard to nutrition education interventions, Contento *et al.* (1995) examined the effectiveness of nutrition education in a study involving 217 experimental studies. They concluded that well-developed training programmes are effective at increasing the nutrition knowledge, attitudes and behaviours of target audiences (154). While many studies have shown a positive effect, others however, have shown a limited (155-156) or no (157) link between nutrition knowledge and food behaviour.

Consumer knowledge has also been cited by many studies as a factor that influences food risk assessment (158-159). For example, in 1995 it was found that people very often attribute high risks to food products if they have less knowledge of the chemical or technological processes involved in their production (160).

Overall, a longstanding finding in the study of food attributes and eating behaviour is that knowledge about nutrition and food risks often does not translate into more healthy eating behaviour (161) or food safety behaviour (162). For example, a consumer may have a good knowledge of food safety practice, however they may not utilise this in the home. Therefore, the extent to which an individual is knowledgeable about the topic or familiar with it may result in overconfidence or complacency (163). In addition, other conflicting influences such as habit, lack of time or facilities, or hedonistic response may come into play.

1.5 Attitudes, perceptions and beliefs

An attitude is a hypothetical construct that describes how positively or negatively a person is disposed to something. They are judgments that can include an emotional response, a behavioural intention and a

cognitive response that includes an evaluation of, or belief about the item. It can be used to describe mental readiness to act and can predict the likelihood that a person will be motivated to move to action (164). An individual's attitudes, beliefs and perceptions, which result from all of the factors we have discussed thus far combined, are often thought to act as predictors of food related-behaviour.

While it is a basic assumption in behaviour change models that attitudes can guide, influence, direct, shape and predict actual behaviour (165), it is unclear to what extent pre-existing attitudes and beliefs about diet and lifestyle can influence an individual's response to dietary recommendations. With regard to food safety, existing beliefs and attitudes have proved to be important predictors of risk perception and influence acceptance of risk messages. Frewer *et al.* (2003) showed that prior attitudes to genetically modified foods were the strongest predictor of variance in perceived risk and benefit (166). Furthermore, the authors illustrated that more extreme, clear or well-established attitudes could influence perceptions of the information source causing mistrust rather than changing perceptions of the risk being communicated (166).

Many studies have also shown strong relationships between attitudes and food choice (167-168). This appears to be the case when attitude ambivalence is low (169). However, food choice has been shown to be subject to ambivalent attitudes (170) and many situational factors may play a part (171). Therefore in certain cases it may be difficult to say how important attitudes are in relation to food behaviour.

Perceptions

How people perceive food risk has been extensively studied, particularly in relation to food safety issues. The most well known and widely accepted model of risk perception is the psychometric model published by Fischhoff *et al.* in the 1970s which uses the characteristics of risk to explain risk perception. Factors include voluntariness, immediacy, uncertainty, dread, controllability, catastrophic potential, novelty, severity of consequences and known to science (172). More recently naturalness has also been suggested as an important attribute (173). The strongest predictors of risk perception have included 'dread', whether people can tolerate living with a risk and think about it calmly, and 'novelty', how precisely the risks were known (172, 174). This model goes some way to explain why certain food issues will precipitate a change in attitude or behaviour, while others struggle to do so, despite having serious consequences. Issues such as Bovine Spongiform Encephalopathy (BSE) have received enormous public attention and caused the public to change their consumption patterns (175) while the prevalence of conditions such as obesity, which have long-term outcomes, continues to rise and behaviour change remains a huge challenge. Therefore there is clear indication that the nature of the food risk can influence how it is perceived and practice specific risk perceptions have been found to be the primary cognitive antecedents of safe food behaviours (176).

One major pan-EU study has recently assessed both nutritional and food safety risk perception among EU citizens. In June 2010, a Eurobarometer survey was carried out across all 27 EU Member States,

involving 26,691 individuals, aged 15 or over. Consumers were asked about their perceptions of food as well as their concerns about food-related risks. With regard to perception of food, the majority of respondents associated, to a large extent, food and eating with enjoyment, such as selecting fresh and tasty food (58%) or the pleasure of having meals with family and friends (54%). Thirty seven per cent of respondents were concerned about the safety of food whereas 23 per cent were concerned about nutritional issues such as checking calories and nutrients (177). The authors further found that those who are concerned about possible food-related risks tended to be more concerned about chemical contamination of food rather than bacterial contamination or health and nutrition issues. (177).

1.6 Conclusions

The influences on food behaviour are complex and multi-factorial. The effects of each of these influences differ from population subgroup to subgroup and from person to person. The data available at this point does not allow quantification of each influence and given the number of factors that could be measured, may never do so. Improving knowledge appears to be an important first step in changing food behaviour, but clearly not a stand-alone solution. From a life course perspective, early influences appear to set an individual on a food behaviour trajectory that may affect how they prepare and eat food over a lifetime. Therefore an emphasis on early childhood and the family is merited. From a communications perspective, the data on socio-demographic differences offers a starting point for segmentation and development of targeted messages. For health practitioners, an emphasis on psychological factors, building self-efficacy, resilience and coping skills may offer alternative ways to improving food behaviour. Much work remains in measuring the influence of the wider environment. In particular the influence of the current economic climate may be a key area of future research.

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