Persuasive Techniques on Food Packaging:

The Exposure, Power and Influence on Children's Food Behaviours

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by

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Author's Declaration

This thesis is the result of my own work. The material contained in this thesis has not been presented, nor is currently being presented, either in part or wholly for any other degree qualification.

I designed this research in conjunction with my supervisors and was responsible for data collection, analysis and write-up.

The data from Chapter 4 has been published:
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Abstract

***Background**:* Experimental studies have shown that exposure to food marketing can affect children's food preferences, choices and consumption in the short-term. However, little is known about the influences of various persuasive techniques used on food packaging, specifically the use of brand equity characters, portion size depictions and traffic light labels. Furthermore, the exposure and power of these persuasive techniques on food packaging has yet to be established in a UK setting. The current thesis used innovative methodologies to examine hypotheses which aim to address the gaps in the current literature, in children aged 4-11 years, and to quantify the power and exposure of these techniques in a UK supermarket.

Key Findings:

The exposure to, and power of, persuasive techniques on food packaging in a UK supermarket (Chapter 3): The number of child-specific products being promoted to children in the UK supermarket was high, and these products were predominantly unhealthy. These findings remained consistent across several supermarkets surveyed, and no seasonal variation was found. Promotional characters (brand equity characters, licensed characters, celebrity endorsers and children) were the most dominant persuasive technique used to promote foods to children, with brand equity characters being the most frequently used character type. Furthermore, brand equity characters were used to promote predominantly unhealthy foods. Front of pack nutritional labelling was present on the majority of child-specific foods, with traffic light labelling being the most frequently used system.

Effects of acute, experimental exposure to persuasive techniques on food packaging (Chapters 4 and 5): Relative to the use of brand equity characters on food packaging (Chapter 4), exposure to these characters on food packaging influenced children's food preferences and choices, in favour of those foods presented with the

character on the packaging. This was true even when the character was presented on a food it is not typically used to promote. With regards to portion size depictions on the front of food packaging (Chapter 5), children in the large portion size condition were found to both serve and consume more cereal, compared to the small portion size condition.

Effects of an intervention to improve accuracy when using traffic light labels (Chapter 6): Children's accuracy when using traffic light labels to identify the healthier item from a matched food pair improved after a brief online intervention. The effect was particularly evident in those who had the lowest accuracy stores at baseline.

Implications: This thesis increases the current understanding of how persuasive techniques employed on food packaging can influence children's food preferences, choices and consumption in response to acute, experimental exposure. In addition, this thesis provides the first comprehensive assessment of the exposure to, and power of, food packaging techniques aimed at promoting foods to children in UK supermarkets.

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Chapter 1: The influence of food packaging on children's food behaviours; a review of the existing literature

This thesis examines the influence of food packaging and on-package promotional techniques (brand equity characters, portion size depictions, and nutritional information in the form of traffic light labelling) on children's food behaviours (including food preference and choice, serving and consumption, and food evaluations). In addition, this thesis includes the only analysis to date of the nature and extent of promotional techniques used on food packaging in the UK aimed at children. This work could inform evidence-based interventions and policy change to try to encourage the uptake of healthier food behaviours in this age group, which is critical for short- and long-term health.

The literature review will begin by outlining the causes and extent of the obesity problem currently faced both globally, but more specifically, here in the UK, and also the negative consequences associated with excess weight in childhood, thus establishing the need to better understand eating behaviours that may contribute to weight gain in children. The research reviewed will span that which relates to unhealthy food choices and their relationship with obesity, as well as research addressing the factors that influence food choices and preference in children, with particular focus given to research on food packaging. Gaps in current knowledge will be identified, and the chapter will conclude with a statement of the specific aims and objectives of the current thesis, as driven by those research gaps.

1.1 Obesity

It is important to understand the wider context in which these eating behaviours are placed, including the extent of the obesity problem and the implications for a child being an unhealthy weight as a result of the overconsumption of unhealthy foods, so that this particular facet of how these unhealthy foods are promoted to them (in this instance, food-packaging) may be explored.

1.1.1 Obesity, body mass index and weight status

In general terms, obesity refers to excessive levels of body fat, to the extent that the individual's health may be negatively affected (refer to section 1.1.3.2 which discusses potential impacts on health). More specifically, the World Health Organisation (WHO, 2015) define overweight and obese in adulthood as having a body mass index (BMI) which is greater than or equal to 25kg/m^2 and 30kg/m^2, respectively; an individual whose BMI is in excess of 40kg/m^2 is considered to be morbidly obese.

BMI is often regarded as a less reliable or sensitive measure of health risk than other assessments such as body fat percentages, skinfold thickness or waist circumference (Bray & Bellanger, 2006; Cole, Bellizzi, Flegal, & Dietz, 2000; McCarthy & Ashwell, 2006) and cannot distinguish between overweight due to excess fat mass, and overweight due to excess lean mass (Must & Anderson, 2006), correlating with both (McCarthy & Ashwell, 2006).Despite these criticisms, BMI measurements are considered to be the international definition of adult obesity, with BMI cut-offs offering clear, operating definitions of obesity which are easily calculated, non-invasive in nature, and are inexpensive to employ, especially when applying them to large populations. Thus, they are routinely used in clinical and research settings, and are particularly useful for tracking population-level trends over time (Cole et al., 2000; Must & Anderson, 2006).

The classification of weight status in children, however, is more complicated. During childhood, BMI differs greatly according to both age and gender (related to varying growth patterns, changes in body composition and weight gain), and so childhood overweight and obesity must be defined using age- and gender-specific BMI distribution curves, in order to be considered meaningful (Butland, Jebb, Kopelman, & Mcpherson, 2007). As recommended by the World Obesity Federation (formerly the International Obesity Task Force; Cole et al., 2000), child weight status can be better defined using age-and gender-specific BMI z-score boundaries, calculated using child growth reference data, which are equivalent to adult BMIs of 25kg/m² and 30kg/m² for overweight and obese, respectively.

1.1.2 Prevalence of childhood obesity

The 'obesity epidemic' is a considerable problem globally (Lake & Townshend, 2006). In an extensive review by Wang and Lobstein (2006), data published between 1980 and 2005 showed that the frequency of overweight and obese children had dramatically increased since 1980 in almost all countries worldwide in which relevant data exist.

The Health Survey for England (HSE; Mandalia, 2011) reported that the prevalence of obesity in children aged 2–10 years in England was up from 10% in 1995, to around 14%, and the prevalence of overweight, including obesity, was around 28%. This marks a drastic increase in the prevalence of obesity over the last two decades. More recently, Public Health England (PHE) report that in 2013, 15% of children in England aged 2-15 years were obese, and 29% were classified as overweight (PHE, 2016). In the UK, the National Child Measurement Programme (NCMP; PHE, 2016) measures and records the height and weight of over one million children each year (aged 4-5 and 10-11 years). These data show that in 2014/15, 1 in 5 children aged 4-5 years, and 1 in 3 children aged 10-11 years, were overweight or obese. The Foresight Report (2007), a white paper produced by the UK Government Office for Science using longitudinal data from 1993-2004, highlighted this disturbing trend in childhood obesity by predicting that 55% of boys and 70% of girls will be overweight or obese by 2050, if no action is taken now.

1.1.2.1 Gender differences in childhood obesity

A review paper by Wisniewski & Chernausek (2009) highlights that although prevalence of obesity and overweight has increased in both girls and boys, the causes of this differs between the sexes. The paper included 58 studies of children aged 0-18 years, which illustrated gender differences in the presentation of obesity in children, or its underlying mechanisms, and found that, on the whole, gender differences in obesity have been understudied. Gender differences were common before and during puberty, and girls and boys differed on various factors which contribute to obesity, such as their susceptibility to particular social, environmental, ethnic and genetic factors, as well as differences in their body composition, hormones and weight gain patterns. Thus, the authors conclude that interventions

which aim to either treat or prevent childhood obesity need to consider and account for these gender differences (Wisniewski & Chernausek, 2009).

In the UK, the NCMP (PHE, 2016) estimated that 22.6% of boys aged 4-5 years were overweight or obese in 2014/15, compared to 21.2% of girls. At age 10-11 years, not only did the levels of overweight and obesity increase (as discussed above in section 1.1.2), but the gender difference increased, with 34.9% of boys being overweight or obese at the later age, compared to 31.5% of girls. These trends are reflected in adult (16+ years) data, where three year averages in England (2012-2014) illustrate that 66.4% of adult men were overweight or obese, compare to 57.5% of women (PHE, 2016). Taking into consideration these data, and the conclusions of Wisniewski & Chernausek's (2009) review paper, gender should be accounted for when investigating obesity and weight gain in child populations. As this thesis is concerned with eating behaviours which may contribute to obesity and weight gain, it is therefore important that gender is measured and accounted for.

1.1.2.2 UK trends

The Foresight Report (Butland et al., 2007) brought to light differences in childhood obesity which are associated with other additional factors, including regions, socioeconomic status (SES) and ethnicity. In a report by the National Obesity Observatory (NOO; 2014), socioeconomic disparities in obesity are highlighted, which appear consistently across a range of various deprivation measures, and across data sets from both the Health Survey for England (HSE) and the National Child Measurement Programme (NCMP). An almost linear relationship emerged between scores on the Index of Multiple Deprivation 2010 (IMD) and obesity prevalence; children in areas with significantly higher rates of free school meal (FSM) eligibility (often used as an indicator of SES) also had significantly higher obesity rates than those living in areas with lower eligibility (NOO; 2014). Data drawn from the HSE shows that child obesity prevalence increases as household income decreases, and children in households where the primary earner has a professional occupation displayed lower rates of obesity than those with a primary earner in a manual position (NOO, 2014).

The NCMP also explored the data at a regional level, reporting that in England, the highest rates of obesity prevalence were found in London (10.8% for 4-5 year olds, and 22.4% for 10-11 year olds). The lowest rates of obesity prevalence in children aged 10-11 years exist in the East, East Midlands and the South East regions of England. Within these regions, there was also evident variation in obesity prevalence between Local Authorities, whereby the least affluent areas displayed obesity prevalence rates which were considerably greater than in more affluent areas. For example, in the Royal Borough of Kingston-Upon-Thames the obesity prevalence was 6%, compared to 11.1% in the less affluent Borough of Hackney. These differences further highlight the existing disparities in childhood obesity across various SES groups, with children from low SES backgrounds being more likely to be overweight or obese. There is a need for research which establishes individual differences, with this thesis collecting SES data, where possible (using parental education as a proxy measure; Chapter 4).

1.1.3 Consequences of Obesity

WHO (2016) highlights that the risk of obesity can be passed on from one generation to the next as a result of behavioural and/or biological factors, and so has the potential to become a perpetual problem. Childhood obesity is also a predictor for adult obesity, with one study reporting that children who became obese as early as 2 years of age were more likely to be obese in adulthood (Freedman et al., 2005). This can result in both immediate and long-term consequences at an individual and societal level, with childhood obesity causing lasting damage to adult health, even when BMI is improved in adulthood (Field, Cook, & Gillman, 2005; Freedman, Khan, Dietz, Srinivasan, & Berenson, 2001; Freedman et al., 2005; Guo & Chumlea, 1999; WHO, 2016). In addition to societal costs and contributions to health problems of individuals, various social and psychological burdens are also associated with overweight and obesity, and will also be discussed.

1.1.3.1 Economic burden of obesity

As previously suggested, childhood obesity is a predictor of obesity and health complications in adulthood, and this life-long obesity burden places a tremendous

financial strain on the National Health Service (NHS). Estimates of the direct costs of obesity, overweight and related morbidity treatment in England to the NHS have ranged from £479.3 million in 1998, to £4.2 billion in 2007 (Butland et al., 2007). Modelled projections suggested that the indirect costs of obesity in the UK could have reached £27 billion by 2015, and it has been estimated that by 2050 obesity and overweight will be costing the NHS £9.7 billion in direct costs, totalling £49.9 billion overall (Butland et al., 2007). It is also worth noting that these estimates are based on prices in 2007, and do not account for inflation. With this in mind, it is clear that the prevention and reduction of obesity across the lifespan provides a lucrative avenue for the reduction of government expenditure on healthcare, and so research which identifies potentially modifiable variables is needed to inform this change.

1.1.3.2 Physical Health

In addition to the societal costs discussed in previous sections are the human costs associated with the burden of obesity, which can have a profound negative impact at an individual level. Physical health can be impacted by overweight both in the immediate, during childhood, and also in the longer-term, during adulthood. Children and adolescents who are overweight are more likely to display risk factors for cardiovascular problems, such as high blood pressure or cholesterol. For example, one population-based sample in the US found that 70% of obese 5-17 year olds sampled had at least one risk factor for cardiovascular disease (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007). A meta-analysis by Yamaki, Rimmer, Lowry, & Vogel (2011) found that overweight and obese children are at a 40-50% increased risk of developing asthma when compared to normal weight children. They are also at greater risk of joint and bone problems, sleep apnoea (Daniels et al., 2005; Yamaki et al., 2011), and adolescents with obesity are also more likely to have prediabetes (Li, Ford, Zhao, & Mokdad, 2009).

Furthermore, as already stated, children and adolescents who are overweight or obese are more likely to be overweight or obese adults, which subsequently puts them at risk for various adult health problems later in life, for example, type 2 diabetes, stroke, heart disease and osteoarthritis (Office of the

Surgeon General, 2010). Overweight and obesity are also associated with an increased risk of many cancer types, including breast, endometrium, colon, kidney, pancreas, oesophagus, thyroid, gall bladder, ovary, cervix, and prostate, in addition to Hodgkin's lymphoma and multiple myeloma (Kushi et al., 2006). This wealth of obesity-related comorbidities clearly demonstrates why obesity is considered to be a major public health problem.

1.1.3.3 Psychosocial risks and mental health

Alongside physical health problems, obesity is associated with psychosocial risks and can also impact upon an individual's mental health. There is strong evidence to suggest that by the time obese children have reached adolescence, they are at an increased risk of low self-esteem and impaired quality of life (Griffiths, Parsons, & Hill, 2010). A report from the NOO suggests that mental health problems in childhood obesity are also linked to body dissatisfaction and eating disorders (Gatineau & Dent, 2011) and findings from the Millennium Cohort Study support the idea that childhood obesity may also be associated with emotional and behavioural problems in young children, particularly in obese boys (Griffiths, Dezateux, & Hill, 2011). A meta-analysis by Luppino et al. (2010) found obesity to increase the risk of depression, and that depression was predictive of developing obesity, indicating a reciprocal relationship between the two issues, with authors concluding that an obese individual was 55% more likely to develop depression, and a depressed individual was 58% more likely to become obese.

An existing body of research focuses on the stigma of obesity, which includes perceptions that individuals with obesity are lazy, unmotivated and less-competent (Puhl & Brownell, 2001, 2003; Puhl & Heuer, 2009, 2010). This can leave overweight or obese persons subject to discrimination and prejudice, and a large national survey in the US reported that this inequity has significantly increased by 66% in the last decade (Andreyeva, Puhl, & Brownell, 2008). In children, being overweight or obese can leave them subject to bullying, social ostracism and being more likely to encounter negative interactions with their peers (Andreyeva et al., 2008; Friedman & Brownell, 1995; Puhl & Brownell, 2001; Puhl & Brownell, 2003; Puhl, Moss-Racusin, Schwartz, & Brownell, 2008). Worryingly, a study by Salvy et al.

(2011) found that being ostracised impaired adolescents' abilities to self-regulate, leading to negative health behaviours such as unhealthy eating. This could suggest that, like the relationship between obesity and depression, obesity and social ostracism may have a reciprocal effect on one another.

In conclusion, it is clear from the body of evidence discussed that childhood obesity and overweight comes with a wealth of negative consequences. However, obesity is a multi-factorial problem and so in order to place in context the role that food packaging may have in the obesity epidemic, the subsequent sections will discuss the many factors which may play a role in the development of childhood obesity.

1.2 Aetiology of Obesity

Obesity is determined by an interaction between a variety of genetic, environmental and psychosocial factors. This happens via energy intake and expenditure, which act as physiological mediators which ultimately lead to an individual's body weight (Jebb, 1997). These factors will now be discussed in brief.

1.2.1 Energy balance

The onset of obesity can be explained, in its simplest terms, as the consequence of an extended period of energy imbalance, resulting from either excessive food intake (energy intake) or of inadequate levels of physical activity (energy expenditure) over time (Hill, Wyatt, & Peters, 2012). A model was developed in normal adults to predict weight gain, based on the laws of thermodynamics (Butte, Christiansen, & Sørensen, 2007), which postulates that any sustained long-term change in energy intake, or energy expenditure, will produce changes in body composition and weight, until a new steady state is established. However, requirements for storing energy may differ in growing children than in adults, and so the level and length of energy imbalance required for the onset of childhood obesity to occur has yet to be established in any certain terms. Energy balance is also affected by various other factors, including genetic, psychological, behavioural and environmental factors, and the interactions between them.

A prominent and often referred to visual example of the intricate nature of obesity is the Foresight Report's 'Obesity Systems Map' (Jones, Bentham, Foster, Hillsdon, & Panter, 2007) which illustrates the links between the various interdependent factors which contribute to obesity. It includes 108 variables in total, which have over 300 links which connect these variables, both positively and negatively. The variables are grouped into seven clusters; social psychology, individual psychology, physiology, food production, food consumption, individual physical activity and the physical activity environment. Whilst this map is too intricate to possibly see clearly in this instance, Appendix 1a includes a copy of the 'Obesity Systems Map', which serves as a visual illustration of the complex, multifaceted and interdependent nature of the causes of obesity.

The current thesis will expand upon the existing knowledge regarding food-packaging as a promotional tool, with the aim to determine whether or not various on-package techniques used to market food to children have a tangible effect on their food behaviours. The content will address certain aspects of two clusters within the Obesity System Map, including food consumption (energy density of food offerings, nutritional quality of food and drink, portion size and palatability) and also social psychology (media consumption, media availability, education, TV watching and exposure to food advertising). Therefore, the following sections will elaborate on the various factors that are known to influence food behaviours in children so that the role of food packaging can be placed in context.

1.2.2 Risk factors for obesity

Obesity is a complex and multi-faceted problem. In order to have some understanding of the importance of environmental risk factors, such as an obesogenic food environment featuring persuasive promotional techniques on unhealthy food packaging, in obesity it is important to first understand that these factors may interact with an individuals' existing predispositions and risk factors, such as genetics, psychology and behavioural risk-factors, and so these will be discussed in brief.

1.2.2.1 Genetic risk factors

Over the last two decades, genetics has become of increasing interest in obesity reduction and prevention efforts. There is considerable evidence for the heritability of obesity, with estimates for obesity typically being > 0.70. Both monogenic (the mutation of a single gene) and polygenic (the mutation of several genes) forms of obesity have been identified (Walley, Blakemore, & Froguel, 2006). One useful tool for studying the influence of genetics are twin studies, which are discussed in relation to taste preference in Section 1.3.1.1.1.

However, genetics cannot be held solely responsible for the rapid rise in childhood obesity. Obesity has always existed, but its rapid increase, coupled with the lack of any marked change in human genes at the population level over time, would suggest that other factors, such as the environment, are playing a stronger causal role in the problem (Rennie, Johnson, & Jebb, 2005). However, these environmental influences are arguably acting in unison with genetics, by uncovering sub-groups of the general population who are genetically pre-disposed to obesity and weight gain (Walley et al., 2006).

1.2.2.2 Psychological and behavioural risk factors

Obesity can be considered just as much of a psychological problem as a physiological one. Section 1.1.3.3 focused on the psychological sequelae of obesity for an individual, where it was suggested that obesity has a reciprocal relationship with certain psychological and behavioural factors. In addition, a systematic review and meta-analysis by Gariepy, Nitka, & Schmitz (2010) found a weak, but positive, association between anxiety disorders and obesity. Other risk factors for obesity include problematic eating behaviours which stem from the chronic use of food for non-nutritive purposes, for example, 'emotional eating,' which refers to eating in response to negative emotional cues such as boredom, stress or anxiety, instead of in response to internal cues of satiety or hunger (Kandiah et al., 2006; Konttinen, Silventoinen, Sarlio-La, & Haukkala, 2010). This behaviour can lead to overeating. In a study of 437 Belgian children, psychological stress was found to be associated with poor dietary patterns, with positive associations being observed between stress and the selection of sweet and fatty food consumption, and negative

associations being observed between stress and the consumption of healthier foods such as fruit and vegetables (Michels et al., 2012).

1.2.2.3 Environmental risk factors

As discussed, environmental factors which contribute to obesity may do so by interacting with psychological, behavioural and/or genetic predispositions to promote weight gain. The current environment, specifically the food environment, plays a key role in eating behaviours and contributes to the onset of obesity, thus is often described as 'obesogenic' (discussed in detail in section 1.4), and is characterised by an abundance of food availability and choice, largely of palatable, energy dense foods which are readily accessible and heavily marketed.

As eating is itself an entirely behavioural act, as an outward expression of an individual's response to the combination of physiological, psychological and environmental factors which they are exposed to, understanding the complex and multi-faceted factors which underpin this behaviour is essential in order to design relevant interventions and inform policy change. In particular, understanding the aetiology of obesity is crucial for identifying key modifiable variables (Reilly, Ness, & Sherriff, 2007) and, in turn, modifiable behaviours. The focus of this thesis is the influence of the food environment, in particular, food-packaging. However, before we can understand how the environment impacts upon children's eating behaviours, we must first establish how these behaviours contribute to obesity. It is these eating behaviours, such as food preference, food choice and consumption, as well as nutritional knowledge, which will next be discussed.

1.3 Eating Behaviours

Human appetite and eating behaviour is a culmination of physiological, psychological and environmental factors, which result in a particular behavioural response. The study of human appetite and eating behaviours is of increasing importance due to the current rise in obesity (Gibbons, Finlayson, Dalton, Caudwell, & Blundell, 2014). In order to appreciate the importance of food packaging's influence on children's eating behaviours, we must first understand the various factors which contribute to the development of these behaviours, and outline how

these behaviours may contribute to dietary outcomes and subsequent childhood obesity.

While there are a variety of eating behaviours discussed in the existing literature, this thesis will focus primarily on food preference, food choice, serving size and consumption as behavioural outcomes. In addition, the final experimental chapter will focus on how a nutritional education intervention can contribute to informed decision making and food evaluations, which in turn may influence eating behavioural outcomes, such as preference and choice, and so these will be the focus of the following discussions.

1.3.1 Development of preferences

Developmentally, children progress through various stages of food acceptance and rejection which are universal, however, even in later childhood some children are still more reluctant than others to try novel foods (Harris, 2008; Pliner & Loewen, 1997). In a review of the development of taste and food preferences in children, Harris (2008) highlights that the existing body of research is relatively scant, and focuses primarily on genetic/innate factors of food acceptance, optimal timing for 'programming' of taste and food preferences, and strategies to optimise food acceptance. Food preference can be defined as the selection of one food item over others (Birch, 1999). It is implied that liking is a driving factor behind these food selections, particularly in children, however, it is not the only factor to consider (Guidetti & Cavazza, 2008); liking of a food does not resolutely lead to its selection. With this in mind it is important to make a clear distinction between a preference for, and liking of, a food and actual food choice, both of which will be discussed in more detail in the following sections.

In addition, it is also important to note the distinction between food preferences and liking, as addressed by this thesis (specifically in Chapter 4), and taste preferences, which are rooted in sensory responses to foods. Broadly speaking, taste preferences have a strong innate element. However, these innate propensities are not concrete in nature and can be modified via pre- and post-natal experiences, paving the way for food preference and food choice later in life

(Beauchamp & Mennella, 2009). While the sensory response of taste preference is beyond the remit of this thesis, important links exist between taste preference, food preference and food choice (Drewnowski, 1997), and therefore will be discussed in brief.

1.3.1.1 Genetic or innate determinants of taste and flavour preference

Early research focused on whether food preferences supported a nutritionally sufficient diet, with the 'wisdom of the body' theory suggesting food preferences reflected innate, unlearned appetites for necessary nutrients. Many studies by Davis (1928, 1933, 1935, 1939; as cited in Birch, 1999) are used to lend support to this theory, where several longitudinal dietary studies, focusing on the self-selection of foods in infants and young children, found that children self-selected a diet which resulted in normal growth and ultimately healthy children, with no feeding problems. However, Davis makes the important evaluative point that while children were able to self-select a balanced diet, this may be mostly due to the nutritious foods on offer. Self-selection and 'wisdom of the body' is not of any value when the foods being offered to children are of poor quality, reflecting the importance of a child's environment in determining their ability to self-select a nutritionally adequate diet. Despite this, it is widely accepted that various genetic predispositions exist, which initially control our food preferences. In order to understand and investigate environmental influences on food preference and choice, and how they may interact with genetic predispositions, it is necessary to have a fundamental understanding of how these innate factors initially influence taste preference.

Predispositions for basic taste profiles (sweet, sour, bitter, salty) in infants have been investigated through both intake studies and infants' facial expressions when tasting. Human infants display a natural preference for sweet tastes (Birch, 1992; Birch & Fisher, 1995; Drewnowski, 1997; Liem & Mennella, 2002) demonstrably preferring sugar solutions to water, as indicated by the movement of mouth to resemble a smile, and the relaxation of facial muscles (Birch, 1999; Liem & Mennella, 2002). This is believed to be an evolutionary, functional response which indicates that sweet foods are a valuable energy source (Benton, 2004; Mennella,

Pepino, & Reed, 2005). In addition, it is also believed that preference for sweet tastes may be, at least in part, hereditary (Keskitalo et al., 2007; Mennella et al., 2005).

Furthermore, human infants have a tendency to reject bitter tastes. This is also considered to be an evolutionary response linked to survival, as many natural poisons tend to be bitter in taste, as are spoiled foods. Identifying such tastes and rejecting them before full ingestion was beneficial to survival (Drewnowski, 1997; Rozin & Fallon, 1980). The genetic predisposition to respond strongly to bitter tastes is one possible determinant of the heritability of food refusal. This response can be measured by an individuals' reaction to 6-n-propythiouracil (PROP). It has been suggested that being a 'taster' (which refers to those who are sensitive to PROP) has an effect on children's rejection of vegetables. A study in pre-school children comparing 'tasters' to 'non-tasters' found that non-tasters ate more bitter vegetables than tasters, and 32% of tasters refused to try any new foods, compared to only 8% of the non-tasters (Bell & Tepper, 2006), which lends support to the idea that PROP sensitivity acts as a genetic contributor to the neophobic response in certain children (Harris, 2008).

It has been noted by Schwartz, Issanchou and Nicklaus (2009) that evolutions in infant taste preferences over the first twelve months of life are not constant across all children, with existing individual differences in taste acceptance increasing and becoming more apparent across this period. The authors suggest that these evolving taste perceptions are not universal, but rather indicate how individual experience contributes to the development of food preference in infants and children (Schwartz et al., 2009).

1.3.1.1.1 Twin studies

Twin studies are a useful means of assessing the genetic determinants of children's food acceptance, and provide a useful model for distinguishing between genetic and environmental contributions. Comparisons have been drawn between monozygotic ('identical' twins that share 100% of their genes and develop from one fertilised egg cell) and dizygotic ('fraternal' twins who develop from two separate

eggs and share 50% of their genes) twins, with a heritability estimate of neophobia (the unwillingness to try new foods; Galloway, Lee, & Birch, 2003) being 78% (Cooke, Haworth, & Wardle, 2007). A study by Breen, Plomin and Wardle (2006) in 4-5 year old monozygotic twins and dizygotic twins rated their acceptance of 77 foods. For 72 of these foods, preference correlated more highly amongst monozygotic twins than dizygotic. Heritability for meat and fish was high (0.78), but for fruit, vegetables and dessert foods heritability was low to moderate (0.51, 0.37 and 0.20, respectively). The opposite was true when they assessed the influence of the shared environment, where the effect of the shared environment on preference for meat and fish was low (0.14), for fruits and vegetables was moderate (0.36 and 0.46, respectively) and for desserts was high (0.62).

Fildes et al. (2014) corroborate these findings in their large scale sample of UK twins born in 2007. The genetic influence was higher for nutrient-dense foods such as proteins, fruits and vegetables, and lower for starches, snacks and dairy foods. On the other hand, they found that shared-environment effects were higher for energy-dense foods such as starches, snacks and dairy foods, and lower for proteins, fruits and vegetables. Harris (2008) argues that it would appear that as the acceptance of meat and fish is highly genetically determined, the intrinsic sensory and textural characteristics of these foods are likely to determine their acceptance, whereas for the other food groups, where preference was not as strongly determined by genetics, environmental factors such as the exposure to, or the availability of, these foods has a strong influence on their acceptance in children. Genetic effects appeared to govern effects for nutrient-dense foods, whereas the shared environment effects were more profound for energy-dense foods which are often associated with weight gain and obesity. This lends support to the argument that the food environment (both within the home and more widely in a child's lived environment) is a key component when determining children's liking of, and preference for, energy-dense foods.

Despite genetic predisposition, inconsistent evidence to support its role in food preference exists. The 'family paradox' refers to the surprisingly low parent-child resemblance for measures of various different preferences, including food

preference (Pliner & Loewen, 1997; Rozin, 1991). Various twin studies on food preferences report conflicting results ranging from no heritable effects to sizeable heritable effects (Falciglia & Norton, 1994; Krondl, Coleman, Wade, & Milner, 1983; Rozin & Millman, 1987), which Rozin, Riklis and Margolis (2004) suggest is evidence that genetics plays a minor role in food preference, with other factors playing a more influential role. Nonetheless, it is important in the context of the work outlined in this thesis to understand genetic influences and how they interact with various aspects of the food environment to produce food preferences.

1.3.1.2 Learned preferences

It has also been suggested that food preference can be learned. Birch (1999) argues that whilst learned preferences take longer to develop, and have more subtle effects than innate preferences, it is likely that they will have a more ubiquitous effect. Much evidence exists which suggests that genetic predispositions towards the basic tastes are altered through experience (Birch, 1999). Brug, Tak, te Velde, Bere, & de Bourdeaudhuij (2008) highlight that preferences for bitter and/or low energy-dense foods such as most vegetables, and some fruits, are not as easily learned, as for sweeter, more palatable foods. However, as children progress into adulthood, many develop preferences for bitter tastes such as coffee, or beer, which suggests that innate disliking of these tastes can be 'unlearned' (Brug et al., 2008; Drewnowski, 1997). It is worth noting, however, that both of these example products have pharmacological side effects (stimulants) which may contribute to willingness to initially try, and subsequently persist with consumption, despite their bitter tastes.

1.3.1.2.1 Pre- and post-natal effects on flavour learning

The term flavour preference refers to a hedonic response to food stimuli which involves the perceived odour (food aromas), taste (sweet, salty, sour, bitter and umami) and texture (trigeminal irritation, or the stimulation of free nerve endings in the mouth) of food, and these flavour preferences are developed largely during the first years of life (Tuorila, 1996).

Experiences during pre-natal developmental have been shown to influence infant and child preferences for salty tastes, for example, 'morning sickness' or birth weight (Crystal & Bernstein, 1995, 1998; Stein, Cowart, & Beauchamp, 2012). The sensory environment in which the foetus develops reflects the food choices of the mother, through the transmission of dietary flavours to the amniotic fluid (Beauchamp & Mennella, 2009; Mennella, Johnson, & Beauchamp, 1995), and these experiences lead to greater enjoyment and acceptance of these flavours after birth and at weaning (Beauchamp & Mennella, 2009; Mennella, Jagnow, & Beauchamp, 2001; Schaal, Marlier, & Soussignan, 2000).

Post-natal experiences also contribute to preferences, whereby exposure to nutrients in breast milk and formula extend the pre-natal flavour learning experience. Breast milk is flavoured by the mother's diet, exposing infants to flavour compounds chosen and presumably preferred by the mother. Similar to flavouring amniotic fluid, exposure to flavours within breast milk will positively influence an infants' acceptance and enjoyment of that flavour in food (Forestell & Mennella, 2007; Mennella & Beauchamp, 1993; Mennella et al., 2001). Beauchamp & Mennella (2009) argue that given the likelihood that a mother would eat the same foods during gestation and lactation, resulting in similar flavour profiles, breast milk may act as a bridge between pre- and post-natal flavour experiences.

Beauchamp and Mennella's (2009) review also highlighted a sensitive period in the first several months of an infant's life, where even unpleasant, unfamiliar flavours can be deemed acceptable, and potentially even liked. Their review turns to research on formula feeding to support this notion, where it has been demonstrated that naïve infants, less than 3 or 4 months, were more readily accepting of the bitter and sour taste of hydrolysed casein formula (Mennella & Beauchamp, 2005) than naïve infants of more than 5 or 6 months - who vigorously rejected the formula, displaying strong, negative facial expressions (Mennella & Beauchamp, 1996). The authors also report that specific brand preferences within the hydrolysed casein formulas was apparent, with infants significantly preferring a familiar formula to an unfamiliar formula, showing that the flavour profile experienced during this period is learned and reflected in the infants' acceptance or

rejection of these formulas (Beauchamp & Mennella, 2009). When being introduced to regular foods, these early flavour experiences with formulas influence preferences (Mennella, Forestell, Morgan, & Beauchamp, 2009), and these influences also appear to last until later in life. For example, children aged 4-5 years, when compared to naïve children of the same age, exhibited more positive responses to foods which shared the same sensory attributes as the formula they consumed as infants, even when several years had passed since their last exposure to the formula (Liem & Mennella, 2002).

Early flavour experiences evidently affect infants' patterns of taste acceptance, and interact with genetic predispositions in order to establish learned flavour and food preferences, which may extend to food choices later in life, and are therefore of great importance when establishing evidence-based interventions and strategies to promote healthier food choices in children. In summary, the evidence clearly highlights that children are predisposed to favour sweet and salty, energy-dense foods, which lead to positive post-ingestive outcomes, such as satiety signals. This describes a preference for foods which are high in fat, sugar and/or salt (HFSS), which has the potential to be exploited by marketing and food promotion techniques, thus contributing to poor dietary outcomes.

1.3.1.2.2 Contexts and consequences of foods

Children also have a propensity to learn preferences through the association of food with the context in which it has been eaten, and any subsequent consequences of having eaten the food. For example, Birch (1999) suggests that if normal satiety is the outcome of consuming a particular food, then the associated post-ingestive signals will be pleasant. This positive experience may lead to a learned preference for the food. Conversely, if consumption of foods leads to negative or unpleasant consequences, such as gastrointestinal discomfort or nausea, it is likely that the child will develop an aversive association with that food (Birch, 1999). All of these experiences set the stage for food preference and food choice in later life.

1.3.2 Purchasing behaviours

Children are a key market as they have potential control over their own independent purchases, in addition to influence over family purchases. With the advent of mass media, children have evolved as consumers in their own right, no longer being seen as extensions of their parents' purchasing power (Wimalasiri, 2004) and are now seen as an important target audience for marketing (Pecora, 1995). There are two types of influence: active and passive. Children can actively influence purchase decisions by asking for and/or hinting that they would like something (McNeal, 1999, as cited in Geuens, Mast, & Pelsmacker, 2002), and also passively dictate what will be purchased, as parents will be influenced by what they believe their children will prefer (Wells, 1965). Active influence can be measured via observation, however, this often relies on memory, and demand characteristics can lead to dishonesty in self-report measures. Geuens, Mast, & Pelsmacker (2002) state that the most common way to measure how much control children have over what is purchased and consumed is to assess three different constructs, including the degree to which children independently choose products, the degree to which children independently purchase products, and the degree to which parents submit to these influences. However, these self-report measures are also open to bias in the form of demand characteristics. Passive influence is difficult to observe and measure, as the influence is mostly unconscious (Geuens et al., 2002) and therefore data on this aspect are absent from the literature.

1.3.3 Linking eating behaviours and obesity

Food choice can depend on many factors such as individual nutrient end energy requirements, health concerns, social, cultural and religious considerations, environmental considerations, cost, food availability and preference. Of all these factors, children are more likely to be concerned with preference, giving little regard to factors such as economic or health concerns when making food choices. As previously discussed, children display a preference for palatable foods which are energy dense and nutrient poor, thus leaving them at risk of making poor dietary selections, which may ultimately lead to weight gain. Food behaviours specifically relevant to this thesis (namely preference, choice, consumption and nutritional

knowledge) will be discussed in more depth in relation to the current body of literature which assesses the effects of food marketing to children on these specific outcomes; see sections 1.4.2.3.1 – 1.4.2.6.

The interplay between the physiological and psychological factors which contribute to obesity have been discussed, however, a full account of the intricacies of these relationships is beyond the scope of this thesis. The following section will briefly discuss how environmental factors can interact with physiological, psychological and behavioural factors to contribute to obesity.

1.4 The Obesogenic Environment

Previous attempts to resolve the obesity problem have focused primarily on educational, pharmacological and behavioural factors, without a great deal of success (House of Commons Health Committee, 2004). This is perhaps not too surprising given that, as already mentioned, obesity is not caused by one single factor alone, with much evidence to suggest that environmental factors have a significant effect on individuals' dietary choices (Popkin, Duffey, & Gordon-Larsen, 2005). These environmental factors potentially unmask latent tendencies to develop obesity (Kopelman, 2000) and interact with genetic predispositions, as previously discussed.

1.4.1 Defining the 'obesogenic environment'

There is a wealth of current literature to support the existence of an 'obesogenic environment' and it is understood to be a key factor driving the increasing obesity problem. The Foresight Report (Butland et al., 2007) defines the term as 'the role environmental factors may play in determining both nutrition and physical activity', and it is applicable at both an individual and population level (Swinburn, Egger, & Raza, 1999).

1.4.1.1 Physical activity in the obesogenic environment

While physical activity is not the focus of the current thesis, it is an important environmental factor that is associated with obesity, and thus will be discussed in brief. Coastal proximity, for example, has been found to be positively associated with leisure-time physical activity (Bauman, Smith, Stoker, Bellew, & Booth, 1999;

Giles-Corti & Donovan, 2002); various other objectively measured environmental variables have similar patterns of associations, such as access to parks, public open spaces and exercise facilities (Giles-Corti & Donovan, 2003; Sallis et al., 1990). However, the overall pattern of associations has been inconsistent, aside from those studies which look at urban design (Jones et al., 2007), of which the majority found modest, positive associations between high levels of walking and various aspects of urban design. As the majority of this evidence is based on US populations, where urban design and structure is considerably different to that of the UK, these findings cannot be easily generalised to a UK population (Jones et al., 2007). Nonetheless, this does lend support to the idea that the environment has an influence on obesity, and presents modifiable avenues for change. Another fundamental aspect of the obesogenic environment is that of the food environment, and is an important contributor to the current obesity problem.

1.4.1.2 Food availability and the food environment

The food environment is the sum of the physical, economic, and socio-cultural surroundings, opportunities and conditions which may influence food choice (Vandevijvere & Swinburn, 2014). Herforth and Ahmed (2015) argue that the food environment signals to consumers what to purchase, based on the availability, affordability, convenience, and the desirability of various foods. There are various aspects of the food environment that can contribute to excessive intake, one of which is food availability (Butland et al., 2007) whether this is access to foods to consume at home from supermarkets, or access to takeaways and restaurants.

It has been suggested that the availability and the price of food potentially mediates the relationship between diet, obesity and the food environment; specifically, it is thought that local availability of high-quality food has the potential to improve diet-quality in the population of that locality (Jones et al., 2007). The presence of, and proximity to, supermarkets has been associated with lower rates of obesity (Morland, Diez Roux, & Wing, 2006), and also associated with higher diet quality in low-income households (Rose & Richards, 2004). However, it is not clear whether the availability of food has a causal effect on obesity, or whether the observed association relates to confounding influences of deprivation.

Studies in North America report variations in food cost and availability between neighbourhoods, with poorer communities experiencing less availability of high-quality food and more expense when purchasing it (Chung & Myers, 1999; Morland, Wing, Roux, & Poole, 2002), an environmental situation which is often referred to in the literature as a 'food desert' (Pearson, Russell, Campbell, & Barker, 2005; White et al., 2004; Wrigley, 2002). There have also been differences in supermarket locations between predominantly black neighbourhoods, compared to predominantly white neighbourhoods in the US (Zenk et al., 2005), with white neighbourhoods having supermarkets 1.5 miles closer, on average. There were also fewer supermarkets available in rural areas than in urban areas (Blanchard & Lyson, 2005).

On the other hand, in the UK, large, empirically robust observational studies have failed to find any association between local food provisions, diet quality, differences in availability of supermarkets and food price, or availability of 'healthy' foods between affluent or more deprived neighbourhoods (Cummins & Macintyre, 1999, 2002; Guy & David, 2004; Pearson et al., 2005; White et al., 2004). Critically, the majority of evidence regarding food availability and diet quality has been observational, therefore the direction of causality cannot be established. An uncontrolled study by Wrigley et al. (2003) evaluated fruit and vegetable intake before and after the introduction of supermarkets in a deprived area in Leeds. The authors report some small increases in fruit and vegetable consumption following the introduction of supermarkets, with the largest improvements being seen in those who had previously consumed two portions or less per day (Wrigley et al., 2003). This suggests that the introduction of supermarkets positively affected fruit and vegetable consumption amongst those who needed it most. Nonetheless, it is worth noting that as this was an uncontrolled study, it is likely that any effects found were confounded by a secular trend in the population (Jones et al., 2007).

In addition to foods consumed in the home, we must also consider the availability of food from fast-food outlets and restaurants as an environmental determinant of obesity and poor diet-quality. Foods consumed outside the home have been shown to be up to 65% more energy-dense and associated with lower-

nutrient intake than an average diet (Burns, Jackson, Gibbons, & Stoney, 2002; Prentice & Jebb, 2003), and regular consumers have been found to weigh significantly more, even after controlling for confounding factors, than those who do not regularly consume food from fast-food outlets and restaurants (Cummins & Macintyre, 2006). Several studies have demonstrated an association between the deprivation of an area and the number of fast-food outlets available (Block, Scribner, & DeSalvo, 2004; Macintyre et al., 2005; Reidpath, Burns, Garrard, Mahoney, & Townsend, 2002). In one study in England and Scotland, it was found that fast-food outlet availability was four times higher per capita in the most deprived areas, when compared to the least deprived (Cummins, McKay, & MacIntyre, 2005), however, the body of evidence has been mixed. The prevalence of fast-food outlets reportedly explained around 6% of variance in obesity levels between US states (Maddock, 2004), and access to fast-food restaurants from both workplace and home were positively associated with a high-fat diet and high BMI, and negatively associated with physical activity, and vegetable consumption (Jeffery, Baxter, McGuire, & Linde, 2006). However, the proximity of the fast-food outlets to work and home was not associated with either BMI or how often individuals ate at fast-food restaurants (Jeffery et al., 2006), corroborating several earlier studies in Australia (Simmons et al., 2005) and the US (Burdette & Whitaker, 2004), which found no relationship between proximity to fast-food outlets and obesity in adults.

In sum, there is evidence in North American studies of the influence of the local environment on obesity, although the evidence in other countries is less conclusive, and so more empirical evidence is needed to establish whether the associations observed in various cross-sectional studies are actually causal, and whether they are applicable to other places. Environmental factors which contribute to food choice, and potentially weight gain, are of specific interest from a public health perspective, particularly in children, given that childhood obesity is a significant predictor of adult obesity (discussed in Section 1.1.3). Worryingly, spatial analysis techniques in Chicago highlighted that fast-food restaurants tended to be clustered around schools, although as Jones et al. (2007) suggest, the

sociodemographic characteristics of the local population in this instance is not clear, and so the extent to which this is associated with the prevalence of fast-food outlets is not clear.

Food which is provided outside of the home is not only considered to be a contributory part of the obesogenic environment, but can also be viewed positively as a potential avenue for change, providing the opportunity to implement initiatives to improve diet quality. For example, school environments are important in shaping children's eating behaviours and so are a possible avenue to introduce healthy eating interventions by positively changing the food environment to support and promote healthier food choices.

1.4.1.3 The role of Government policy and the food industry

There is a general consensus that lessons can be learned from tobacco control, which suggests that in order to increase the healthiness of food environments, broad social change is needed, with effective government policies being key (Raine et al., 2013; Yach, Lopez, & Novotny, 2005). These may include policies and actions aimed at improving food composition, labelling, prices, promotion, provision and availability (Vandevijvere & Swinburn, 2015). Cooperation between governments and the food and beverage industry is fundamental to positively reshaping the current obesogenic food environment, by ensuring healthier choices are supported, and consequently easier to make.

Serious and meaningful action from the food industry and governments around the world has been slow or even lacking, and this has been attributed to many causes. Vandevijvere, Souza, & Swinburn (2014) highlight that pressure for relevant policy change has been predominantly elite, being driven by health professionals and academics, and not grass-roots (i.e. public driven), believing this to be a key reason for the inadequate policy action to date. Alternatively, the main barriers to successful policy change have been suggested to be the pressure from commercial food and media sectors on governments (i.e. lobbying), in addition to difficulties providing robust evidence to support the effectiveness of introducing

new policies in advance of their implementation (Fraser, 2013; Moodie et al., 2013; Stuckler, McKee, Ebrahim, & Basu, 2012; Vandevijvere et al., 2015).

The WHO Commission on Ending Childhood Obesity Report (WHO ECHO, 2016) suggested a wealth of areas for change at the population-level, two of these, which are particularly relevant to this thesis, are, firstly, taxes on sugary drinks (Novak & Brownell, 2012) and, secondly, clear legislation on the marketing of foods and beverages to children (Harris, Pomeranz, Lobstein, & Brownell, 2009; Novak & Brownell, 2012). However, these are often met with resistance from industry (Gortmaker et al., 2011). Modelling studies have estimated that a 20% tax on sugar sweetened beverages in the UK would, via predicted reduced consumption, reduce the number of obese adults in the UK by 1.3% (approximately 180,000 people), and the number of those who are overweight by 0.9% (approximately 285,000 people), demonstrating taxation as a promising population-level method to target obesity (Briggs et al., 2013). A study in Australia estimated that the same tax would result in 'modest' reductions in BMI and the number of obese Australians, however, this modest reduction would translate into 170,000 healthy life years for that population, and the reduced health care expenditure would cover the cost of the legislation and taxation monitoring 14 times over (Veerman, Sacks, Antonopoulos, & Martin, 2016).

Swinburn, Gill and Kumanyikia (2005) proposed a framework in order to define the current evidence base for obesity prevention, and to generate impetus for change. This framework refers to five interconnected and overlapping steps: (i) building a case and demonstrating why there is a current need to act; (ii) identifying factors for intervention which contribute to the problem; (iii) defining opportunities for action; (iv) evaluating potential interventions; and (v) creating a portfolio of evidence-based policies, actions and programmes which are based on empirical evaluation. The authors suggest that evaluating potential interventions was the most problematic step, due to the relative scarcity of efficacy and effectiveness studies to date (Swinburn et al., 2005), and so this should be a potential priority for future research. This thesis addresses various aspects of steps (i) through (iv), and contributes to the current body of evidence aimed at encouraging and informing

policy change. Firstly, by establishing why there is a need for change, through the quantification of the extent of food promotion techniques used to promote food and beverages to children, and also the nature of the techniques used in Chapter 3, and also by investigating the effects that various on-package techniques may impose on children's dietary outcomes (Chapters 4 and 5). Finally, Chapter 6 will evaluate the efficacy and effectiveness of a brief, online nutritional education intervention, aimed at increasing children's accuracy when using nutritional labelling. Legislation regarding the marketing of foods and beverages to children is particularly salient to this thesis and so will be discussed briefly in this chapter, and at length in relevant chapters.

1.4.1.4 Limitations of current research on the food environment

Methodological challenges are faced by researchers of the obesogenic environment. The environment is complex, and various research methods are used when addressing links between the environment and obesity, spanning indirect, intermediate and direct measures (Booth, Pinkston, & Poston, 2005; Lake & Townshend, 2006). It has been suggested that a combination of objective and subjective measurements are necessary to fully explain the relationship between obesity and the environment (Booth et al., 2005; Lake & Townshend, 2006), and more consistent research methods need to be developed and applied to this particular field of research if we wish to make meaningful progress (Booth et al., 2005).

Lake and Townshend (2006) suggest that the food environment and the built environment are closely related, and there is a need to move from viewing them as two separate entities, to viewing these two factors together when considering obesity prevention. Whilst there is no doubt that obesity reduction and prevention will also require behaviour change at an individual level, Flynn et al. (2006) argue that much more comprehensive, ecological changes need to be made to support those individual changes, creating a more permissive food environment where healthy choices are more favourable. However, as it stands, the current evidence base surrounding the influence of the physical environment on obesity is

inconclusive (as outlined above), and therefore does not provide strong enough incentive for change at a policy level.

However, another aspect of the current food environment that has produced more consistent evidence is the marketing of food to children, which has been identified as an important target for intervention in the prevention of childhood obesity (WHO ECHO, 2016). A wealth of empirical research supports food promotion activity as a contributing factor to childhood obesity, one which could potentially be modified via government intervention and policy change at a societal level. Marketing and food promotion to children is a central theme of this thesis and so an overview of the current literature will follow.

1.4.2 Marketing food to children

Marketing has been defined as activity which an organisation or company engages in, in order to facilitate an exchange between itself and its customers (McCall, 2003; as cited in Story & French, 2004). A report by Cairns, Angus and Hastings (2009), commissioned by the WHO, postulates that children are exposed to increasingly sophisticated strategies of marketing, with multi-pronged channels of promotion which often overlap (see Figure 1-1). Linn (2004) highlights that the role of food promotion and marketing to children is of particular concern when we consider that marketers preferentially target children. This is arguably because children can affect product sales in multiple ways: presently (both as primary, independent consumers, and as influencers over family purchases) and also in the longer-term, by remaining loyal consumers, with established brand loyalty and preferences which may span a life-time (Boyland & Whalen, 2015; Story & French, 2004), and as such children are a potentially lucrative population for companies to target.

Marketing to children is often discussed in terms of the exposure (frequency, reach) to the marketing and the power (creative content, persuasive techniques) of that marketing to influence behaviour (Kelly et al., 2013; Shelton, Macmullan, Glayzer, & Voudouri, 2011; WHO, 2010; see section 1.4.2.3 for expansion on exposure and power). The research to date has focused predominantly on TV advertising, and more recently online advertising, and so these factors will be the primary focus of

the subsequent sections, however, other avenues of promotion will also be discussed in brief, where relevant. Food packaging, for example, is a key aspect of marketing to children, however it has been the subject of much less discussion in the literature, relative to TV and online marketing strategies.

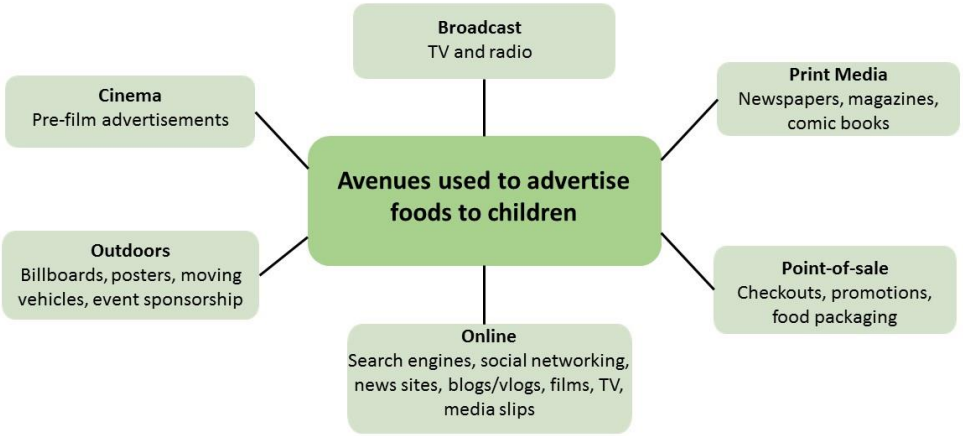


Figure 1.1 A representation of some of the main avenues through which children are exposed to food advertising (adapted from Boyland & Whalen, 2015).

1.4.2.1. Types of foods and beverages being promoted

Additional concern about the influence of food marketing on eating behaviour arises when we consider that the majority of foods and beverages which are promoted to children are considered to be 'unhealthy', predominantly promoting highly-palatable HFSS foods and beverages, which are energy-dense, but nutrient poor (Boyland, Harrold, Kirkham, & Halford, 2011; Gunderson, Clements, & Neelon, 2014; McGinnis, Gootman, & Kraak, 2006). A diet high in HFSS foods and beverages will not only have implications regarding weight gain, but it may be low in fibre and nutrients, which can lead to nutritional imbalances. High levels of salt and sugar, and low levels of fibre and nutrients, can cause additional health problems, independently of overweight, such as dental cavities, cardiovascular disease and type 2 diabetes (Johnson et al., 2009; Kanker & Fonds, 2007; Schulze et al., 2004;

Sonestedt, Overby, Laaksonen, & Birgisdottir, 2012; Strazzullo, D'Elia, Kandala, & Cappuccio, 2009).

Kelly and King (2015) suggest that the ubiquitous promotion of less healthful foods creates a negative food culture in which these food products are normalised, becoming part of everyday life. This is in direct opposition to current nutrition recommendations and guidelines for disease prevention, and creates positive brand images for HFSS foods which contribute to their (over) consumption (Hoek & Gendall, 2006).

1.4.2.2 Ethical considerations when marketing to children

Due to the pervasive nature of marketing to children, child campaigners and media experts believe this constitutes an increasing public health concern (Children's Food Campaign, 2004). Numerous studies have documented that before the age of 8, children are at a developmental disadvantage, not being able to understand the intent of advertisements, instead accepting their claims as being fact (American Academy of Pediatrics, 1995). The intense and ubiquitous promotion of HFSS foods to children has been described as exploitation (Story & French, 2004), as children are unaware that commercials are designed with the specific aim of persuasion in order to sell products, with younger children being unable to defend against these tactics due to a lack of comprehension or evaluative ability.

Older children are not immune to these promotional strategies either, and are vulnerable to strong, emotive messages found in advertising campaigns (Strasburger, 2001). The nature of current food marketing online is such that even older children are struggling to identify marketing from other content, and this has repercussions for their ability to resist marketing even when these critical skills may be present (Ali, Blades, Oates, & Blumberg, 2009; Harris, Brownell, & Bargh, 2009). Children, therefore, should be viewed as a vulnerable group and as such there is a social responsibility to protect them from influences which may have adverse effects on their health (Story & French, 2004, WHO ECHO, 2016).

1.4.2.3 Exposure and power of food marketing

Children are exposed to marketing through a variety of avenues (see Figure 1-1 above), including advertisements in magazines, outdoor advertising, event sponsorship and at point-of-sale in retail settings (Bhargava & Donthu, 1999; Chapman, Nicholas, Banovic, & Supramaniam, 2006; Clark & Brownell, 2012; Jones, Gregory, & Kervin, 2012; Linn & Novosat, 2008; No, Kelly, Devi, Swinburn, & Vandevijvere, 2014). The effectiveness of these marketing strategies at influencing eating behaviours is contingent on a combination of both the exposure of consumers to (relates to the reach and the frequency of exposure to this marketing technique), and the power of (relates to the design and creative content of the marketing technique) (Cairns, Angus, & Hastings, 2009; Figure 1-2) the message, and so both will be discussed simultaneously in the subsequent sections.

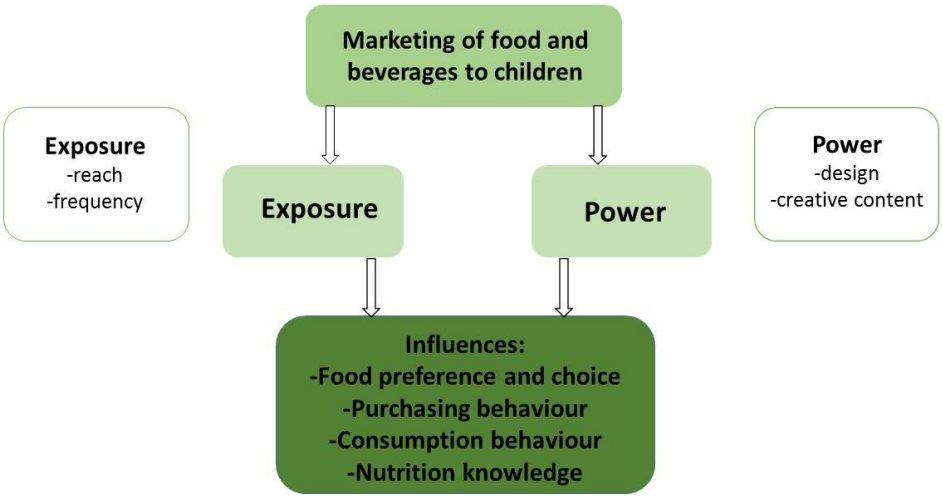


Figure 1.2 Diagram outlining that the effectiveness of marketing strategies is dependent upon the exposure and power of the message (WHO, 2010).

1.4.2.3.1 WHO recommendations on marketing to children

In 2010, WHO released a set of recommendations for its Member States on the monitoring and reduction of marketing to children, which suggested that policy should aim to reduce the impact on children of marketing foods which are high in fat, sugar or salt (HFSS). The overall objective of these policies should be to reduce

both the exposure of children to, and the power of, the marketing of HFSS foods (WHO, 2010).

The first step towards the development of any new policy is to establish a sound rationale, based on strong empirical evidence, and so WHO further recommends that Member States adopt varying approaches, dependent on available resources and circumstance, to reduce the marketing of HFSS foods to children. A comprehensive approach would involve wholly restricting the marketing of HFSS foods to children, eliminating the exposure, and thereby also the power, of these marketing techniques. Otherwise, they suggest a stepwise approach as an alternative, whereby Member States can begin the process by addressing either exposure or power discretely, or dealing with aspects of both simultaneously, in a stepwise approach.

The current thesis will adopt elements of the latter, with regards to persuasive techniques on food packaging specifically. Chapter 3 will monitor, for the first time, the level of exposure to various persuasive techniques on food packaging which children experience in a UK supermarket. Chapters 4 and 5 will assess the influence certain persuasive techniques (BE characters and portion size depictions, respectively) may have on children's eating behaviours. Furthermore, Chapter 6 will identify whether TLL on food packaging can aid children's decision making when identifying healthier choices. While nutritional labelling and logos are not generally considered to be marketing techniques, they have the potential to be persuasive techniques, specifically at the point-of-purchase, when within-product decision-making occurs and, arguably, should therefore be given consideration by policy makers.

Furthermore, WHO recommends clear definitions, from Governments, for key policy components, which would allow for a standard, uniform implementation process which would allow for the greatest impact of the policy. For example, in Chapter 4, in which the influence of BE characters on children's food preferences and choices is investigated, the current body of evidence is discussed. However, BE characters are often referred to in this literature by a variety of names, including spokes-characters and brand characters (refs), to name a few. This can make the

interpretation of existing evidence confusing for those who look to it to identify current research needs and to inform policy.

Moreover, current UK policy on marketing to children prevents the use of licensed characters to promote HFSS foods to children, however, these regulations do not extend to the use of BE characters, which are treated as a brand logo; this difference in approach does not appear to be evidence based, and so the influence of BE characters on children's eating behaviours needs to be established empirically in order to inform potential policy change (see Chapter 4). Furthermore, additional promotional characters exist which are not currently regulated, for example, the use of more generic cartoon characters which are neither licensed nor well-established enough to be considered a BE character, anthropomorphised animals and objects, or the use of images of children, all designed to appeal to a child-audience. A strong, empirical evidence base is needed which first identifies the variety of promotional characters which are currently in use (this will be addressed in Chapter 3), thus informing clear-cut definitions and terms for use in policy and research. In addition, establishing the extent of their usage and identifying gaps in the literature for future research to address will help to inform the development of comprehensive policies, preventing companies from exploiting policy loopholes to market HFSS foods to children.

1.4.2.3.2 Television advertising

The existing body of research has focused primarily on television (TV) advertising, and more recently, advertisements featured on online TV viewing. This is probably not surprising as TV is one of the first avenues for children to encounter food promotion (Boyland & Halford, 2013; Boyland & Whalen, 2015) and remains the principal channel for food promotion advertising around the world (Kelly et al., 2010). In 2007 Ofcom reported a rapid increase in the number of commercial children's channels available, increasing from 7 in 1998 to 25 in 2007 (Ofcom, 2007) and they also indicate that commercial television viewing accounts for 74% of children's television viewing time (Ofcom, 2014). Further to this, 27% of children aged 3-4 years, 38% of children aged 5-7 years, and 43% of children aged 8-11 years

reportedly watched on-demand TV content online (Ofcom, 2014); this demonstrates the wide reach of TV and online advertising.

A large collaborative research project involving 13 independent research groups compared the television food advertising to children in 11 countries across Asia, Australia, US, UK, North America and South America (Bridget Kelly et al., 2010). Each research group recorded TV data for 2 weekdays and 2 weekend days (06.00-22.00) on the 3 channels most popular with children under 13 years in their country (192 hours of TV data per country, 2496 hours of TV data in total). They concluded that food advertisements made up 11-19% of the advertisements coded. Non-core foods are defined by Bell, Kremer, Magarey and Swinburn (2005) as foods which do not fit into the five core food groups needed to obtain all the nutrition needed by the body, and were featured in 53-87% of the food advertisements included in Kelly et al.'s (2010) study. The number of non-core food advertisements were highest during children's peak viewing times, the majority of which contained some form of persuasive marketing (Kelly et al., 2010).

This demonstrates that, internationally, children are exposed to high volumes of food advertising on TV, and while the exact figures vary between countries, the overall landscape is similar, in that they are consistently favouring the promotion of unhealthy foods and beverages to children, using a variety of child-oriented marketing techniques that have a demonstrable effect on children's preferences, choices, purchases, and intake (Cairns, Angus, Hastings, & Caraher, 2013; Hebden, King, Kelly, Chapman, & Innes-Hughes, 2011; Livingstone & Helsper, 2006). In a more recent study, Gunderson, Clements and Neelon (2014) found that 35% of TV advertisements were for food, of which 70% were classified as 'unhealthy'. They also reported that children were targeted significantly more than adults in these advertisements, with 92% of the advertisements aimed at children.

More pertinent to this thesis, due to links between persuasive techniques in TV advertisements and those used on food packaging (e.g. licensed characters, brand equity (BE) characters), is a UK study by Boyland, Harrold, Kirkham and Halford (2012), which coded 18,888 food advertisements aired on popular UK

commercial television channels which were broadcast during peak children's viewing times. They found that promotional characters or celebrity endorsers featured in 56% of food advertisements, of which significantly more were promoting non-core (unhealthy) foods. Of those food advertisements which included a promotional character, significantly more employed the use of a BE character than a licensed character across all channel types. As the use of BE character is not currently subject to any restrictions here in the UK, it is crucial that we understand the extent and the influence of their use when promoting foods to children, and their influence on children's food preference and choice will be the focus of Chapter 4.

A systematic review by Cairns et al. (2013) reports that marketing techniques such as the use of animated or fictional characters were more likely to be used in food advertisements, when compared to non-food advertisements, which were aimed at children. These advertisements rarely used disclaimers, or health and nutritional appeals, aside from the promotion of breakfast cereals, but instead tended to focus on themes of persuasive appeal such as humour, fantasy, fun, action, adventure and taste (Cairns et al., 2013). For example, Gantz, Schwartz, Angelini, and Rideout (2007) found that 34% of TV advertisements for food targeting children employed the use of taste appeals, 18% used 'fun', and only 2% referenced health or nutrition appeals.

In low-and middle-income countries, the marketing strategies and channels used mirror those of high-income countries taste (Cairns et al., 2013). Hawkes (2007) highlights that this marketing landscape is rapidly growing and evolving, promoting foods which are novel to the indigenous food culture in these countries, such as fast-food, carbonated non-alcoholic beverages, or dairy products in Asia; the same micro-nutrient poor, energy-dense foods are being promoted, using the same techniques as those observed in developed countries (Cairns et al., 2013), and so the marketing of HFSS foods and beverages to children, alongside the growing obesity problem worldwide, is of global concern.

1.4.2.3.3 Integrated food marketing

Although most literature to date focuses on exposure to the more dominant television advertising, there is a need to acknowledge that advertising is often supplemented with other marketing tactics, and current media strategies are becoming increasingly creative, complex and engaging, using television and the Internet as an indirect method of advertising; for example, product placement in TV shows, or on social media, where celebrities and social media 'stars' are paid to promote or endorse certain products via their social media accounts. In addition, companies often utilise familiar television/movie characters (known as licensed characters, refer to section 2.4.1.2 for description) by placing their images on food packaging as part of their integrated marketing strategies (see Figure 1-3 below for examples). Voorveld, Neijens and Smit (2011) believe that the use of multiple platforms of promotion increases the perceived credibility of these marketing messages, as each platform is considered as an independent and distinct source of information.

Figure 1.3 Examples of integrated advertising, clockwise: product placement for Coca Cola® on US TV show American Idol; product placement for Pepsi® on Beyonce's personal Instagram® account; the use of licensed characters from the children's movie Shrek® on Kellogg's® cereal packaging; the use of licensed characters from the children's movie Frozen® on Yoplait® frozen yoghurts.

1.4.2.4 Effects of food marketing on children's food behaviours

There is a substantial body of research to date which has consistently demonstrated that exposure to food and beverage marketing has an effect on children's eating behaviours (Veerman et al., 2009), including food preference and choice, purchasing behaviours and consumption, with the completion of many major reviews in the last 10-15 years (Cairns et al., 2009; Hastings, Mcdermott, Angus, Stead, & Thomson, 2006; Kelly & King, 2015; Livingstone & Helsper, 2006; McGinnis et al., 2006). Cairns et al. (2009)'s systematic review, commissioned by the WHO, found that not only did food marketing influence children's food preferences, consumption and nutrition knowledge, but that these effects functioned both at a brand and food category level. This means that the promotion of foods can lead to switching between brands within a food category, but can also lead to a greater

likelihood of selecting the category of foods promoted per se (e.g. being more likely to select and consume snack foods or fast foods), thus indicating the powerful nature of food promotion.

1.4.2.4.1 Food Preference and Choice

The vast majority of research on the effects of marketing on children's food preferences and choices are field experiments, or cross-sectional correlational studies and surveys. While correlational studies provide the opportunity for high external validity due to the range of potential influences that can be studied, it is not possible to establish causality from such data. A review of the effects of television food advertising on children's food behaviour by Coon and Tucker (2002) reported that children exposed to advertisements chose the food products advertised more often than those children who were not exposed. It has previously been argued that the current body of literature is generally lacking in relevant meta-analyses and longitudinal data on the whole (Story & French, 2004). However, recently, several meta-analyses have been published which add to the current body of evidence. One meta-analysis on food cue reactivity and cravings (Boswell & Kober, 2016) found an overall medium effect of food cue reactivity and craving on outcomes, which suggests that they significantly influence and contribute to eating behaviours and weight gain.

There have been many experimental studies which have addressed marketing effects on children's food preferences, where children are typically asked to indicate their favourite foods, often from a series of pictures (Chernin, 2008). A review of the effects of TV advertising and branding on the eating behaviour and preferences of children by Boyland and Halford (2013) concluded that the impact of this exposure is readily established in the literature, and has been robustly demonstrated in a variety of experimental paradigms. For example, in a randomised, controlled trial by Borzekowski and Robinson (2001), 46 children (2-6 years) were exposed to a videotape of a children's cartoon, either with or without embedded commercials. When subsequently asked to identify their preferences from pairs of similar products, one of which from each pair was advertised in the embedded commercials condition, children who were exposed to the commercials

were significantly more likely to choose the advertised items than the children who were not exposed to the embedded commercials.

A review by Cairns et al. (2013) found that, in 10 out of 17 studies reported, food preference was significantly influenced by food promotion exposure. The authors concluded that, while modest, the body of evidence would suggest that food marketing and promotion does in fact influence food preference in children. More specifically, the research base strongly suggests that children's preference for HFSS foods in particular, and their likelihood of choosing these HFSS foods, is influenced by their exposure to food advertising (Boyland, Kavanagh-Safran, & Halford, 2015; Coon & Tucker, 2002; Halford et al., 2008), which is of great concern from a public health perspective.

More recently, a study by Boyland, Kavanagh-Safran and Halford (2015) used a within participant, counterbalanced design, which included two conditions: exposure to ten toy adverts across two breaks of five adverts each (control), or exposure to one advert in each block of 5 for a McDonald's Happy Meal® (experimental), both embedded within a cartoon. Children were then required to complete a hypothetical menu task, which established their reported liking of fast food in general, and also specifically McDonalds®. No significant difference was found between the two conditions for the nutritional content of the meal bundles which the children selected, however, their liking of fast-food in general was significantly higher when exposed to the food adverts, when compared to the control condition. This study is an example of how exposure to food promotion affects children's food preferences, favouring fast-food when exposed to food promotion adverts. However, interestingly, this did not have an effect on their selections during the menu task. Arguably, this may demonstrate that preference does not always translate to choice in children, but it is worth emphasising that the menu task was hypothetical and therefore may not be representative of what children would actually choose if given the opportunity to consume the foods.

1.4.2.4.2 Purchasing behaviour

Purchasing behaviours can be measured as actual purchases made by children, purchase requests, the types of requests made (i.e. food type, brand specific requests) and also reported influence over family purchases. Many data collection methods have been used to record purchasing and purchasing requests, such as surveys, food diaries, direct observation of mother and child during shopping trips and also experimental trials; each method consistently demonstrates that exposure to TV advertising of foods leads to increases in the number of purchase requests, and attempted influence over parental purchases, and also increases specific brand and food product requests (Coon & Tucker, 2002).

One cross-sectional study reported that children's weekly TV viewing positively correlated with reported requests made by children, and actual purchases by parents, of foods that were advertised on TV (Taras, Sallis, Patterson, Nader, & Nelson, 1989). A survey by Isler, Popper and Ward (1987) reported that the number of requests for specific food products by children decreased with age, as did the citing of TV advertising as a main influence of children's requests. This is potentially due to additional factors becoming more relevant as a child's age increases, for example, the influence of peers, or it may be that younger children are simply more susceptible to these influences. However, this has not been empirically established and requires further investigation. The failure of older children to report that these TV advertisements actually influenced their requests may simply reflect their inability to detect the implicit nature of these marketing techniques and so we cannot assume that their influence has truly declined. More recently, a review by Cairns et al. (2009) found that 7 out of 8 studies examining the impact of food promotion on children's food purchasing and purchase-related behaviour found that exposure to food promotion was significantly associated with purchases and purchase-related behaviours. For example, one experimental study found that promotional signs on vending machines in schools significantly increased the sales of low fat snacks, persisting with and without price reductions.

On the whole, the literature provides evidence that children's food purchases and purchase-related behaviours are influenced by food promotion.

Purchasing behaviours, though not a central outcome addressed by the current thesis, are often influenced by preference and are a representation of choice, and are therefore worthy of consideration when discussing the influence of marketing on children's food behaviours.

1.4.2.4.3 Consumption behaviour

Long-term dietary consumption research often links parental reports of children's regular eating habits to estimates of children's exposure to marketing (Chernin, 2008). Short-term dietary studies tend to use children's actual eating behaviour or intake as an indicator of their choice (for example, a child is given the option to choose and consume a snack). A recent meta-analysis on the effects of acute exposure to unhealthy food advertising on intake in children and adults was published (Boyland et al., 2016). Overall they reported a small-to-moderate effect size for advertising on food consumption, with subgroup analyses revealing a significant moderate effect size for children, with exposure to food advertising being associated with increased food intake. However, there are fewer experimental studies on the influence of marketing on children's habitual consumption. Arguably, this is due to difficulty when controlling children's exposure to advertising and to foods outside of experimental settings (Coon & Tucker, 2002; Story & French, 2004).

A correlational study by Taras et al. (1989) demonstrated a positive correlation between children's weekly viewing hours (used as a proxy measure of exposure to TV advertising) and caloric intake. An experimental study in the UK determined whether exposure to celebrity endorsement in TV advertisements for food and also exposure to the same celebrity in non-food contexts, would affect *ad libitum* intake of an endorsed product when compared to a perceived alternative brand (Boyland et al., 2013). Children aged 8-11 years (n = 181) were exposed to one of the following advertisements, embedded in a cartoon: (1) commercial for Walker's crisps, with a well-established celebrity endorser; (2) a commercial for a savoury food; (3) TV footage of the endorser in his role as a well-known TV presenter; or (4) a non-food commercial. Children's ad libitum consumption of identical crisps, labelled either 'supermarket brand' or 'Walker's,' was then

measured, post-exposure. The authors report that the children who viewed the endorsed commercial, or the TV footage featuring the endorser outside of the food context, consumed significantly more Walker's crisps than the children who were shown a non-food commercial or a commercial for a different savoury food. In addition, these children did not reduce their consumption of the 'supermarket brand' crisps to compensate, thus leading the authors to conclude that the endorser contributed to overconsumption. This influence also appeared to extend beyond the specific endorsed food commercial to non-food contexts, emphasising the ubiquitous nature of these marketing techniques. Celebrity endorsers could be considered a form of promotional character, and therefore this study provides relevant context for the current thesis, in particular Chapter 4, which focuses on the influence of BE characters on children's food preferences and choices.

Many of the studies concerned with consumption are focused on short-term, immediate responses to food promotion exposures. Kelly and King (2015) highlight that there are many additional factors which may also influence the amount that children consume, such as hunger, preference for the test foods used and prior accumulated exposure to food promotions, and therefore studies should aim to measure and control for these factors. A novel study by Goris, Petersen, Stamatakis and Veerman (2010) attempted to address these limitations by conducting a two week summer camp, in which children were exposed to approximately five minutes per day of TV advertisements for either confectionery, fruit, public service announcements regarding sugar reduction, or no advertisements (control). They found that children exposed to the confectionery advertisements consumed significantly less fruit as snacks over the two week summer camp, compared to those children in the other advertisement conditions.

Research has also revealed that children's weight status may play a role in their response to food promotion, such as branded packaging (Forman et al., 2009; discussed in depth in Chapter 4) and exposure to unhealthy food advertising (Halford, et al., 2008), with overweight children consuming more kcal than non-overweight children in response to the marketing messages. When weighing up the

body of evidence, Cairns et al. (2009) concluded that food promotion does indeed have an effect on children's consumption.

1.4.2.5 Nutritional knowledge

A key assumption is that in order to improve dietary behaviours, such as healthier food selections, people must be given sufficient nutrition information (Worsley, 2002), however the findings for this type of educational approach are inconsistent. A number of studies suggest that nutritional knowledge has a limited impact on food choice, and propose that economic, cultural and educational factors, as well as food availability (Dallongeville et al., 2001; Lalor, Kennedy, & Wall, 2011; Shepherd & Towler, 2007), have a much more important influence on dietary behaviour. O'Brien & Davies (2007) reported no significant correlation between BMI and levels of nutritional knowledge, and Rodolfo and Nayga (2000) highlight that consumers' use of food labels is not affected by their nutritional knowledge. While many studies have found inconsistent findings, some have noted some beneficial effects of increased nutritional knowledge. A survey in England found that people with higher nutritional knowledge were 25 times more likely than those with lower nutritional knowledge levels to meet the recommended guidelines for consumption of fruit, vegetables and fat (Wardle, Parmenter, & Waller, 2000).

This tentative evidence suggests that nutritional education may improve children's nutritional knowledge, and their ability to utilise this knowledge when making food decisions. However, little knowledge of how children's eating behaviours are influenced by nutritional knowledge exists, with the body of research focusing on adult populations. Unlike adults, children may be less inclined to consider factors such as cost or culture when making food choices, and so may be influenced by additional on-package factors, which is where the current thesis will provide novel and timely insight.

A subsequent review by Cairns et al. (2009) included nine studies which investigated whether food promotion had any influence on children's nutrition knowledge, five of which were randomised, controlled studies and four were cross-sectional. The five randomised controlled trials (RCTs) reported that food

promotion had an effect on, or an association with, differences in nutrition knowledge. Two of these were experimental designs and three were cross-sectional. One cross-sectional study by (Harrison & Marske, 2005) found that TV viewing had a significant adverse effect on nutritional knowledge, relating to foods that were marketed as 'diet' foods, highlighting that children are susceptible to, often misleading, marketing messages. Three studies included in the review found no significant associations between food promotion exposure and children's perceptions of what founds a healthy diet or of their perceived healthfulness of different foods (Goldberg, Gorn & Gibson, 1978a, 1978b, as cited in Cairns et al., 2009).

The body of evidence here is mixed, and would suggest that food promotion has little influence on children's ideas regarding a healthy diet, however, it may have an effect on certain types of nutritional knowledge and future research should seek to establish what promotional techniques influence children's nutritional knowledge and perceptions of foods healthfulness, and whether these can be manipulated to inform and guide healthier food choices. It is also worth noting that all of this research was carried out more than a decade ago, and marketing techniques are constantly evolving and adapting in order to circumvent policy change, and so more recent research is required that reflects the current food promotion environment.

1.4.2.6 Industry self-regulation

Statutory restrictions have been strongly opposed by industry lobbyists with economic motives, and is similar to that of both the alcohol (Gortmaker et al., 2011) and tobacco industries (Moodie et al., 2013). In December 2007, in response to calls for the food industry to change the way they advertise and market foods to children, and to use commercial communications to support parents to make healthier diet and lifestyle choices for their children, leading food and beverage companies in Europe (for example, Coca Cola®, Mars®, Danone® and Kelloggs®) voluntarily implemented the EU Pledge. It consists of two main commitments, no advertising of food and beverages that do not fulfil nutritional criteria to children (<12 years) on TV, print and internet, and no communication related to food and

beverage products in primary schools, unless for educational purposes. Several studies have examined aspects of the EU pledge, finding little support for its efficacy, and highlight various flaws in its design which lead them to question its effectiveness (Effertz & Wilcke, 2012; Romero-Fernández, Royo-Bordonada, & Rodríguez-Artalejo, 2010). A review by Ronit & Jensen (2014) of 22 publications addressing self-regulation pledges, suggests these schemes are often vague, lenient and ultimately exhibit small effects, rendering them ineffective.

Neyens and Smits (2016) monitored the online advertising of food brands who were signatories on the EU pledge, finding that the nutritional profiles for the products marketed did not differ from those who had not signed the pledge, with 88.5% of these foods being considered unhealthy. Ustjanauskas, Harris and Schwartz (2014) claim that these self-regulatory frameworks that are currently in place do not sufficiently protect children from online marketing. However, as the introduction of online food marketing regulations is relatively recent, and there is no regulatory framework specific to online marketing, there is relatively little evaluation of their impact to date (Clarke & Svanaes, 2012). As food packaging, as a promotional technique, is currently unrestricted, there is no existing regulatory framework specific to its monitoring, and little policy to evaluate. It is important, however, to have a baseline understanding of the power and exposure of food packaging promotional techniques, in order to inform the development of potential policy changes in the future, and subsequent monitoring frameworks.

1.4.2.6.1 Calls for food marketing regulations

Recognising that food promotion to children was still a policy priority, in 2010 the WHO released a report called 'Set of recommendations on the marketing of foods and non-alcoholic beverages to children', which called for global action to reduce the impact of the marketing of HFSS foods to children and outlined recommendations for policy change (WHO, 2010). The WHO further posited that the promotion of HFSS foods to children was a priority in the context of childhood obesity prevention and reduction with the later release of a framework for implementing the set of recommendations on the marketing of foods and non-alcoholic beverages to children (WHO, 2012) and the subsequent update report,

entitled 'Marketing of foods high in fat, salt and sugar to children: update 2012-2013' (WHO, 2013). These documents are intended to guide member States in strengthening existing policies and implementing new ones with regards to food marketing to children. However, despite these recommendations and frameworks, few countries worldwide have successfully restricted marketing to children.

The following sections will outline the current regulations and monitoring strategies, which deal predominantly with TV advertising. Following that, section 1.5 will then highlight the current gap in this body of evidence and evaluation surrounding the use of the, currently unregulated, food packaging techniques to promote food products to children.

1.4.2.7 Co-regulation of advertising in UK

The UK advertising regulatory system is enforced by the Advertising Standards Agency (ASA), and is a combination of both self-regulation for non-broadcast advertising and co-regulation for broadcast advertising. Since November 2004, broadcast advertising in the UK has been co-regulated by the Advertising Standards Authority (ASA) and Office of Communications (Ofcom), meaning decisions regarding advertising campaigns across several media platforms, for example TV, radio and posters/billboards, are now being made by one single organisation.

The UK Advertising Codes are written by two industry committees: the UK Code of Broadcast Advertising is written by the Broadcast Committee of Advertising Practice (BCAP), and the UK Code of Non-broadcast Advertising is written by the Committee of Advertising Practice. Ultimately, what this means is that the system is funded by, and the rules are written by, industry, however, these rules are then independently monitored and enforced by the ASA. Ofcom, however, have a statutory duty to uphold the regulatory system and have the final say on any changes made to the UK Codes.

1.4.2.8 Current regulations on marketing to children

Following a report by Hastings et al., (2003), in November 2006, Ofcom announced a statutory ban on HFSS advertising during children's (<16 years) airtime, and surrounding TV programmes with a large child audience. HFSS advertising would be

allowed to continue at other times. HFSS products were defined using the Food Standard's Agency's (FSA) nutrient profiling model (as discussed in Chapter 2, and employed in Chapter 3), and the ban on these advertisements began in 2007.

Ofcom carried out an interim review in 2008, before the final phase of advertising restrictions came into play, and reported that children saw approximately 34% less HFSS advertising than they did in 2005. A final review of the restrictions, carried out by Ofcom in 2009, suggested an increase in advertising of non-HFSS products from 2005, and that HFSS advertising has been eliminated from children's airtime, with children aged 4-9 years being exposed to at least 52% less HFSS advertising, and children aged 10-15 years being exposed to at least 22% less HFSS advertising. While this all seems promising, objective and independent studies which sought to monitor and evaluate the efficacy of these restrictions do not report findings consistent with Ofcom's report, and so this report has come under scrutiny. One major flaw with Ofcom's report, that independent research strove to overcome, was that they used only a short-term time frame, failing to monitor long-term trends. A comprehensive study by Boyland et al. (2011) monitored 12 months of UK TV during 2008, which included coding over 5000 hours. They reported that food advertising was responsible for 12.8% of advertisements, of which 56% were for unhealthy (non-core) foods. This is corroborated by further independent studies, for example, Adams et al. (2012) compared a week of TV recorded 6 months before the regulations were implemented, to a week of TV following the full implementation of all regulations, and found no change in the amount of HFSS food promotion that children were exposed to, which is in direct opposition to Ofcom's report and suggests that these regulations are not enough to protect children from the detrimental effects of HFSS food promotion.

The majority of this policy evaluation and monitoring has dealt with TV advertising restrictions and regulations. As yet, marketing via food packaging is not regulated in the UK. Considering the overwhelming support for the reduction of children's exposure to the promotion of HFSS foods, it is vital that evidence based policy changes are made to create a food environment which supports children to make healthier diet and lifestyle choices. Food packaging provides an unregulated

method through which food companies can freely market their products to children, and so should be considered a public health policy priority in the fight against childhood obesity. Strong, empirical evidence is required to address any gaps in the current body of literature and to support evidence-based policy change.

1.5 Food Packaging

Food-packaging is a relatively understudied area of food marketing in comparison to the more dominant TV advertising and, in more recent years, online marketing tactics, and is routinely overlooked (Chandon, 2012; Elliott, 2009). Food packaging includes all the ways in which foods and beverages are wrapped, boxed and presented to consumers in retail stores (for example, bags, boxes and bottles), but may also refer to how food is presented in restaurants (for example, bowls, plates and glassware) (Chandon, 2012), the latter of which is beyond the scope of this thesis and therefore will not be discussed.

Aside from a small number of mandatory aspects of food packaging, such as nutritional labelling on the back-of-package or volume/size information, any information provided on the front-of-package is controlled by the food companies themselves (Chandon, 2012). Packaging is evidently increasing in stature as a marketing vehicle (Hawkes, 2010), and Chandon (2012) argues that it is currently the fastest-growing marketing tool. Hawkes (2010) suggests two main reasons for this increase: firstly, many food choices are made at the point of sale. Rettie and Brewer (2000) refer to a Henley Centre Study from 1996 which found that 73% of purchases are decided at the point-of-sale, and rely on food packaging as the primary influence over their choice. Focus groups with mothers revealed that children were attracted to packaging that looked 'nice', and if mothers were to purchase the food it must first look appealing to the child so as to ensure that the child would eat it and that it would not be wasted (Gelperowic & Beharrell, 1994). It is estimated that consumers spend between 4-10 seconds when making product selections at the point-of-purchase (Pettigrew, Pescud, & Donovan, 2011), and so food-packaging plays a key role in guiding and informing these quick-fire decisions. The second reason for the increase in food package-based marketing is that the nature of food marketing itself is evolving, with less emphasis on food advertising

alone (Hawkes, 2010; McGinnis et al., 2006), and more focus on other aspects of food marketing such at the point of purchase, via food packaging (Harris, Schwartz, & Brownell, 2010; McNeal & Ji, 2003). Packaging has been described as 'the silent salesman' (Hill & Tilley, 2002, as cited in McNeal & Ji, 2003), as it has evolved to be much more than simply a functional facet of food and beverage sales. It is a fundamental aspect of marketing, branding, related communication and positioning, as part of the complex, integrated marketing campaigns that are currently favoured (Ahmed, Ahmed, & Salman, 2005; Ogba & Johnson, 2010; Rettie & Brewer, 2000), and so warrants attention within the wider context of environmental influences on children's food behaviours.

1.5.1 The current landscape of food packaging

Before discussing the current body of literature surrounding the influence of food packaging on children's dietary behaviours, in a similar vein to the TV advertisement monitoring detailed in Section 1.4.2.2.1, there is a need to understand the current food-packaging landscape. That is, the nature of the food-packaging promotional techniques that are being used, the extent to which they are being used, and the nutritional quality of foods and drinks they are being used to promote. Worldwide, various content analysis studies have striven to give an account of the current food-packaging landscape (Elliott, 2008; Grigsby-Toussaint, Moise, & Geiger, 2011; Harris et al., 2010; Hebden, King, Kelly, Chapman, & Innes-Hughes, 2011), and will be discussed in more depth in Chapter 3. However, while the majority of these studies have had a narrow focus, for example, looking specifically at the use of promotional characters (Hebden et al., 2011), cross-promotions (Harris et al., 2010), cereal packaging (Page, Montgomery, Ponder, & Richard, 2008), or at small-scale convenience stores rather than supermarkets (Gebauer & Laska, 2011), it is apparent that these studies seem indicative of a general pattern. That is, there has been an increase in the range of food-packaging techniques targetting children, and the foods and beverages which are found to be marketed to children in this manner are more likely to be unhealthy, than healthy (Berry & McMullen, 2008; Harris et al., 2010; Page et al., 2008), thus mirroring that of TV and online advertising.

A comprehensive study in Canada assessed child-oriented marketing in all product categories, reporting that 90% of the products were deemed unhealthy, 84% used cartoon characters, and 63% employed misleading health or nutrition claims (Elliott, 2008). A further study in Australia found that 75.2% of foods marketing to children via food packaging represented non-core foods, which were high in fat or sugar, and they reported at least 16 unique marketing techniques used on child-oriented food-packaging in supermarkets, including bright colours, child-oriented script, kid-size/lunch-box packs, links to food company websites, promotional characters (licensed and unlicensed), references to play/education, references to flavour, captions which exaggerated attributes of the food (e.g. 'dangerously cheesy'), discounts, novel packaging shapes, cross promotions and movie tie-ins, images of children, celebrities and games (Mehta et al., 2012). No such monitoring studies have been carried out in the UK to date and so the current situation is unknown, therefore this gap in the literature needs to be addressed and will be the focus of Chapter 3.

1.5.2 Nature of food-packaging marketing techniques

Research to date discusses the concept of 'eatertainment' when discussing children's perceptions and attitudes towards food, describing a combination of food and fun (Harris et al., 2010; Roberts, 2005), creating a type of food which is distinct from that of adults. This may include on-package techniques such as premium offers (free gifts, toys, stickers, trading cards etc), the use of promotional characters (including celebrity endorsers, sports personalities, licensed characters, BE characters, children represented on the packaging, or generic child focused illustrations such as animals, aliens etc), movie tie-ins and cross-promotions, kids meals (child-sized portions of food combined with soft-drinks and free toys) and fun product designs (including unusual shaped food or packaging). In addition, colour is also an important aspect of food choice, and so products marketed towards children tend to be brightly coloured (Marshall, Stuart, & Bell, 2006).

All of these food-packaging techniques are used to draw attention to the products at the point-of-purchase, and create positive associations with the product, thus differentiating it from other similar foods, which Chandon (2012)

argues creates additional value in the consumer's mind, and encourages them to choose this product over others. Therefore, it is crucial that we establish the extent to which these techniques are used, and their impact on children's food behaviours. As surveying what people actually purchase raises additional methodological difficulties, experimental research which assesses how these techniques influence preference and choice will be used as indicators of purchasing behaviour and choice in the real world. It is important to understand not only how these food-packaging promotional techniques contribute to children's preference, choice and purchasing behaviours, but also to actual consumption, and so the current body of research will be discussed in brief (see relevant chapters, as indicated, for more in depth discussions of the literature where appropriate).

1.5.3 Influence of packaging on children's food preference, choice and consumption

While food-packaging has been relatively understudied, the existing evidence for general child-oriented marketing (for example, TV advertising, as previously discussed) has been shown to have pronounced effects on the food preferences, choice and consumption of children (Enax et al., 2015) and so it stands to reason that food-packaging techniques would also exert similar influences. The subsequent sections will provide an overview and a brief summary of the existing research, with further details given in the relevant chapters.

1.5.3.1 Branding

Packaging is generally seen as an extension of the brand, providing a recognisable logo which is easy for people to recognise when evaluating a food-package. Robinson, Borzekowski, Matheson and Kraemer (2007) found that by placing five pairs of identical foods and beverages in either McDonald's® or matched unbranded packaging, children indicated a preference for the tastes of foods and drinks when presented in the McDonald's® packaging. This effect was found to be moderated by children who ate at McDonald's® more often, and among those with more TV sets in their homes, thus emphasising the powerful effects of branding and TV advertising on children's perceived liking and preference of foods, and how this effect is carried over to food packaging evaluations.

How a product is branded, however, goes beyond simply slogans and logos, and is complex in nature. For example, in an adult population, Lee, Frederick and Ariely (2006) found that beer was perceived as tasting better when vinegar was added if the vinegar was described as a special ingredient, however, not when they stated the ingredient was vinegar, which can demonstrate the effectiveness of how certain ingredients are branded. The nature in which various products are branded can even impact on physiological measures of satiation, for example, Crum et al. (2010) found that describing a milkshake as either 'sensible' or 'indulgent' had a measurable effect on gut peptide ghrelin levels, thus demonstrating the powerful nature of branding as a marketing tool.

There has been a recent focus on the application of neuroscience to marketing, exploring the impact of branding on consumers at a neurological level, through the use of functional magnetic resonance imaging (fMRI), which offers potential for broad insights into the biological basis of behaviour (Plassmann, Ramsøy, & Milosavljevic, 2012). Research has demonstrated that HFSS food advertising produces greater activation in the reward regions of the brain in adolescents, which have been previously demonstrated to predict consumption of nutrient poor, energy-dense foods (Gearhardt, Grilo, DiLeone, Brownell, & Potenza, 2011). Bruce et al. (2014) examined children's (aged 10-14 years) brain responses to food logos (*n*=20). Children (50% obese, 50% normal weight) were shown 60 non-food logos and 60 food logos, as well as baseline images, while in an fMRI scanner. In response to the food logos, normal weight children displayed significantly more brain activation in regions which are commonly associated with cognitive control than obese children. A more recent study by the same author investigated how food commercials influenced children's food choices (Bruce et al., 2016). Children (*n*=23, aged 8-14 years) were asked to provide both taste and health ratings for 60 food items. These children were then asked to make food choices (whether to eat or not to eat foods) while in the fMRI scanner, after being exposed to food and non-food commercials. The authors reported that watching the food advertisements led to differences in how children made their decisions, with more importance placed on taste after food advertisement exposure, relative to controls. Health values were

not used when making their food choices, suggesting that choice was driven predominantly by immediate, hedonic rewards (how the food tasted). In addition, children placed significantly more importance on the taste of foods after watching food advertisements than non-food advertisements. As in the previous studies detailed, children displayed increased activity in the reward regions of the brain, when exposed to food promotion (Bruce et al., 2016). In line with the existing research on the effects of food marketing, such as TV advertising (refer to section 1.4.2.4), this suggests that obese children may be more susceptible or vulnerable to branding, such as food logos.

1.5.3.2 Promotional characters

Many studies have also been able to clearly demonstrate the effect of various promotional characters on children's food preferences and choices, including licensed characters (de Droog, Buijzen, & Valkenburg, 2012; Roberto, Baik, Harris, & Brownell, 2010; Smits & Vandebosch, 2012) and celebrity endorsers (Boyland et al., 2013), with children favouring the foods presented with a promotional character on the packaging, compared to identical foods without a character.

A recent study (Enax et al., 2015) demonstrated that food packaging can also have a positive influence on children's dietary outcomes when used to promote healthier food items (in this instance a mixture of cereals, yoghurt and fruit). Enax et al. (2015) used the relatively novel approach of assessing handgrip strength as a measure of effort provision for food items in children. They found that packaging cues significantly influenced a taste-placebo effect in 88% of participating children, producing taste rating differences for identical food products in different packages. Both taste ratings, and the amount of effort applied to receive the product, were found to be highest for the foods which included cartoon characters on the packaging.

To date, no research has investigated the use of brand equity (BE) characters on food packaging on diet-related outcomes in children. BE characters are often spoken about in the literature using a variety of terms (for example, spokes-characters or brand characters), which may result in confusion for policy

makers and researchers when interpreting the existing body of research. A move towards a clearer, universal term may aid this interpretation.

BE characters merge both branding and the use of promotional characters to promote a product. They are treated as a brand logo and as such are not subject to regulation. The distinction is evident in regulatory approaches (Ofcom, 2010) that restrict the use of licensed, but not BE, characters when marketing HFSS foods to children. However, this approach does not seem to be evidence- based and further research is needed to assess whether this distinction between character types is appropriate, and so Chapter 4 will assess the influence of BE characters on the food preference and choices of children.

1.5.3.3 Portion sizes

Portion size has been acknowledged in the literature as contributory factor in the obesogenic environment (Vermeer, Steenhuis, & Poelman, 2014). There is a vast body of literature which confirms the portion size effect, demonstrating that larger portions of food are associated with increased food consumption and energy intake in both adult (DiSantis et al., 2013; Mrdjenovic & Levitsky, 2005; Rolls, Morris, & Roe, 2002; Steenhuis & Vermeer, 2009; Wansink & Cheney, 2005; Wansink, van Ittersum, & Painter, 2006) and child populations (Birch, Savage, & Fisher, 2015; Fisher, Liu, Birch, & Rolls, 2007; Kral, Kabay, Roe, & Rolls, 2010; Looney & Raynor, 2011; Mathias et al., 2012; McConahy, Smiciklas-Wright, Birch, Mitchell, & Picciano, 2002; Piernas & Popkin, 2011).

One potential theory is that consumption norms are driving this portion size effect (Neyens, Aerts, & Smits, 2015; Zlatevska, Dubelaar, & Holden, 2014). These are perceptual suggestions of what is a reasonable, appropriate or typical amount of food to consume (Wansink, 2004; Wansink & van Ittersum, 2007). As Fisher et al., (2013) posit, children's self-served portion sizes are influenced by size-related cues in their environment, and so it is therefore important that we fully understand the influence of various existing, external cues in the food-environment which may influence children's eating behaviours. There is a relative paucity of empirical evidence which evaluates the potential effects of more subtle influences on children's eating behaviours, for example the use of visual cues.

A relevant study by Neyens, Aerts and Smits (2015) investigated whether altering the size of front-of-pack portion size depictions on cereal boxes would influence children's consumption of cereal. The authors reported a significant main effect of image size, with children who were exposed to a larger image on the cereal box serving and consuming more cereal than children exposed to the smaller image. Chapter 5 will discuss in depth the current body of literature supporting the portion size effect and expand upon the findings of Neyens et al. (2015), by investigating whether altering the amount of food depicted in the portion size on the front of the cereal box (i.e. the amount of food in the bowl) will have a similar impact upon children's serving and consumption as altering the size of the picture depicted on the box (without adjusting the portion size) as in Neyens et al's (2015) study.

1.5.3.4 Evaluations of healthiness

Chandon (2012) suggests that the key consumer benefits associated with food, such as pleasantness of the food, sensory perceptions and healthiness, cannot be reliably or easily established before the consumer experiences them. When reliable information about these factors cannot be obtained, consumers will look to design cues and claims on food-packaging to make their assessments of the foods, in particular, when assessing novel and unfamiliar foods. This can be done via one of two processes: the categorisation of foods into goal-oriented (e.g. healthy or not, tasty or not) or pre-existing, natural categories (e.g. snack foods or fruits), or by inferences which are based on available information, (Chandon, 2012), for example, assuming a food is low in calories if it has a nutritional claim of reduced levels of fat, or assuming a cereal is healthy as it is presented on the packaging beside a piece of fruit. This has been demonstrated in adult populations, for example, participants viewing a cheeseburger alongside celery incorrectly estimated it to have fewer calories than a cheeseburger alone (Chernev, 2011; Chernev & Gal, 2010), referred to as the 'negative calorie illusion'. This is attributed to people considering the average healthiness of a meal, as opposed to looking at each individual component of the meal (Forwood, Ahern, Hollands, Fletcher, & Marteau, 2013).

The wider concept of inferred healthfulness is often referred to in the literature as the 'health halo effect' (Chandon & Wansink, 2007; Ebneter, Latner, & Nigg, 2013; Williams, 2005). This refers to a cognitive bias, whereby when learning of a perceived healthy attribute of a food item, consumers draw inaccurate inferences about the food as a whole, which can alter the perceived healthiness of the food, potentially leading to over-consumption. For example, nutritional claims such as 'no added sugar' may give the impression that something is low in sugar, when in fact it may contain high levels of naturally occurring sugars.

A study by Elliott (2009) employed a series of focus groups to examine how children interpreted food packaging appeals, and how the theme of fun was connected to children's understanding of health and nutrition, and their evaluations of the foods' healthfulness based on these appeals. Children were asked to name a healthy food, of which 67% named a fruit or veg, 17% referenced bread or pasta, 7% yoghurt or cheese, and 15% were unable to name a healthy food. However, despite the majority identifying fruit and vegetables as healthy, they displayed very limited comprehension of why they were actually healthy, with 70% of the children not knowing why it was healthy or providing a self-evident answer such as 'carrots, because they are a vegetable.' The authors highlighted that this lack of nutritional knowledge extended to the children's evaluations of nutritional claims and food packaging. When asked to indicate what aspects of food packaging that children used to establish whether a food was healthy or not, while providing sophisticated explanations, the majority of children's responses were relatively inaccurate. A variety of factors were identified, such as the ingredient list (22%), with children suggesting that long words which they couldn't pronounce generally meant the product had high levels of sugar, for example. Worryingly, only 8% of children referenced the nutrition facts table as an evaluative tool, and those that did could not effectively explain what it actually was, merely that they had been previously instructed to look for it. Some children detailed the use of symbols on packaging (17%), often used on packaging as an indication of aspects of healthfulness (refer to Figure 6-2 for examples). Some children believed the

absence of allergy-inducing ingredients equated to healthier foods, for example, the logo used to indicate that a food is nut-free (14%).

Elliott (2009) reported that 20% of the children reported a reliance on some aspect of the food packaging image to establish if a food was healthy or not, for example, green indicated that a food was healthy, or a picture of honey on the box indicated that the honeycomb cereal was a healthy option. Nutrition facts tables and nutritional claims appear too complex for children to comprehend and appropriately apply, and children display a strong reliance on imagery and visual assessments of the food-packaging, which in the wider context of health halos is concerning. However, symbols and imagery potentially present a feasible and easily modifiable opportunity for intervention.

In the UK, traffic light labelling (TLL) on food packaging is the recommended food labelling format. It has the potential to bridge the gap between detailed nutrition based facts which follow evidence-based nutritional guidelines, and a simple, front-of-pack symbol which can guide informed, healthier choices. Children's interpretation and application of TLL to identify healthier food choices has yet to be empirically assessed and will therefore be addressed in Chapter 6. In addition to this, it has been suggested that interventions which promote media literacy and nutritional education could provide protection from the influential messages of child-oriented food promotion (Story and French, 2004), and so Chapter 6 will also test the efficacy of a brief, online intervention aiming to educate children on basic, age-appropriate nutrition guidelines, including the use of TLL to identify healthier food choices.

1.5.4 Conclusion

Although the (now defunct) Food Standards Agency (FSA; 2007) and Ofcom have indicated that they recognise a need for a ban on advertising HFSS foods to children, as yet no such restrictions have been put in place with regards to food packaging promotional techniques, which remain largely unregulated in the UK. Children in the UK currently consume too much HFSS food, with excessive levels of saturated fat and energy consumption (Brug et al., 2008; Drewnowski, 1997) and too little fruit and vegetables in their diets (Umeh & Crabtree, 2006) which are not

in line with dietary recommendations. Children in the UK have been shown to habitually eat too much HFSS foods, with an estimated 47% of primary school aged children's dietary energy coming from HFSS foods (The Food Foundation, 2016). As such, there is a need for strong, empirical evidence to inform policy change and industry regulation with regards to the marketing of HFSS foods to children via food-packaging techniques, in order to reduce their influence on the dietary behaviours of children in the UK, and worldwide.

1.6 Thesis aims and objectives

This thesis consists of six further chapters; one focused on the overarching methodologies used, followed by four experimental chapters, and finally a synthesis and discussion of the overall findings and their implications. The literature demonstrates that food marketing to children has a measurable effect on children's food behaviours on the whole, however, it also highlights that there is a paucity of research surrounding less established methods of food promotion, such as food packaging. As food packaging is one of the fastest growing mediums of food promotion, it therefore warrants attention in the wider context of understanding the potential drivers of weight gain in children so that this may inform the prevention and reduction of childhood obesity. A body of strong, empirical evidence is needed in order to inform and guide policy change, and as yet this research is lacking. This thesis aims to build upon and strengthen the existing body of research.

Chapter 2 outlines the key methodological tools, challenges and strategies employed within this thesis, and serves as a supplement to the experimental chapters where the individual methodology of each study is discussed in depth.

Chapter 3 will give an overview of the current food packaging landscape here in the UK, which has yet to be assessed, by establishing the exposure and the power of marketing techniques on food packaging that children are currently exposed to. In addition, it will also take a novel approach and assess whether seasonal differences exist.

Chapter 4 examines the influence of BE characters on food packaging on children's food preferences and choices. There is a wealth of literature which suggests that promotional characters influence children's eating behaviours, in favour of those marketed with these characters, however, to date, no research has established the influence of BE characters specifically, and as they are not currently regulated, it is key that we understand their impact.

Chapter 5 expands upon the abundant body of literature on the portion size effect, which demonstrates its influence on eating behaviours, and also the evidence surrounding the influence of external, visual cues on children's eating behaviours, by examining for the first time whether altering the amount of food presented in the front-of-pack portion size depictions can influence how much children serve themselves, and subsequently consume.

Chapter 6 is the final experimental chapter, which aims to establish whether children can successfully employ the use of TLL as a tool to identify healthier food choices. In addition, it assesses the efficacy of a brief online intervention, which is aimed at increasing children's nutritional knowledge and understanding of TLL. As little is known about the effects of nutritional education on children's ability to employ nutritional labelling as an evaluative tool, this study provides some novel insight.

Chapter 7 is the final discussion, which will bring together the results from all of the experimental studies and highlight their implications in a wider context.

In summary, the main aim of this thesis is to establish the current landscape of food promotion on food packaging, and to examine various food promotion strategies that are employed on food packaging to market food to children. By identifying potentially problematic aspects of food packaging promotion, this thesis will contribute to the current body of literature in this field by increasing our understanding of the potential drivers of HFSS food consumption in children. These data will inform interventions and assist policymakers seeking to prevent and reduce childhood obesity.

Chapter 2: Methodology

This thesis will contribute to the current literature on the impact of marketing techniques on food packaging on children's eating behaviours. The following chapters will open with an initial content analysis of food and beverage products targeted at children in Chapter 3, including the application of a nutrient profiling model to characterise the health status of the foods. This will provide an overview of the current food-packaging landscape in the UK, thus giving context to the subsequent experimental chapters, which adopt a variety of experimental designs. Chapters 4 and 5 featured the use of an adapted version of a previously published experimental paradigm conducted in schools with child participants. Specifically, Chapter 4 follows on from several published studies which used comparable paradigms to address similar research questions with regards to the influence of branding and promotional characters on food packaging (Roberto et al., 2010; Robinson, Borzekowski, Matheson, & Kraemer, 2007). In a similar vein, the experimental design adopted in Chapter 5 is based on relevant existent literature relating to the portion size effect, but has been adapted to respond to our specific hypotheses. Chapter 6, the final experimental chapter, was an online study in which child participants were asked to complete tasks on a PC, on three occasions, under the supervision of a parent/guardian. It assessed the success of an online intervention aimed at improving children's ability to comprehend and use the Traffic Light Labelling (TLL) system on food-packaging. A general overview of the methods will be provided in the following sections, which serves as a supplement to the corresponding chapters which follow.

2.1 Participants

This thesis focuses on the effects of various food-packaging elements on the dietary preferences and choices of children. Therefore, in order to obtain representative results, children across both genders, and a range of ages were included to maximise the generalizability of the results. However, within this, the age ranges of the children used were adjusted to suit both the aims and limitations of each of the

studies, as well as the number recruited being driven by power requirements. Overall, participants were both male and female children aged 4- 11 years. Chapter 4 included children of both genders, aged 4-8 years (Mean = 6.9y ± 1.1y). This age-range reflects two primary considerations; (i) consistency with the age range used in previous studies which show the effect of various promotional characters on children's food choices and taste preferences in children aged 4-6 years (de Droog et al., 2012; Lapierre, Vaala, & Linebarger, 2011; Roberto et al., 2010), and (ii) an examination of marketing effects across the age-range when children are believed to be more vulnerable to marketing techniques, due to their inability to detect their persuasive nature before 8 years of age (Levin, Petros, & Petrella, 1982). Chapters 5 and 6 included children of both genders, aged 7-11 years (Mean = 9.0y ± 1.5y and 9.1y ± 1.5y, respectively). This age range was selected with the increasing food-behaviour related autonomy of pre-teen children in mind (Bassett, Chapmen & Beagan, 2008), who may be more likely to self-serve food, thus regulating their own portion sizes, and also exercising more control over their food choices and family purchases to a greater extent than younger children. Ethnicity, whilst not controlled for nor used as an inclusion/exclusion criterion, was recorded for Chapters 4 and 5, and the opportunity sampling (see section 2.1.1 below) resulted in a Caucasian majority (77% and 68% of self-reported ethnicity, respectively). Ethnicity data was not requested for the online study in Chapter 6.

2.1.1. School-based Recruitment

In order to recruit sufficient numbers of children within the required age-range, local primary schools and nursery groups were contacted (Chapter 4 and 5). All participants were recruited from the UK (primarily from primary schools in Merseyside, however, one primary school in Lancashire, one primary school in Warwickshire, and one primary school in Tyrone, Northern Ireland, were also included). Initial contact was directed to head teachers (Gatekeepers; see Appendices 4a and 5a for a copy of the letters used for Chapter 4 and 5, respectively), and subsequent parental contact followed in letter format (Appendices 4b and 5b, respectively), via the school administration/teaching staff (see section 2.2.2 for a detailed description of consent procedures). All

documentation given to schools/parents was ethically approved prior to being administered. In the majority of schools, the classes who were selected to take part were chosen by the school, based on those who were available at the time (i.e. those not undertaking assessments, not recently participated in other research, not on school trips etc.) and was also at each individual class teacher's discretion, and so an opportunity sample within the appropriate age-range was recruited within each participating school.

2.1.2. Online Recruitment

Chapter 6 was an online study; recruitment was carried out online, and so no direct contact with children was required. An opportunity sample was obtained by issuing open requests to parents via various online media, including social media (Twitter, Facebook), parenting websites/blogs and university emailing lists. Parents/legal guardians were asked to email the investigators if they would like more information regarding their child's potential participation in the study. Parents/legal guardians were then issued with a parental information sheet which they were advised to read (Appendix 6a). Those who responded stating that they wished to take part were then issued with an online link to the study, where they were asked to confirm that all inclusion criteria were met, before informed consent procedures took place (see section 2.2.2 for more detailed information on these procedures).

2.1.3 Potential biases associated with sampling methods

Schools were recruited using a convenience sampling technique, whereby schools were targeted initially based on location, with preference for those located close to the university and also in conjunction with a departmental database, maintained by researchers within the Department of Psychological Sciences who recruit children for their research (e.g. language development and appetite groups). This database ensured no overlap of schools being recruited and also made it clear which schools had expressed interest in taking part in further studies, thus ensuring we were not placing too much pressure on the schools nor contacting those who expressly did not wish to be contacted. The head teachers of these schools were initially approached via letter, which was followed up with a telephone call where they could ask any further questions and register potential interest. This may have

potentially resulted in a bias towards including schools that were more motivated to promote healthy eating initiatives and interventions. Many participating schools stated that they had obtained National Healthy Schools Status, a UK government run project designed to encourage education and health providers to work together to improve the health of pupils; this was not measured nor controlled for in the data.

In addition, when in schools or day care centres, the use of opportunistic sampling meant many children who met the inclusion criteria were excluded due to their attendance on school trips and activities, absence due to illness, or undertaking examinations which coincided with data collection periods. For ethical reasons, the parental information sheets were considerably lengthy and were required to provide in depth information; this may mean that parents with higher literacy skills or higher levels of interest in their children's eating behaviour were more likely to read the information and, subsequently, consent for their children to participate in the research.

Chapter 6 was an online intervention study which was advertised online via social media, an internal university notification system, and also by word-of-mouth. This poses the same potential for bias as the school recruitment, with potentially only parents with an existing interest in healthy eating, and motivation to encourage their children to make healthier choices, expressing interest and contacting the researcher for more information. In addition, this may bring additional bias by only appealing to parents who are computer-literate, or regular users of the Internet, during the recruitment process.

2.1.4 Weight Status and Body Mass Index

An age- and gender-adjusted Body Mass Index (BMI) is currently the standard measure of overweight and obesity in children. Participants' weight was measured to the nearest 0.5kg, using recently calibrated weighing scales (SECA 770), and height was measured to the nearest 0.5cm using a stadiometer (SECA Leicester Portable Height Measure). A BMI z-score was then calculated using the WHO anthropometric calculator (WHO Anthro, version 3.2.2. January 2011, downloaded

from www.who.int). This is software that has been developed to facilitate the application of the WHO Growth Reference 2007 for children and adolescents aged 5-19 years, in order to monitor their growth.

Using the criteria recommended by the World Obesity Federation (formerly the International Obesity Task Force; Cole et al., 2000), weight status was defined using age-and gender-specific BMI z-score boundaries, which were equivalent to adult BMIs of 25kg/m² and 30kg/m² for overweight and obese, respectively. Due to small numbers of overweight and obese children participating in the studies, these two weight statuses were combined. This resulted in a dichotomous variable for weight status, representing normal weight status and a combined overweight/obese weight status group, which aimed to reduce disparity between weight status group sizes in order to meet the assumptions for parametric analyses.

2.2 Experimental Ethics

Child-centred research presents some ethical challenges, with regards to both the experimental procedure and the recruitment process itself. Whilst any potential risks posed by the act of taking part in the research are of a primary concern, there are also questions regarding the participating child's ability to give informed consent, due to their age. All relevant studies (those involving human participants) obtained ethical approval from the University of Liverpool, either as a separate project submitted to the central University Research Ethics Sub-Committee for Non-Invasive Procedures (Chapter 4; Ref RETH000617), or as an individual project for which the methods proposed had previously been approved for use in this population as part of a generic ethics application acquired by the primary supervisor in 2013 and valid for 5 years (Chapters 5 and 6; Ref IPHS-1415-028 and Ref IPHS-1415-140, respectively, reviewed within the School of Psychology and approved under the generic approval RETH000643).

2.2.1 Ethical Considerations

All experiments that included human participants (Chapters 4, 5 and 6) provided minimal risk to participating children. Chapter 6 details an online intervention study, where direct interaction between the researcher and participants did not

occur. For Chapters 4 and 5, which took place in a school setting, a member of school staff was present at all times during the research. This was particularly important to ensure that they could witness the child giving informed consent to the researcher and observe the measurement of height and weight, as well as to ensure children were comfortable at all times during testing. Anthropometric measurements were taken individually, either in a separate space within the allocated study room or in a private room, dependent on the school facilities available. The measurements recorded were identifiable only by participant number and were not visible to subsequent participants. Children were asked if they were happy for these measurements to be taken and reminded that this was entirely optional; had children indicated any discomfort or reluctance at this point, measurements would not have been taken, however, all participating children were willing. An additional ethical concern for the studies detailed in Chapters 4 and 5 was food allergies/intolerances, as children were provided with food to consume. Parental consent forms requested that parents indicate whether their children had a history of food allergies/intolerances, and those that indicated any such history were immediately excluded from the study. No adverse events occurred during data collection for any of the studies detailed.

2.2.2 Informed Consent Procedures

The consent procedures detailed within the subsequent sections of this thesis are fully compliant with the University of Liverpool's policy documents for obtaining consent for research involving human participants. As previously detailed, head teachers were always the initial gatekeeper, but often they devolved specific consent provision to other relevant gatekeepers, such as teachers or breakfast club managers (gatekeepers), who provided the initial informed consent before recruitment for the school-based studies could commence. They read the information letter (see Appendices 4a and 5a), were given an opportunity to ask any questions and, if content, they then signed a consent form (see Appendices 4a and 5a). Where studies took place during school hours and on school property, gatekeepers were responsible for safeguarding the pupils' interests, giving permission for the study to take place in their school only when they were content

that the study itself would provide no additional physical or psychological risk to the children, beyond that of a typical school day. The informed consent procedures for the online intervention study are detailed in Sections 2.2.2.1 and 2.2.2.2, below.

2.2.2.1 Obtaining Informed Parental Consent

Following permission from the gatekeepers (as explained above in section 2.2.2), the parents of potential participants were provided with study information via the school and, using an opt-in system, were asked to sign and return the attached consent form (and any additional study questionnaires provided) to the school/day care centre, if they were happy for their child to participate (see Appendices 4b and 5b, respectively). As the study detailed in Chapter 5 involved an element of deception *(parental information stated an interest in the effects of food packaging on children's eating experiences, without specifically referring to the influence of portion size depictions on children's serving and consumption behaviours)* a debrief letter for parents was also given to each child upon completion of the study, explaining the full aims of the study, and why this mild deception was necessary to ensure that children's behaviour was not influenced by the study aims (see Appendix 5f). For the online study in Chapter 6, parents/guardians were asked to contact the researcher by email expressing an interest in participation. They were given an overview of the study, including inclusion criteria, and offered a web link to the study. This web link directed parents to an online copy of the participant information sheet and consent form (see Appendix 6a and 6b, respectively). Parents were asked to read the inclusion criteria and obtain their child's verbal assent before commencing with the study. Parents were advised by text clearly displayed on the screen that by clicking on the continue button they were confirming that their child met the inclusion criteria, that they give consent for their child to participate and that they had also obtained verbal assent directly from the child.

2.2.2.2 Obtaining Informed Child Consent

The University of Liverpool's policy document, entitled 'Requesting Consent,' states that children, as defined in the Human Tissue Act, are those less than 18 years of age. They may consent to their involvement in research if they are competent enough to do so. However, within experimental ethics, children are generally

considered capable of comprehending what an experiment involves and therefore capable of providing consent from the age of 12 onwards. As the upper age limit of this thesis was 11 years, it was felt necessary to also include parental consent (as detailed in the previous section) to provide an additional level of protection for children, before making contact directly with the child (Chapters 4 & 5 only, in Chapter 6 direct contact with children was never made).

During experimental test days involving face-to-face contact between the researcher and participating children (Chapters 4 and 5), all participants were given age appropriate study information (Appendices 4c and 5c), which they were encouraged to verbally discuss with the researcher, ensuring comprehension of the study requirements. Those children who were willing to participate gave verbal assent, which was witnessed by a member of school staff and documented by the researcher on the child consent form (Appendices 4c and 5c). Upon completion of the studies children were thanked and given an age-appropriate debrief of the studies' aims, and asked not to discuss this with their peers. For the online study (Chapter 6) parents were asked to indicate, using the online system, that their child had understood what the study involved and had given verbal assent for their participation and that they knew they were free to withdraw from the study at any time, without having to give a reason, and without penalty.

2.2.3 Data Confidentiality

For school-based studies (Chapters 4 and 5) children were allocated a participant number upon entering the study so that their data were not identifiable. For Chapter 6, parents were asked to create and enter a unique participant code for their children, which consisted of the first 2 letters of the child's first name, the month they were born in, their current house number and the last 2 letters of their surname (examples were given). Parents/guardians were advised that they would be required to enter this code at each study point, and were provided with a reminder of how the code was created at each point, so as to avoid error. All paper-based data were stored in a locked filing cabinet in a locked office in the University of Liverpool, and electronic data were stored on a virus- and password-protected computer. All participating schools and parents were informed at the point of

consent that this data would remain confidential, and that any subsequent write-ups of the research would present the data anonymously, without referring to individual children.

2.3 Materials

When carrying out experimental research that strives for ecological validity, it is preferable to measure outcomes of participant exposure to normal stimuli in natural contexts, for example, at the point of sale. However, measuring the response of participants to certain food-packaging stimuli in this way can result in some fundamental, methodological difficulties, such as a lack of control over the manipulation itself, whereby confounding variables are not accounted for, and also a lack of control over measurement, for example, human error or under-/over-reporting when asking subjects to self-report, or to report retrospectively on previous behaviours. The brand equity (BE) character stimuli (described in section 4.2.4) and the foods used in the traffic light labelling intervention (described in section 6.2.5) used real BE characters and foods which are commonly available to UK children, which aimed to ensure that the experimental stimuli were as naturalistic as possible. Similarly, the cereal boxes in Chapter 5, whilst created solely for the purpose of this study, mirrored cereal box designs typically used in the UK and were presented under the guise of obtaining feedback on a new product (see Chapter 5 for image used). Moreover, two of the three experimental studies took place in schools, and the third took place in the homes of participants, and so could be considered to be a suitable compromise between the artificial settings of laboratory-based studies and the decline in methodological control that is commonly associated with epidemiological studies (Stubbs et al., 1998).

2.3.1 Brand Equity Character Stimuli

To assess the acute experimental effects of brand equity (BE) character placement on food packaging in Chapter 4, bespoke food-packaging stimuli with BE characters present were developed. In order to identify optimal experimental stimuli, characters were selected based on pilot work, which is detailed in the following section (2.3.1.1). Using Microsoft Word®, labels were created for each of the study foods, both with and without BE characters as required, which were affixed to clear

packaging (see Chapter 4 for more information regarding the foods and characters used, and food-character pairings).

2.3.1.1 Pilot Work

To order to identify characters that were familiar to the children, and broadly well liked, initial pilot work was carried out. A variety of BE characters from the UK food market were identified by examining food packaging in supermarkets (see Chapter 3) and also television advertisements recently recorded from the UK commercial television channels most popular with young people (data readily available as part of an ongoing food advertising monitoring project within this research group). This meant the BE characters identified were those that children in the UK were most frequently exposed to as part of typical food marketing activity. Consideration was given to the role the character played, such as their level of prominence, extent to which they are animated, having names and personalities (versus being simply an extension of a brand logo), and how long-standing that the character-food brand association had been. Having identified a selection of potentially well-known characters, parents/legal guardians of children in the appropriate age range (4-8 years) were approached with information about the pilot study via university announcements, word-of-mouth within the department and also on social media. 28 parents/legal guardians responded and were issued with consent forms and questionnaires (see Appendices 2a and 2b, respectively) by email, post or in person, where appropriate. Children were asked to rate their recognition and liking of each of the 10 characters identified (using smiley face Likert scales), and a basic points system was employed to identify the most recognised and liked BE characters. Of the four highest scoring BE characters, 3 were selected which ensured a range of snack foods. The 3 characters identified were also comparable across features such as facial expressions, hand gestures/body language and gender.

2.3.2 Portion Size Stimuli

To assess the acute experimental effects of altering portion size depictions on the front of cereal packaging, novel cereal boxes were designed. These boxes, dependent on condition, displayed either a recommended 30g portion (standard serving size stated on most cereal packages) or a 90g portion (representing the

portion size more typically depicted on cereal boxes). Photographs of these portions were taken and the cereal boxes were created using CorelDraw® (Graphics Suite X7, Corel Corporation, 2014). Whilst these boxes were novel, as this was not a cereal brand children were familiar with and the box was designed and created solely for the purpose of this study, in order to obtain data which was as ecologically valid as possible these cereal boxes were based on existing cereal boxes that are marketed to children in the UK (see Chapter 5 for a picture of the cereal boxes used). These boxes were made to as high a spec as possible, within the typical constraints of equipment and skills available, but the children's lack of familiarity with the cereal was not a problem as the study was presented as testing a new cereal. Furthermore, all data was collected in breakfast clubs in schools and childcare centres, providing additional ecological validity.

2.3.3 Traffic Light Label Stimuli

The foods selected for comparisons in Chapter 6 are all foods which are readily available in the UK and came from a range of supermarkets. As it was not always possible to find comparable foods that displayed traffic light labels (TLL) on the front of packaging, and did so in a way that was large and clear enough for children to see when displayed online, the study included a visible, uniform TLL below each of the foods. The study was designed and completed online using Qualtrics® (Qualtrics®, July 2015, available from www.qualtrics.com). The food pairs used were visibly matched as closely as was possible, plausible, but with each pair differing on TLL scores (see Chapter 6 for more information on scoring). The TLL stimuli was derived using genuine nutritional information for each of the food products (see Figure 2-1 below for an example of a food pair).

Figure 2-1 An example of a matched food pair, as displayed on online survey

2.4 Methods

A primary strength of the current thesis is the broad range of hypothesis driven research designs, which span both observational and experimental paradigms, in order to thoroughly examine the various aspects of food packaging, and their effects on children's food behaviours, as opposed to the repetitious use of similar research designs and questions. The following sections will detail the methods used.

2.4.1 Content Analysis

In Chapter 3, both the nature and extent of food-packaging marketing techniques in the UK were systematically measured, using the UK's largest supermarket chain. The protocol for this research was developed using a combination of key literature including monitoring guidelines (Consumers International, 2011; Kelly et al., 2013), in addition to existing empirical research of a similar vein, whether monitoring food packaging or other marketing techniques such as television advertising (Mehta et al., 2011; Gantz et al., 2007; Kelly et al., 2010). The associated strengths and weaknesses of the study design are discussed in depth in Chapter 3; the sampling

technique and definitions used for the coding of food packages will be outlined in the following sections.

2.4.1.1 Food packaging sampling

Chapter 3 focuses on data collected in Tesco® supermarkets, the largest supermarket chain in the UK. To obtain the largest sample, 3 Tesco® superstores were used, at 3 time points (August, October and December); this allowed for seasonal comparisons. The data collection was focused, and included only foods and drinks that fell within 7 specific food categories (detailed in section 2.4.1.2 below).

2.4.1.2 Coding of food packaging

Each of the food packages included were individually coded based on a variety of pre-determined variables, which were identified through consultation of similar studies which addressed the monitoring of food and beverage promotions (Gantz et al., 2007; Kelly et al., 2010). Additional variables were also included, which aimed to address any gaps in the existing literature, providing a wider account of the current situation. These variables will be discussed in more depth below.

Food Category

Products were only included if they fell into one of the following 7 food categories: cereal and cereal products, confectionery (not including frozen), confectionery (frozen), dairy, fruit and vegetables, savoury snack foods (crisps, nuts, etc.) and non-alcoholic beverages. Food categories were chosen based on existing literature which suggests that sugar-sweetened cereals, confectionery, soft drinks and high fat snacks have been found to be amongst the most frequently marketed to children (Cairns et al., 2008). In addition to these categories, we aimed to identify whether marketing via food-packaging expanded beyond those identified to more healthy food categories (including fruit, vegetables and dairy, for example). This would better reflect the true balance of healthy versus less healthy products targeted at children, ensuring that any opportunity where healthier foods might be marketed to children was also captured, thus providing a more comprehensive and objective report of the current food-packaging landscape in the UK.

Promotional Characters and Celebrities

Each food product was also coded to indicate the presence of the following promotional characters: i) brand equity characters, which are characters used specifically for the promotion of a single brand or food product; ii) licensed characters, which are characters which are borrowed from the media, such as movies and cartoons; iii) generic illustrations, which refers to a pictorial representation of an unknown character without a known name or personality, that is not established enough to be considered a brand equity character, but may still hold appeal for children. This could include the presence of children on the packaging, both illustrated and photographed, cartoon animals, aliens etc.

In addition, the products were coded to indicate the use of celebrities on-packaging for promotion. These included: sports personalities, entertainment celebrities or other (Gantz et al., 2007).

Cross Promotions

This variable indicated whether any promotions were included on the food-packaging, such as movie tie-ins, cross-promotions with other products, company websites/social media.

Special offers/Discounts

This variable refers to any monetary offers associated with the product as indicated on the food packaging or at point-of-purchase, for example, buy one get one free promotions, 25% extra free, reduced prices, and so on.

Premium Offers

This refers to offers placed on food packaging such as giveaways, competitions, contests, vouchers and rebates to promote foods (Gantz et al., 2007; Kelly et al., 2010).

Novelty of Packaging or Food Shape

This variable refers to the design or novelty factor of the food itself, or of the food packaging. For example, the small, individually wrapped Babybel® (Bel Group®) cheeses are packaged in a fun and novel way, or Smiles® (McCain Foods®), which are smiley faces made from mashed potato, and are designed to appeal to children (see Figure 2-2 for example images).

Figure 2-2 Examples of novel food packaging and novel food shapes, respectively.

Front-of-pack nutritional labelling

The nature of any front-of-pack nutritional labelling was also coded. This is a novel variable which has not been used in previous research, but is an important aspect of food packaging that can influence food behaviour, and is currently under-researched in child populations. Products were coded as having Monochrome Guideline Daily Amounts (GDA), coloured GDAs, traffic light labelling (TLL), or kilocalories.

Location

Products were coded based on their location within the store; this included presence in the main aisle associated with their food category, special offers

stands/aisle or beside till/counter. There was also an option to code the product as appearing in multiple locations within the store.

2.4.2 Experimental Designs with Human Participants

Chapter 4 used a mixed-measures design to assess the influence of BE characters on children's food choices and preferences, where all participants were exposed to all food-character permutations (see Chapter 4 for more information), and acted as their own control, thus allowing for a robust assessment of the effects of BE characters. Chapter 5 used a between-subjects design to assess the impact of adjusting serving suggestion depictions of cereal on front-of-pack on children's serving sizes and consumption. Finally, Chapter 6 used a within-subjects, repeated-measures design to assess the effectiveness of an online intervention which aimed to teach children how to use TLL to identify healthier food items.

2.5 Measures

To address the research questions approached within this thesis, assessments of various demographic and lifestyle factors were required. This section details the relevant measures used, and will give consideration to their strengths and weaknesses. For child self-report measures, it is important to note that children were given age-appropriate instructions on how to complete the measures, and guided through the various questionnaires by the researcher, or by parents where appropriate. This ensured accurate and valid responses, and avoided incomplete datasets where possible. Children were not influenced by the researcher who remained neutral when guiding responses, and they were tested individually so as not to be influenced by other children's responses or opinions. For the 'at home' task in Chapter 6, children were instructed and guided through the task by parents, who were advised not to help children with selecting their responses, but only to provide assistance with navigating the online system and instructing them on what was required from them to complete the task.

2.5.1 Measuring habitual television viewing and internet usage

Due to the financial constraints associated with this thesis, self-report measures of children's habitual television and internet usage were deemed the most

appropriate and feasible manner in which to obtain this information in Chapter 4. Previous research has demonstrated that self-report tools used to assess TV viewing habits have demonstrated moderate-high test-retest reliability of r = 0.94 (Robinson & Killen, 2013) and r = 0.82 (Mendoza, McLeod, Chen, Nicklas, & Baranowski, 2013). Whilst self-report measures are open to demand characteristics, Mendoza et al. (2013) found that, when comparing the validity of various television viewing measurement methods in preschool children, self-report television viewing diaries had the highest test-retest reliability, followed by the 'TV Allowance' measure (Mindmaster inc., Miami, Florida), which is an electronic device which objectively monitors each time a television is switched on or off. Parents are supplied with unique code which must be entered when the television is powered on, which indicates whether the television was being watched by the child or not. The convergent validity demonstrated between the self-report television viewing diaries and the objective TV Allowance measure (Mendoza et al., 2013), coupled with the expense associated with electronic measurement devices, suggests that a self-report questionnaire was the most suitable tool to measure the habitual television viewing habits of children on this occasion.

As the participating children were aged 4-8 years, a parent-report measure was deemed appropriate, and used in place of a self-report measure. As marketing to children on the whole is evolving to include a wealth of online marketing techniques such as websites, social media and 'advergaming' (electronic games used to advertise, which are accessible on social media, company websites or as downloadable content or apps on mobile devices; or, commercial messages which are embedded within retail-accessible games; Nairn & Hang, 2012), the parent-report questionnaire used in Chapter 4 also included measures of children's internet usage alongside television viewing so as to obtain a more comprehensive evaluation of children's exposure to marketing, in particular, marketing which included the use of BE characters.

The questionnaire itself was developed by adjusting the Revised Habitual Television Viewing Questionnaire (HTVQ) reported in Dr Emma Boyland's thesis (Boyland, 2011), and also in a published study by the same researcher (Boyland et

al., 2011). The original HTVQ was a 24-item questionnaire which aimed to quantify children's habitual television advertising exposure by using habitual television viewing as a proxy measure. To reduce demands and encourage completion of the optional questionnaire, the revised version of the HTVQ, as used in Chapter 4, was reduced to 14 items with a greater focus on viewing hours rather than specific channels viewed. The questions referred to the hours of TV viewing and internet usage in a typical week day and a typical weekend day (used to calculate average weekly times), whether it was predominantly commercial or non-commercial television viewing and whether the child had a television in their bedroom. Further questions addressed how often a child made purchase requests for branded items, and how much influence they had over food purchases (see Appendix 4b).

For analysis, participating children were categorised into high and low TV viewers and high and low internet users, based on median splits. Whilst attempts were made to distinguish between commercial and non-commercial television viewing time, parents' responses were often unclear, failing to indicate a preference for either type of television viewing. Ofcom (2007) reports a rapid increase in commercial children's channels, with the number available increasing from 7 in 1998, to 25 in 2007, and they also indicate that commercial television viewing accounts for 74% of children's television viewing time (Ofcom, 2015), and so it was deemed plausible to assume that the majority of participating children's television viewing consisted of exposure to commercial television channels. All internet use was considered commercially driven, as children are exposed to a wealth of marketing online (Clarke & Svanaes, 2012).

2.5.2 Child Eating Behaviour Questionnaire (CEBQ)

The Child Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson & Rapoport, 2001) is a 35-item, parent-report measure that was designed to measure variations in eating styles in young children. Parents are asked to indicate responses to each item on a five-point Likert scale (ranging from never to always). The measure comprises of 8 scales; food responsiveness, emotional over-eating, enjoyment of food, desire to drink, satiety responsiveness, slowness in easing, emotional under-eating, and food fussiness.

The CEBQ is generally considered to be one of the most comprehensive instruments when assessing children's eating behaviour, and was specifically developed for and validated in the UK. The creators of this measure report the results of Principal Components Analysis, which revealed that each of the 8 scales had a single factor with an eigenvalue greater than one, accounting for between 50-80% of the variance across the 8 scales. Internal reliability coefficients ranged from .74 to .91 (Wardle et al., 2001). Test-retest reliabilities were calculated, uncovering no significant differences between scores over two time points, with rest-retest reliability being high for all scales, except for both of the emotional eating scales where it was deemed medium (reliabilities of .52 and .64; Wardle et al., 2001). In addition to factor structure and internal reliability, Carnell and Wardle (2007) also validated three CEBQ scales against behavioural measures of eating in 4-5 year olds. Multiple regression revealed that the aggregated behavioural measures of eating explained 56% of the variance in satiety responsiveness, 40% of the variance in enjoyment of food and 33% of the variance in responsiveness to food, supporting the validity of the CEBQ when assessing eating behaviours in children which may be linked to obesity.

As the current thesis focuses on a UK population, this validation and reliability testing is particularly relevant, however, it is worth noting that the CEBQ has also been validated in various other child populations, such as in Portugal (Viana et al., 2008) and the Netherlands (Sleddens, Kremers & Thijs, 2008). Specifically, one US study examined and found support for the internal consistency, factor structure and validity of the CEBQ in a low-income, pre-school aged US population (Domoff, Miller, Kaciroti, & Lumeng, 2015). Confirmatory Factor Analysis showed that the CEBQ displayed a reasonable fit to the data, and that sub-scales demonstrated good internal reliability (α's $\geq$ .70) and validity, with 7 of the 8 CEBQ sub-scales found to be associated with children's BMI z-scores in the expected directions. This body of evidence indicates that the CEBQ as a measure is validated, and also widely applicable to a variety of populations.

2.6 Statistical Analysis

A range of statistical analyses are employed throughout the current thesis, which reflects the range of outcome variables that were measured. The appropriate analyses for each variable are described below, and again in each chapter, where relevant.

For Chapter 3, data from food-packaging attributes were originally entered into an Excel 2010 spreadsheet (Microsoft Corporation, US). Data for each coding sample (i.e. each store at each time point) was then summarised into a Masterfile using SPSS Statistics 21 (SPSS Inc., Chicago, US).

For all chapters, data analysis was performed using SPSS Statistics 21. Prior to analysis, where appropriate, data were tested to ensure they met assumptions for parametric data analysis. Normality of distribution was assessed by examining skewness and kurtosis. Z-score analysis (which determines how far an individual score falls from the entire distributions mean) was used to identify outliers; those that were more than ± 3 standard deviations from the mean were considered an outlier and not included in subsequent analysis (refer to specific chapters for details of any identified outliers). For normally distributed data, homogeneity of variance (using Levene's F-test) and sphericity (using Mauchly's test) were assessed; where assumptions of sphericity were violated, degrees of freedom were adjusted using a Greenhouse-Geisser correction. If assumptions for parametric analysis were met, bivariate correlations (Pearson's *r*), and *within*-subjects and mixed-measures analyses of variance (ANOVA), were used (Chapter 5 and 6). Where appropriate, post-hoc *t*-tests (with Bonferroni adjustments) were used to establish where significant differences occurred. Comparisons were two-tailed, with significance taken at the 0.05 level, unless otherwise stated. Where data did not adhere to the assumptions for parametric data (normality of distribution), non-parametric tests were used (Chi square, Mann-Whitney *U* and Wilcoxon signed-rank tests; Chapter 3 and 4).

Chapter 3: The exposure to, and power of, food packaging techniques used to promote food and beverages to children in a UK supermarket

3.1 Introduction

As evidenced in Chapter 1, it is clear there is a global childhood obesity problem. Marketing has been identified as a contributory factor to this problem, founded on a strong body of scientific evidence which links the commercial promotion of foods and non-alcoholic beverages to poor dietary outcomes in children (Hawkes, 2007). WHO (2006) posits that the existing evidence demonstrates that food and beverage promotion to children is extensive, that children are aware of and engage with this marketing, and that it is overwhelmingly used to promote foods which are energy-dense and nutrient-poor, which undermines the current recommendations for a healthy diet. In addition, they highlight that food and beverage promotion has an adverse effect on children's consumption, purchasing behaviours, attitudes and food knowledge (WHO, 2016). A report by the Institute of Medicine noted the importance of gathering data on various marketing methods which are used to promote food to children (McGinnis et al., 2006). With this in mind, there is a clear and pressing need to know the extent of the problem, where the greatest exposure to powerful marketing of unhealthy products occurs, to underpin policy action.

Supermarkets play a key role in the food environment, as this is where most food selections take place (Tarasuk, 2010). Approximately 80% of food purchase decisions taking place in supermarkets, and these are often made on impulse (Page et al., 2008; Royall, 2009). Packaging of food products combines what Hawkes (2010) described as all the 'Ps' of marketing: products, packaging, public relations, price and promotions, and this combination of features means that packaging can now be considered a fundamental part of any product and its associated marketing strategy (Ahmed et al., 2005; Hawkes, 2010). Food packaging has been described as a 'two-second commercial' (Elliott, 2012) or as the 'silent salesman' (Pilditch, 1973, Hill & Tilley, 2002, as cited in McNeal & Ji, 2003) as they act as a standing

advertisement on a supermarket shelf (Elliott, 2012). Packaging provides communication of the promotional message from the company to the consumer at the point at which they are actually making their decision, via product information such as nutritional facts and claims, as well as other promotional aspects (Hawkes, 2010). This cements food packaging as a key aspect of the decision-making process for consumers (Silayoi & Speece, 2007).

Therefore, a focus on child-targeted foods in the supermarket is important, as it is not only an opportunity for children to make their own purchases and selections, or for parents to succumb to 'pester power' (where children pester their parents to buy them the foods they like), but also parents purchasing foods for their children, with their children's preferences in mind (Cook, 2008; Elliott, 2012). Indeed, it has been suggested that children can influence up to 80% of a family's food budget (Hunter, 2002). Elliott (2012) refers to this as a co-consuming model, and emphasises the complex nature of child-targeted food and its associated policy. There are existing studies in various other regions that may be similar to the UK, such as Australia or Canada, but no UK-specific data exists and so the present study will address a notable gap in the literature. Without these data, policy efforts have to rely on conjectures, and so this new knowledge provides the opportunity for bespoke policies to be generated which are specifically aimed at addressing the current situation in the UK foodscape.

3.1.1 Calls for regulation

There has been much encouragement from international organisations and public health lobbyists for governments to impose statutory regulations which would limit the effects of more traditional methods of marketing, such as TV advertising and online marketing, by providing ongoing, comprehensive guidance for the development and implementation of policy aimed at reducing both the power and exposure of food promotion to children (WHO, 2010, 2013). However, much less focus has been given to food packaging as a promotional tool. Although TV has historically been the most dominant medium for promotion to children, Chandon (2012) argues that food packaging is the fastest growing aspect of marketing and therefore is of increasing concern in the fight against childhood obesity, when we

consider that it is subject to little restriction, in particular when marketing food and beverages to children.

In May 2004, a report by Hawkes highlighted the many regulatory gaps in the literature surrounding the marketing of foods to children. A follow-up report in 2007, which addressed changes in the global regulatory environment with regards to marketing food to children between 2004-2006, details relatively little regulatory change surrounding the use of food packaging, when compared to the more dominant marketing methods such as TV advertising and online marketing (Hawkes, 2007), with only Finland introducing statutory codes relating directly to food packaging. Finland's code, introduced in 2005, stated that when marketing food products to children via food packaging, competitions and collector series' should not be used, and free gifts should not be the main point of interest for children in both TV advertisements and food packaging. The report concluded by recommending statutory regulations which would reduce both the quantity (exposure) and the effectiveness (power) of all forms of marketing experienced by children "in any place, at any time, and using any technique," which included food packaging (Hawkes, 2007, p.53). However, in general, food packaging falls outside of the coverage of marketing regulations, with even the most recent updated 'non-broadcast' rules in the UK (announced by CAP in November, to come into force in 2017) not covering food packaging.

3.1.2 Monitoring and evaluation of recommendations

In 2010, the World Health Organization (WHO) released a set of recommendations to guide Member States on the development of policies to tackle the promotion of food (including non-alcoholic beverages, hereinafter referred to solely as food) to children. These recommendations detailed systems for the monitoring and evaluation of the employment of these recommendations (WHO, 2010). Kelly et al. (2013) highlight that this monitoring is needed to (i) identify the persuasive power of these promotions and children's exposure to them; (ii) to inform policy, by identifying the specific promotional techniques which need to be addressed; and (iii) to evaluate whether these policy interventions have succeeded in reducing children's exposure to these food and beverage promotions. The current study will

aim to address points (i) and (ii) by identifying the power of, and exposure to, food-package based promotional techniques which target children in UK supermarkets, with subsequent chapters aiming to establish the influence several of these techniques may impose on children's food-related behaviours.

Food promotion is often discussed in the literature in terms of both the exposure and the power, based on WHO's (2010) 'Set of recommendations on the marketing of foods and non-alcoholic beverages to children', and so the current study will use this model as a framework for its approach. Exposure relates to the extent, or the quantity, of promotion, including the number of people reached and the frequency of that promotional contact, as well as the products being promoted. Power refers to the persuasive nature of the communications, focusing on the content and the message of the promotional communications (WHO, 2014). Many content analysis studies into the power and exposure of TV advertising have been conducted, which have sought to quantify the persuasive techniques used and children's exposure to them, assisting in the objective monitoring of changes in the landscape over time, with relatively little focus being given to point-of-sale in comparison (Boyland, Harrold, Kirkham, & Halford, 2011, 2012; Kelly et al., 2010; Li et al., 2016; Ng et al., 2014; Powell, Schermbeck, & Chaloupka, 2013; Smithers, Lynch, & Merlin, 2014; Zhou et al., 2015). For example, an extensive, collaborative project among 13 research groups (spanning Australia, Asia, Western Europe, North America and South America) explored television food advertising to children globally (Kelly et al., 2010). The authors reported that food advertisements formed 11% – 29% of the advertisements, being the second most advertised topic (network advertisements being first), with an average rate of 5 food advertisements per hour, per channel. Kelly et al.'s (2010) study also reported that between 53% - 87% of these food advertisements promoted non-core foods (identified as foods which were high in undesirable nutrients or energy, as defined by dietary standards), and that these were more frequent during children's peak viewing times. In addition, they reported that the majority of advertisements that used persuasive marketing techniques were also for non-core products. In the largest UK study to date, Boyland, Harrold, Kirkham and Halford (2012) quantified the power and exposure

of persuasive marketing techniques in TV advertisements when promoting foods to children. 18,888 TV advertisements for food were coded across a number of key characteristics, including healthy/unhealthy/miscellaneous food types, peak/non-peak viewing time, and also persuasive appeals, premium offers, promotional characters (licensed and brand equity), celebrity endorsements and website promotion. They found that promotional characters, celebrity endorsers and premium offers were used more frequently to promote unhealthy foods, and that BE characters were more dominant than licensed characters. However, perhaps due to less emphasis on food packaging specifically as a marketing technique in recommendation reports and calls for regulations, there are comparatively fewer studies which assess the current food packaging landscape in relation to food and beverage promotion to children. The current body of literature will now be discussed.

3.1.3 Existing content analyses of food packaging

When compared to TV advertising, there are far fewer studies that quantify food-package based marketing techniques, and fewer still which focus on child- or youth-oriented products. In addition, those studies that exist have tended to have a comparatively narrow focus, looking specifically at the use of promotional techniques, such as promotional characters or cross-promotions individual (Harris et al., 2010; Hebden et al., 2011), single food categories (Page et al., 2008) or at small-scale retail outlets such as convenience stores (Gebauer & Laska, 2011). The current study aims to provide a comprehensive study which will address these failings, by targeting several large supermarkets, and encompassing a wide variety of promotional techniques and food categories. Nonetheless, in order to place the current study in context, the existing body of literature relating to the amounts of exposure to various food-packaging promotional techniques children are subject to, including the food types and nutritional profiling of these products where appropriate, and also the power of the promotional techniques used to promote these foods, will now be discussed.

3.1.4 Children's exposure to food-packaging promotional techniques

A content-analysis of 'fun foods' marketed to children in a Canadian supermarket, focusing solely on 'regular' foods (dry goods, dairy, fresh fruit and vegetables and frozen food, excluding confectionery, soft drinks, cakes, potato chips etc) revealed 367 child-focused, 'fun food' products (Elliott, 2008). 'Fun foods' were those which had direct claims or allusions to fun/play, cartoon iconography, tie-ins with merchandise, films and children's TV, unconventional tastes, colours or shapes, and the inclusion of puzzles or games which targeted children. Based on the appearance of the packaging, the authors judged that approximately three-quarters of the products surveyed were directed solely to children, 16% were deemed appropriate for children and teenagers, and 12.8% made a direct appeal to parents on the packaging. When identifying 'fun foods' marketed to children, Elliott (2008) reported that dry goods were the dominant category, (43% of this category were cereal, 40% fruit snacks and 29% drinks). This was followed by dairy (14.4% of total sample), including cheese (53% of dairy sample), yoghurt drinks (26% of dairy) and yoghurt (19% of dairy). Worryingly, only 1% of the total sample included fresh fruit and vegetables, with only small apples or baby carrots being promoted to children. Historically, cereal has dominated child-oriented food packaging techniques, however, only 11.4% of the products surveyed were classed as breakfast foods, and 65% of products coded were classified as a snack or a mixed/variable food, signifying a shift in the market. Child-oriented beverages accounted for 17% of the products surveyed.

A subsequent study by Elliott (2012) profiled the marketing strategies used in Canadian supermarkets to promote food (excluding 'junk foods') to children and their parents across 2009. Foods targeted at children from two major grocery stores in Calgary were purchased (n = 354), and their packaging, marketing appeals, food type and nutritional quality were assessed. They reported that the dominant food category, with 64% of their sample, was 'dry goods', with 21% of these being fruit snacks, 19% cookies/biscuits and 14% cereal. They highlighted that 87% of the total foods sampled fell outside of breakfast foods, which lends support to their previous findings (Elliott, 2008). Elliott posits that this is not indicative of a decline in the

promotion of cereal to children, but signifies an increase in the promotion of 'fun foods' across all eating occasions, not just breakfast. Based on these previous findings, the current study will focus on the following food groups: breakfast foods (including cereal bars), fruit and vegetables, dairy (including yoghurt, yoghurt drinks and cheese), snack foods and non-alcoholic beverages. In addition, in order to get a comprehensive account of the most commonly found child-specific foods in the UK supermarket, and based on TV advertisement data which demonstrated that confectionery was frequently advertised (Kelly et al., 2010) the additional categories of confectionery and frozen confectionery were also included.

3.1.4.1 Nutritional quality of foods

A key consideration when monitoring the exposure and power of food marketing to children is the nutritional quality of the foods being promoted. Kelly et al.'s (2010) extensive study reported that between 53% - 87% of food advertisements were promoting non-core foods, and that these were more frequent during children's peak viewing times. In addition, they reported that the majority of advertisements that used persuasive marketing (discussed in section 3.1.2.2) were also for non-core products. In addition, although nutrient profiling was not a focus of their study, Elliott (2012) assessed the content of the foods and found that 73% of the foods were of poor nutritional quality (defined as having more than 20% of calories being derived from sugar). TV advertisement regulations adopt the use of nutrient profiling to determine what can and cannot be advertised to children on TV, and so to enable us to better judge the types of products children are being exposed to (i.e. healthy or unhealthy), it is useful to apply the same profiling system to point-of-sale promotions. In terms of informing policy and intervention, it is also beneficial to keep the assessment criteria consistent. The current study will adopt a nutrient profiling (NP) model in order to assess the nutritional quality of the foods surveyed, which can then be coded as healthy or unhealthy based on a standardised NP score (detailed in section 3.2.3).

3.1.4.2 Seasonal variation

The final aspect of exposure which this study will address is seasonal variation. It would be reasonable to assume that during periods of the year where children are

on holidays, they would be more likely to attend the supermarket with their parents, which provides more opportunity for them to be exposed to, and engage with, promotional techniques used at the point-of-sale. In addition, these exposures provide more opportunity for 'pester power' (refer to section 3.1 for detail on 'pester power').

To our knowledge, there are no studies that focus on food packaging which have addressed seasonal variation. However, there are content analysis studies which examine seasonal differences in TV advertising which suggest that seasonal variations do exist, although these are few and often focus on small samples of TV airings (Batada, Seitz, Wootan, & Story, 2008; Folta, Goldberg, Economos, Bell, & Meltzer, 2006; Sixsmith & Furnham, 2010). With regards to exposure, a study in New Zealand, by Hammond, Wyllie and Casswell (1999) found that the frequency of TV food advertisements significantly increased during school holidays, and more recently in the UK, Boyland, Harrold, Kirkham and Halford (2011) demonstrated that the range of food types represented in television during school holidays actually appeared to be more balanced than during non-school holiday periods. When focusing on the power of TV advertising, that is, the persuasive techniques employed, there are even fewer studies still. A study on Malaysian television addressed seasonal variations in the use of promotional characters, finding increased usage of characters for less healthy foods during periods of school holidays (Ng et al., 2014). While the literature is small, it does appear to indicate that seasonal variation in marketing via TV advertising exists.

As noted, there is a relative paucity of research addressing seasonal fluctuations in marketing in general, with point-of-sale promotional techniques wholly missing from the existing body of evidence. It would be reasonable to assume that the marketing strategies found on TV advertising may apply to point-of-sale, but more so, there is an apparent increase in novel, seasonal products during holidays, such as 'trick-or-treat' products for Halloween, or 'stocking fillers' for Christmas (see Figure 3-1 below for examples) which could suggest increases in child-focused products, but in particular, confectionery. The current study will aim to address this gap in the literature by assessing if seasonal variations exist in either

exposure or power of food-package based promotional techniques in a UK supermarket.

3.1.5 The power of marketing techniques used on child-specific food products

As previously outlined in section 3.1.2, the power of a marketing technique refers to the nature of its persuasive appeal, or the type of promotional technique that it employs. The following sections will outline the current promotional techniques that are commonly employed when promoting food and non-alcoholic drinks to children, in order to justify their inclusion for monitoring and to provide a point of convergence between the existing literature and the current study.

Figure 3-1 Examples of novel, seasonal confectionery available at Halloween and Christmas, respectively.

3.1.5.1 'Fun foods'

Elliott (2008) posits that children's foods are marketed as 'fun', which they found included cartoon script or child-like font (84%), around three-quarters of products had a cartoon image on the box, which were mostly anthropomorphised animals or figures (37%), or children (19%). They found that 9% of foods directly referenced fun, for example slogans such as "fun to eat", and often fun was also connoted by the use of unusual product names, for example, Bug-A-Licious pasta. One in ten

products promoted collectibles, contests, coupons or codes for free downloads, with three in ten offering games or activities on the back of the package. Children were encouraged to visit a company's website on 10.9% of the packages. They reported that 26.7% of the products sampled were 'child sized' and 18.3% were an unusual shape, such as an animal, fish, shape, letter, twist or roll (Elliott, 2008).

More recently, further research by Elliott (2012) carried out in Canadian supermarkets reported that 86% of packages included a cartoon image, 22% used cross-merchandising such as licensed characters, 15% used collectibles, codes, coupons and competitions, and 3 out of every 10 products offered a game or a competition on the back of the packaging. 17% of the items were 'child sized,' 26% were unusually shaped, and 12% of the foods themselves were unusually coloured. The current study will therefore focus on promotional characters (including celebrity endorsers), illustrations, collectibles/giveaways/competitions, novel shaped foods and food package designs, all of which will be discussed in detail in the subsequent sections.

3.1.5.1.1 Competitions and giveaways and cross-promotions

Another aspect of 'fun' associated with child-focused foods are the use of cross-promotions, competitions and giveaways. In the US, Harris, Schwartz and Brownell (2010) analysed youth-oriented (children and adolescents) cross-promotions on food packaging in the supermarket. They visited a large supermarket on three occasions, across 2006-2008, and purchased all foods which included a cross-promotion on the packaging (*n*=397). The number of products that displayed youth-oriented cross-promotions increased by 78% over the study. The authors reported that 71% of cross-promotions involved licensed characters and 57% were primarily targeting children under 12 years. In addition, they found that the use of other types of cross-promotions increased from only 5% of the total in 2006, to 53% in 2008, which suggests the market is evolving and rapidly increasing. Only 18% of the products surveyed met nutritional standards in the US for foods which are promoted to youth, and the nutritional quality of the foods actually declined across the study. The authors also categorised foods by company policy on marketing to children, and worryingly found that the food manufacturers with policies aimed at

limiting marketing to children represented the majority (65%) of youth-oriented cross promotions, with the frequency of these cross-promotions also significantly increasing over time, with no improvement of nutritional quality of their food products. They concluded that the current supermarket environment was deteriorating, positing that there is a need for expansion of current industry self-regulatory pledges in the US. The current study will measure cross-promotions in the form of licensed characters, these will be discussed under the heading promotional characters.

Furthermore, the current study will also monitor the use of competitions and giveaways on food packaging. These premiums have been identified as a dominant marketing technique on TV advertisements globally (Kelly et al., 2010), but their use on food-packaging has yet to be quantified.

3.1.5.2 Promotional characters and endorsers

Boyland et al. (2012) demonstrated that promotional characters are a prevalent marketing technique used to target children. These characters provide advertisers with a key persuasive tool to engage children with their brand, and children aged 2-7 years are increasingly influenced by symbolism and imagery in advertising (Mizerski, 1995; Stutta & Hunnicutt, 1987). As previously outlined, promotional characters and imagery are of particular concern, as they have been found to predominantly promote high fat, salt and sugar (HFSS) foods, with an Australian study reporting that the foods and beverages whose packaging employed promotional characters were, on average, less healthful than those which did not (Hebden et al., 2011).

A wealth of existing research supports the influence of promotional characters over children's eating behaviours, including food preference, choice and consumption, in favour of the products that they are promoting. Some evidence also exists for celebrity endorsers (Boyland et al., 2013). However, food packaging can carry additional child-centred endorsements, such as the use of children, on food-packaging. These children may represent what Friedman and Friedman (1979, as cited in Smits, Vandebosch, Neyens, & Boyland, 2015) refer to as a 'typical consumer' endorsement. In addition, the existing evidence has also given focus to

the use of licensed characters as a marketing tool, whereby characters from popular media sources are licensed by a company to promote their products (de Droog, Buijzen, Opree, & Valkenburg, 2011; de Droog, Buijzen, & Valkenburg, 2012; Kotler, Schiffman, & Hanson, 2012; Lapierre, Vaala, & Linebarger, 2011; Letona, Chacon, Roberto, & Barnoya, 2014; Roberto, Baik, Harris, & Brownell, 2010; Smits & Vandebosch, 2012; Ülger, 2008). Furthermore, food packaging may employ the use of BE characters (characters used specifically to promote a particular brand/product) to influence children's food preferences and choices, however, their influence has yet to be empirically studied and will be the primary focus of Chapter 4.

With this in mind, the current chapter will aim to quantify the use of promotional characters on child-oriented food-packaging, including celebrity endorsers, licensed characters, BE characters, children, and also any generic illustrations which fall outside of these categories that may appeal to children (for example, illustrations of animals or animated fruits and vegetables).

3.1.5.3 Nutritional labelling

The point-of-purchase offers an additional opportunity to alter children's choices and preferences positively, through the use of nutritional information of the front-of-package (FOP). This is an area of research which is generally overlooked when assessing marketing to children (as studies have tended to focus on the promotion of less healthy foods via the use of fun and engaging promotional techniques). However, it is important to quantify the extent to which these labels are present on child-focused foods, and the types of foods which employ them. This may help to focus experimental research which assesses the impact of nutritional labels on children's dietary outcomes and food evaluations (refer to Chapter 6 which assesses children's ability to accurately employ TLL to inform food evaluations). In addition to children's perceptions, these nutritional labels may play a more pivotal role within parental evaluations of foods, with parents potentially giving more focus to health outcomes when selecting foods for their children. Currently there are a variety of FOP labels in use in the UK, all of which will be monitored in the current study. These include Guideline Daily Amounts (GDA), Combinations of GDA's and

colour coding, single nutrient labels which display only the energy content of the foods, and Traffic Light Labelling (TLL), which is the UK Government's recommended form of FOP labelling.

3.1.5.4 Limitations of existing literature

Currently, no monitoring of the use of food packaging as a child-oriented promotional tool exists in the UK, and this gap in the literature needs to be addressed in order to establish an overview of the current marketing landscape, including both the exposure to and power of food packaging techniques currently being used in the UK to market food to children. In addition, the existing studies have predominantly focused on small stores, or single food categories, and a more comprehensive evaluation is needed. Identifying the dominant promotional techniques in use and nutritional quality of foods being promoted may guide future research into the influence of these promotional techniques on dietary outcomes, and potentially inform subsequent policy interventions.

3.1.5.5 Aims

The current study aims to quantify the exposure and the power of food promotion techniques used on child-oriented food packaging in four stores of a major UK supermarket chain, including the nutritional quality of these child-oriented foods using nutritional profiling.

3.1.5.5.1 Hypotheses

H1: There would be no significant differences between stores in the proportion of child-specific food products available, with all stores providing a high percentage of such foods.

H2: The proportion of child-specific food products will vary by month, with a greater proportion of child-specific products available during months containing school holidays (e.g. August and December).

H3: The majority of child-specific foods would be unhealthy (products (based on UK FSA Nutrient profiling system outlined in section 3.2.3), and the proportion of unhealthy child-specific products would vary by month, with a greater proportion of

unhealthy products than healthy products during months containing school holidays (e.g. August and December).

H4: The food groups most heavily marketed to children will be snack foods and the least frequently marketed food group will be fruit and vegetables.

H5: Promotional characters will feature on a significantly greater proportion of unhealthy foods than healthy.

H6: Brand equity characters will be the most dominant promotional character used on child-specific products (due to lack of restrictions).

H7: The use of novel shaped foods and food-packaging will be higher during months with seasonal holidays (e.g. Halloween in October, Christmas in December), reflecting the introduction of additional seasonal products.

H8: Front-of-pack nutritional labelling will be used predominantly on healthier foods.

3.2 Method

While the previous chapter has outlined the general methodology employed within this chapter, the following section will outline the specific methods employed by this study in further detail, including the sampling, coding and nutrient profiling methods used to obtain the data.

3.2.1 Food packaging sampling

As no human participants took part in this study, ethical approval was not a requirement and therefore was not sought for Chapter 3. Tesco® supermarkets were chosen as the focus of this study as this chain represented the largest market share in the UK at the time of the study design. Three Tesco Superstores® (Allerton Road, City Centre and Old Swan) and one Tesco Extra® store (Park Road) were selected, as these are the largest of the available Tesco® outlets in Liverpool (the difference being that Tesco Extra® stores stock additional non-food items, in comparison to Tesco Superstores®) thus offering the largest possible sample of food packaging. Each store was visited on three separate occasions: once during

August, October and December 2013, resulting in 12 data points. All data were collected by a single researcher.

3.2.2 Coding

Food packaging was examined and any aspects of marketing visible on the food packaging were coded. Based on the literature outlined in the chapter introduction, in addition to noting the brand and product names, the coding categories included product category (confectionery, frozen confectionery, fruit and vegetables, savoury snacks, dairy, non-alcoholic beverages), promotional characters (licensed, brand equity, celebrity endorser, children, generic characters), generic illustrations, novelty (novel food shape, novel packaging shape/design), added value (giveaways, free gift, competitions and on-package games), cross-promotions with other products (excluding licensed characters) and front-of-pack nutritional labelling (traffic light labels, GDA labelling (coloured/monochrome) or single nutrient labels (such as energy).

3.2.3 Nutrient profiling

Due to time constraints associated with collecting such a large dataset, the nutritional data for the nutrient profiling was collected retrospectively using the nutrition information panel for each food product, which Tesco® are legally required to make available to consumers online.

Nutrient profiling (NP) was carried out using the Food Standards Agency (FSA) model, which was developed to provide Ofcom, the broadcast regulator, with a tool that allowed for nutritional differentiation between foods, to be used in the context of TV advertising to children. Foods are classified as healthy or unhealthy based on a simple scoring system, with points being allocated based on the nutrient content of 100g of the food or drink. Points were awarded for 'A' nutrients (including energy, saturated fat, total sugar and sodium) and for 'C' nutrients (fruit, vegetables and nut content, fibre and protein). The 'C' score is then subtracted from the 'A' score to obtain the final NP score. Foods which score 4 or more points, and drinks which score 1 or more points, are classified as unhealthy and would, therefore, not be permitted to be advertised to children on TV.

3.2.4 Statistical analysis

These data did not adhere to the assumptions for parametric data, (variables were categorical) therefore non-parametric, chi-square analyses were performed to establish if significant differences in frequencies across the variables existed within this sample.

3.3 Results

Given the breadth of the data presented in this chapter, the results will be presented in two parts, addressing first the exposure to child-focused food-packaging, which will focus on the amounts of child-focused foods available (including food type and variations by month) and the nutritional quality of the foods marketed to children. Secondly, the findings on the power of the marketing techniques used on food packaging in UK supermarkets (in this instance, specifically, Tesco®) will be stated. Here, the data for all 4 supermarkets will be combined to ensure a reliable representation of the wide range of child-focused foods and beverages which are available in the UK's largest supermarket chain. As the majority of items stocked in each store were identical, duplicates were removed from the dataset, for example, if all 4 stores surveyed stocked a particular item, it was only included in the dataset once. This conservative approach was adopted so as not to overstate the number of products which employed each promotional technique.

	Number of products surveyed					
	August		***October***		***December***	
Store	**Total products, *n* (%)**	**Child-specific, *n* (%)**	**Total products, *n* (%)**	**Child-specific, *n* (%)**	**Total products, *n* (%)**	**Child-specific, *n* (%)**
Old Swan	1825 (25.1)	363 (19.9)	2016 (25.0)	433 (25.1)	1930 (25.1)	386 (20.0)
Park Road	1828 (25.1)	364 (19.9)	2010 (25.0)	428 (24.8)	1912 (24.9)	375 (19.6)
Allerton Road	1807 (24.8)	352 (19.5)	2018 (25.1)	433 (25.1)	1918 (24.9)	372 (19.4)
Hanover St	1819 (25.0)	357 (19.6)	2009 (24.9)	431 (25.0)	1929 (25.1)	382 (25.2)
Total (*n*)	7279	1436	8053	1725	7689	1515

Table 3-1 The number of products surveyed in each store during each month, displayed as a frequency and percentage of total products surveyed, and also child-specific products identified as a frequency and percentage of total products surveye

3.3.1 Exposure

H1: There would be no significant differences between stores in the proportion of child-specific food products available, with all stores providing a high percentage of such foods.

All stores provided a high percentage of child-focused foods at each time points (August: 15.9-16.8%; October: 17.6-17.7%; December: 17.6-17.7%). The number of products surveyed which were identified as being child-specific did not differ significantly between stores. This was true at each time point (August: χ^2 (3, N = 7277) = .162, P = .98; October: χ^2 (2, N = 8053) = 0.26, P = .99; December: χ^2 (2, N = 5760) = .145, P = .93). See Table 3-1 and Figure 3-1.

As no significant differences existed between stores (see H1 above), at each time point the data sets for all 4 stores were combined and duplicates were removed, giving the most comprehensive account of child-specific products available at this supermarket chain during each month (August: n = 364, October: n = 431, December: n = 386).

The total number of child-specific products identified (when duplicates from each store and time points were removed) was 1181 products. These combined data sets are subsequently used for H2-H4.

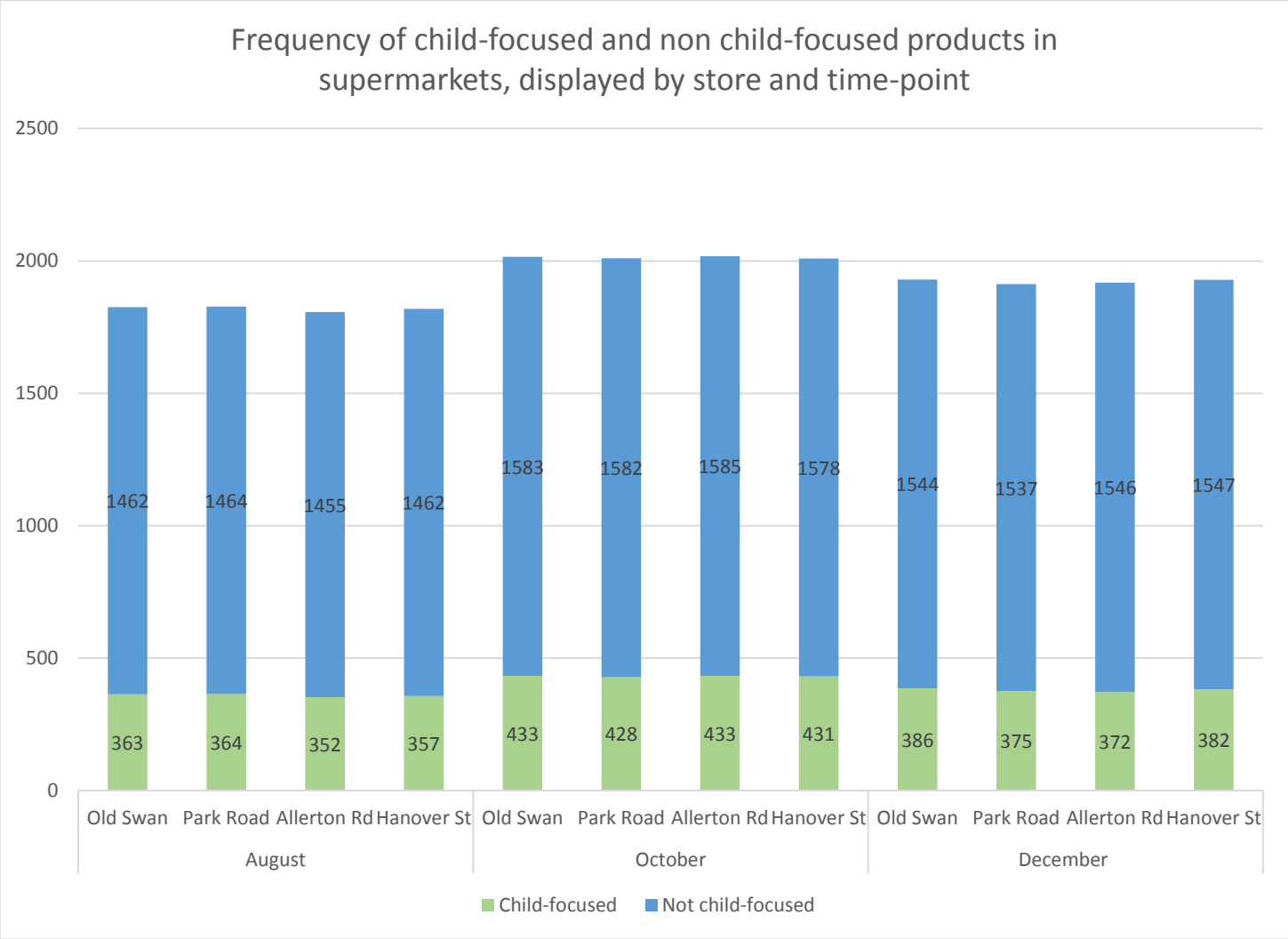


Figure 3-1. Frequency of child-focused vs not child-focused products in supermarkets, displayed by store and time-point

H2: The proportion of child-specific food products would vary by month, with a greater proportion of child-specific products available during months containing school holidays (e.g. August and December).

The data sets for all stores were combined to give a total frequency of child-focused foods available at each time point. A chi-square test of independence revealed no significant differences in the number of products marketed to children across the 3 time points (χ^2 (2, N = 5743) = 2.32, P = .31).

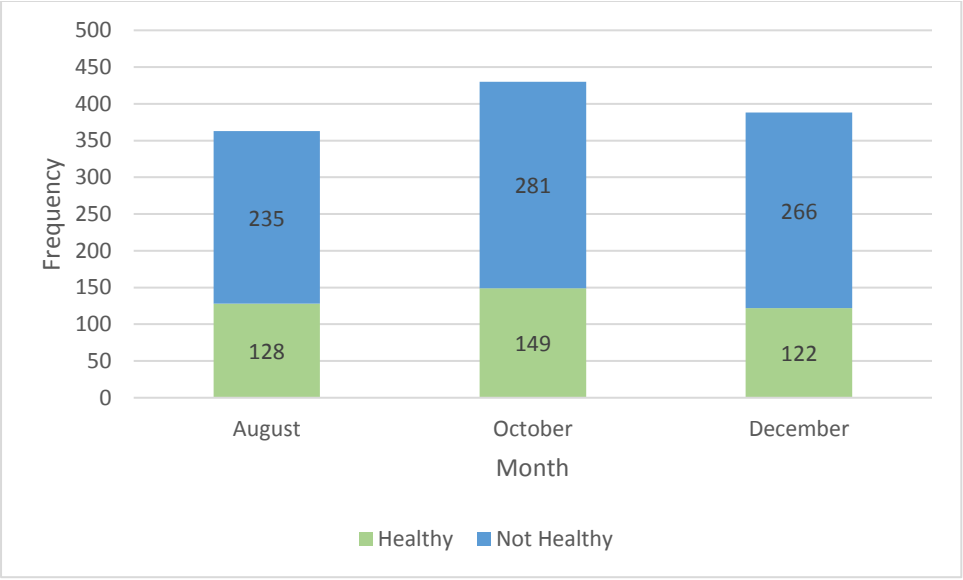


Figure 3-2. Frequency of healthy Vs not healthy foods (based on nutrient profiling scores), displayed by month of data collection.

H3: The majority of child-specific foods would be unhealthy products (based on UK FSA Nutrient profiling system), and the proportion of unhealthy child-specific products would vary by month, with a greater proportion of unhealthy products than healthy products during months containing school holidays (e.g. August and December).

In total, 1181 child- focused food products (including data from all 4 stores) were nutrient profiled across the three time points combined, of which 782 (66.2%) were considered to be unhealthy (and would not be permitted to be advertised to children on television), based on their NP score.

At each time point, the majority of products marketed to children were classed as unhealthy; in August, 235 out of 363 (64.7%) child-focused foods were classed as unhealthy; in October, 281 out of 430 (65.3%) child-focused foods were classed as unhealthy; in December, 266 out of 388 (68.6%) of child-focused foods were classed as unhealthy (see Figure 3-2). A chi-square test of independence revealed no significant differences in the nutritional quality of the products marketed to children across time points (χ^2 (2, N = 1181) = 1.45, P = .49).

H4: The food groups most heavily marketed to children will be snack foods and the least frequently marketed food group will be fruit and vegetables (as in previous studies).

A chi-square test of goodness-of-fit revealed that the frequencies of each food group (combining data from all 3 time points) differed significantly (χ^2 (6, N = 5748) = 1614.171, P < .001). The frequency of child-specific products in each food group followed a similar pattern during all 3 months of data collection, with non-alcoholic beverages being the product most frequently marketed to children (24.2-30.9%), and fruit and vegetables being the least frequently marketed product (1.4-1.7%). Confectionery (24.2-30.9%) and breakfast cereals (13.4-14.9%) were the second and third most frequent child-specific product across all three months (see Table 3-2).

Furthermore, a series of chi-square tests of independence revealed no significant differences between months in the frequency of non-alcoholic beverages, confectionery, cereal products, snack foods, frozen confectionery or fruits and vegetables (*Ps* > .05; see Table 3-1). However, differences in dairy products being marketed to children were approaching significance (P = .054), with higher frequency of child-specific products in October, compared to August or December).

3.3.2 Power

Data were collected on the frequency of the various persuasive techniques used on any identified child-specific food products, and the existing body of research, as discussed in the introductory sections, has informed the following hypotheses (see Table 3-2 for descriptives).

Persuasive Technique	***N* (%) of child-specific foods**		
	August (*n* = 363)	*October* (*n* = 430)	*December* (*n* = 388)
Promotional Characters	109 (30)	131 (30.5)	108 (27.8)
BE characters	76 (20.9)	95 (22.1)	5 (1.3)
Children	21 (5.8)	27 (6.3)	16 (4.1)
Celebrity endorsers	8 (2.2)	4 (0.9)	6 (1.5)
Licensed characters	4 (1.1)	5 (1.2)	5 (1.2)
Generic Illustrations	75 (20.7)	120 (27.9)	87 (22.4)
Giveaways/Competitions	15 (4.1)	15 (3.5)	13 (3.4)
Novel Food	90 (24.8)	129 (30.0)	112 (28.9)
Novel Packaging	88 (24.2)	111 (25.8)	98 (25.3)
FOP nutritional labelling	255 (70.2)	287 (66.7)	257 (66.2)
TLL	100 (27.5)	113 (26.3)	103 (26.5)
Monochrome GDA	84 (23.1)	93 (21.6)	79 (20.4)
Energy	69 (19.0)	79 (18.4)	73 (18.8)
Combined	2 (0.6)	2 (0.5)	2 (0.5)

Table 3-2 Frequency and percentage of persuasive techniques employed on child-specific foods, displayed by month

H5: Promotional characters would feature on a significantly greater proportion of unhealthy foods than healthy.

Promotional characters were used on 29.5% of child-specific foods. Chi-square tests of goodness-of-fit were performed to determine whether the frequency of each promotional character type surveyed would differ between unhealthy and healthy foods. The tests revealed that the use of promotional characters did differ significantly across healthy and unhealthy foods, whereby the majority of brand equity (BE) characters, (χ^2 (1, N = 252) = 83.790, P < .001) and celebrity endorsers (χ^2 (1, N = 18) = 119.629, P < .001) were employed on unhealthy products. However, no significant differences in the distribution of promotional character use across healthy and unhealthy foods were found for either licensed characters (χ^2 (1, N = 14) = 125.698, P = 1.0) or the depiction of children (χ^2 (1, N = 252) = 83.790, P = .831).

H6: Brand equity characters will be the most dominant promotional character used on child-specific products (due to lack of restrictions).

A chi-square test of goodness-of-fit indicated that the frequency of use for each promotional character differed significantly (χ^2 (4, N = 1181) = 2045.12, P < .001). BE characters represented the largest proportion of promotional character employed, being placed on 21.3% of child-specific products, and representing 72.4% of the promotional characters used on child specific products. The depiction of children was the second most dominant promotional character employed (on 1.5% of child-specific products, representing 5.2% of promotional characters used), followed by celebrity endorsers (on 1.2% of child-specific products, representing 4.0% of promotional characters used) and licensed characters (on 5.4% of child-specific products, representing 18.4% of promotional characters used), respectively.

Food group	Frequency of food type, *N* (%)			Chi-square	
	August	*October*	*December*	χ^2 (df, *N*)	*P*
Soft drinks	115 (31.7)	115 (26.7)	115 (29.6)	0.33 (2, 1721)	.984
Confectionery	88 (24.2)	130 (30.2)	120 (30.9)	2.538 (2, 964)	.281
Cereal products	54 (14.9)	60 (14)	52 (13.4)	.629 (2, 564)	.730
Snack foods	53 (14.6)	58 (13.5)	49 (12.6)	1.431 (2, 692)	.489
Frozen confectionery	35 (9.6)	33 (7.7)	34 (8.8)	0.178 (2, 345)	.915
Dairy	12 (3.3)	28 (6.5)	12 (3.1)	5.852 (2, 446)	.054
Fruit and vegetables	6 (1.7)	6 (1.4)	6 (1.5)	0.060 (2, 1011)	.970

Table 3-2. Food products marketed to children in each food group, displayed by month

H7: The use of novel shaped foods and food-packaging will be higher during months with seasonal holidays (e.g. Halloween in October, Christmas in December), reflecting the introduction of additional seasonal products.

Novel shaped foods were employed more frequently during October and December, appearing on 30.0% and 28.9% of child-specific foods surveyed, respectively, when compared to 24.8% in August. However, Chi-square analysis revealed this distribution did not differ significantly across each month (χ^2 (2, *N* = 1181) = 2.847, *P* = .241).

Novel shaped food-packaging were employed more frequently in October, appearing on 25.8% of child-specific foods surveyed that month (*N* = 111), followed by December (25.3%, *N* = 98) and August (24.2%, *N* = 88). However, Chi-square analysis revealed this distribution did not differ significantly across each month (χ^2 (2, *N* = 1181) = .262, *P* = .877).

H8: Front-of-pack nutritional labelling will be used predominantly on healthy foods.

The most popular FOP label was traffic light labelling (TLL; 28.8%), followed by Guideline Daily Amount (GDA, combining both coloured and monochrome; 21.8%), then energy (18.8%) and finally the combined nutritional label (GDA and colour-coding; 0.5%). Percentages represent proportion of particular FOP label found on all child-specific foods surveyed.

Front-of-pack (FOP) nutritional labelling as a whole was used on 66.4% of healthy child-specific foods and 68.29% of unhealthy child-specific foods surveyed. However, as the majority of child-specific foods surveyed were deemed to be unhealthy (according to nutrient profiling), this resulted in a majority of 66.2% of the FOP nutritional labelling identified during the survey being on unhealthy foods.

3.4 Discussion

To our knowledge, this is the first study to quantify both the power of, and exposure to, food-packaging based marketing of child-specific foods in a UK supermarket. Furthermore, it has included the use of a nutrient profiling model in order to systematically assess the nutritional quality of these foods. In addition, it is the first study to assess potential differences over time/seasons.

Our first hypothesis aimed to identify the amount of child-focused products that were available in a UK supermarket, and identified that across all four stores at all three time points, the percentage of child-oriented food products were consistently high, ranging from 15.9-17.7% of the total foods surveyed. This highlights the prominence of child-specific foods available within the current UK foodscape, specifically, those which target children via promotional techniques on food-packaging at the point-of-sale.

In addition, whether the number of products aimed at children varied between the stores surveyed was investigated, however, in this instance no differences were found. This may be due to all four stores being from the same supermarket chain, who may have a set range of products which they stock in all of their larger stores; little variation was identified between products stocked in each. The stores selected were done so on a convenience basis, as they were the largest stores available in Liverpool, and not specifically selected to represent a range of different levels of SES, or of obesity prevalence. Wider literature (as discussed in section 1.1.2.2) has suggested that there are disparities in obesity across regions and socioeconomic status (SES); for example scores on the Index of Multiple Deprivation 2010 (IMD) were found to have an almost linear relationship with obesity prevalence. Children in areas with significantly higher rates of free school meal eligibility (which is often used as an indicator of SES) had significantly higher obesity rates, and childhood obesity prevalence has been found to increase as household income decreases (National Obesity Observatory, 2014). In addition, the physical food environment has been reported to influence food choice, signalling to consumers what to purchase, based on factors including the availability of certain foods (Herforth & Ahmed, 2015). However, our findings here did not reflect any existing differences across the stores surveyed. It may be useful for future studies to strategically pick stores with this in mind, and perhaps to survey a variety of supermarkets and store types, for example, corner shops where children may be more likely to shop alone, or attend on a more regular basis.

As predicted, the majority (66.2%) of child-specific foods identified were deemed to be of poor nutritional quality, that is, they would be considered unhealthy based on the nutrient profiling (NP) model employed in the current study and would not be permitted to be advertised to children on TV. This is in line with the existing literature on the content analysis of marketing to children on both TV advertising (Boyland et al., 2011; Kelly et al., 2010) and via food-packaging/point-of-sale (Elliott, 2008; Elliott, 2012). These findings highlight that the balance of healthy and unhealthy foods being marketed to children via food-packaging techniques needs to be corrected. Furthermore, it was hypothesised that more child specific

food products would be available during months containing school holidays, in this case, August and December, based on the idea that children would be more likely to attend the supermarket with their parents when not attending school, therefore being exposed to more in-store marketing such as food-packaging, which may influence their choices. However, when data sets for each store were combined to get an overview of all possible child-focused foods available at each time point, no significant differences in the number of child-specific products identified were found.

In addition, it was also predicted that the proportion of unhealthy foods targeting children would be greater during months that contained school holidays. Across all three months sampled, the majority of child-specific products were deemed to be unhealthy, based on the UK FSA Nutrient Profiling model used, which is of concern from a public health perspective. Furthermore, analysis revealed no significant differences in the overall nutritional quality of the child-specific products across the three months sampled. This suggests that levels of marketing to children via food-packaging remain fairly constant. We must be mindful that this study only sampled three months out of a five month period, and is therefore not representative of an entire year, and so future studies may wish to extend the data collection period for a more comprehensive and in depth overview of the current UK foodscape. Nonetheless, it is clear that food-packaging promotional techniques are being used to predominantly promote foods which are in direct conflict with nutritional guidelines, and policy makers should consider restricting child-specific promotions at point-of-sale in order to address the current childhood obesity problem.

Various existing studies which look at food-packaging techniques in supermarkets or smaller-store settings have identified particular food groups which dominate the child-focused market. These included fruit snacks (dried fruit), drinks, cereal and dairy (Elliott, 2008) and in a later study by the same research group, a similar pattern was observed with the addition of cookies/biscuits (Elliott, 2012). Both studies indicated that the previous dominance of cereal marketing has subsided, but Elliott (2012) suggests this is not due to the decline of cereal

promotion to children, but is an indication that the promotion of child-focused, 'fun foods' is no longer limited to breakfast. With this in mind, the current study hoped to cover a wide range of food groups, providing a more complete estimation of the marketing children are exposed to via food-packaging by sampling the food groups previously identified (cereal, fruit and vegetables, dairy, drinks, savoury snack foods) but with the addition of both confectionery and frozen confectionery also.

On a similar vein to the existing literature, the current study identified non-alcoholic beverages (26.7-31.7%) and confectionery (24.2-30.9%) as the dominant food groups in this particular study, followed by cereal products (13.4-14.9%), savoury snack foods (12.6-14.6%), frozen confectionery (7.7-9.6%), dairy (3.1-6.5%) and lastly, as with the Elliott (2008; 2012) studies, fruit and vegetables were the least dominant food group targeting children (1.4-1.7%). This indicates that the current food environment in the UK, in relation to point-of-sale, is promoting unhealthy food groups to children. Furthermore, no significant differences were found in the dominance of food groups between the months sampled, suggesting again that the promotion of less healthy food groups may remain constant, but this is currently speculation and must be empirically assessed before such claims can be made.

With regards to the nature of the marketing techniques employed to promote foods to children, it was hypothesised that BE characters would be the most dominant promotional character found, based on the lack of restrictions surrounding their use. Recent years have shown other forms of promotional characters, such as licensed characters, being subject to regulations regarding their use when marketing to children. However, BE characters are treated as equivalent to a logo or other brand imagery and as such are not subject to such restrictions, therefore they may be a viable option when companies wish to promote products to children which do not meet certain nutritional criteria. Subsequently, BE characters will be the focus of Chapter 4, in which their influence over children's food preferences and choices will be assessed in order to address that gap in the literature. Here, we hypothesised that promotional characters will be used predominantly to market unhealthy foods, compared to healthy foods. This was

true of BE characters and celebrity endorsers, whereby a significant majority of these promotional characters were employed to promote unhealthy products to children. However, no significant differences were found for the use of either licensed characters or the depiction of children on food-packaging.

The existing literature touts 'fun foods' as a key marketing tool for child-specific food products (Elliott, 2008, 2012). The current study addressed the use of novel shaped foods and novel package designs, hypothesising that their use would be higher during months with seasonal holidays, for example, trick or treating during Halloween in October, and stocking fillers and gifts at Christmas during December. While novel food-packaging design and novel shaped foods were most dominant in October and December, when compared to August, these differences were not significantly different, and so this hypothesis was not fully supported.

Front-of-pack (FOP) nutritional labelling is not often considered in the child-focused literature, or in studies which are addressing their use on food-packaging when marketing foods to children. Within the current study, FOP labelling as a whole was used on a relatively even split of healthy (66.42%) and unhealthy (68.29%) foods marketed to children. Of the foods marketed to children identified within this survey, 30.1% did not carry any nutritional labelling on the package. Traffic light labelling (TLL) was the most frequently adopted FOP label on child-focused foods, followed by Guideline Daily Amount (GDA), single nutrient (energy) and finally the combined label (GDA and colour coding). As TLL is the most popular format of communicating the nutritional quality of a food on child-centred products, and as the UK Government's recommended form of nutritional labelling (FSA, 2007) it is necessary for further research to explore children's ability to interpret and apply these labels to make decisions, and as such will be the focus of Chapter 5 of the current thesis.

An additional consideration is the selection of one NP model as a definitive measure of a foods healthiness. Various NP models have been developed, but the level of concordance between these models is not clear. A study by Scarborough et al. (2013) measured the agreement between eight NP models which have been offered for the regulation of marketing to children, using a representative dataset

of advertisements for foods broadcast on TV viewed by children in the UK (dataset collected in 2008); the dataset included 11763 advertisements, representing 336 different food brands or products. Nutritional information was obtained from food packaging, company websites and a food composition table, and each of the eight NP models was applied to the data. The authors reported great variation in the percentage of advertisements that would be permitted, based on the various NP models, ranging from 2.1% - 47.4%, with half of the pairwise comparisons between the NP models yielding kappa statistics of less than 0.2, which indicates little consistency between the models employed. In terms of informing policy and intervention, it is beneficial to keep the assessment criteria consistent, and so there is a need for consensus on a reliable NP model which can be applied to all forms of child-focused marketing in the UK.

3.4.1 Limitations and future directions

The current study looked at specific aisles in the store, based on those identified from previous research, however, it did not address the foods available in the ethnic aisles, where a wide range of foods are available. Due to the multicultural nature of the UK, children are often exposed to foods which are imported from a variety of countries and so future studies may wish to include these aisles in their content analysis. Furthermore, in order to get a fully comprehensive overview of the whole UK foodscape at point-of-sale, future studies may wish to survey the entire store, including all food product types which are available in the UK supermarkets.

An additional consideration is that the nutritional information was gathered retrospectively, and so may not have been an accurate representation of the nutritional quality of the foods at the time of initial data collection. However, it is unlikely that the nutritional makeup of these foods will have changed during this time, and as foods tend to be reformulated for the better, it would be potentially underestimating the amount of unhealthy foods at the point of initial data collection in store.

The current study only addressed foods which were perceived to be specifically marketed to children, failing to address additional foods which are actually marketed at adults, which children may be exposed to and regularly purchase or consume. Children are exposed to many more food and beverage products than this study can possibly demonstrate, and the boundaries between child and adult marketing are often unclear, therefore the current study only provides a small snapshot of the point-of-sale promotions children are exposed to. However, it has attempted to quantify these techniques in an empirically informed, systematic and replicable way.

3.4.2 Conclusion

To conclude, this is the first study to assess the use of promotional techniques on food-packaging in UK supermarkets. Furthermore, it is the first of its kind to assess whether seasonal fluctuations in the data existed. It is a large and interesting dataset, which has employed the use of nutrient profiling, in order to empirically establish both the power and exposure of food-packaging promotional techniques in UK supermarkets, when marketing foods to children. The current findings help to pave the way for experimental research which can specifically address gaps in the existing body of evidence surrounding the techniques identified.

It is clear from the current chapter that not only are there a large proportion of products being marketed to children at the point-of-sale, but worryingly, that the balance of foods being promoted to children using food-packaging promotional techniques favours the promotion of less healthy foods, with soft-drinks and confectionery being the dominant food groups promoted to children, and fruit and vegetables being the least dominant. These findings are in direct conflict with nutritional recommendations for a healthful diet and may be contributing to the current childhood obesity problem.

Promotional characters were the most dominant form of point-of-sale promotional technique, with BE characters being used most frequently. Furthermore, BE characters were used predominantly for the promotion of less healthy foods. There is a current gap in the literature, which fails to establish the

effect of BE characters on children's eating behaviours, and as they are a popular way to market foods to children at the point-of-sale, their influence should be established in order to inform policy change regarding their use when targeting children; this will be the focus of the subsequent chapter.

Chapter 4: The influence of brand equity characters on children's food preferences and choices

4.1 Introduction

As highlighted by the previous chapter, promotional characters are a key persuasive tool as used at point-of-sale in UK supermarkets, and brand equity (BE) characters in particular were not only the most dominant form of promotional character used on child-specific foods in the UK supermarket, but they were also used predominantly to promote less healthy foods to children. Therefore, the current chapter will describe two studies which focus on the influence of acute exposure to BE characters on children's food preferences and choices. Furthermore, the second study will aim to assess whether existing influences still exist when BE characters are employed on foods they are not normally associated with (incongruence).

4.1.1 Branding

Multiple marketing channels are used to nurture brand loyalty and recognition in children (Story & French, 2004), spanning television advertisements, advergaming, product placements and also various on-package techniques, including giveaways, cross-promotions, novelty packaging and the use of promotional characters. Despite recent interest in the effects of food marketing on children, the literature has tended to focus on television and Internet advertising, with few studies specifically examining how children respond to marketing tools on food packaging itself. One component that has received some research attention is the impact of brand imagery (e.g. logos). Robinson et al. (2007) assessed the effect of branding on food packaging on children's (aged 3-5 years) food preferences and choices, and found that children reported a preference for four out of five food and drink comparisons, if they thought they were from McDonalds, compared to the identical foods which were presented in matched, non-branded packaging. They also reported that these effects were greater amongst children who ate food from McDonald's more often, and amongst children with more TV sets in their homes,

suggesting that familiarity (due to repeatedly consuming McDonald's or by potentially being exposed to more TV advertisements for McDonald's, due to more TV sets in the home) may also play a role in mediating the effects of branding on children's eating behaviours, and future studies should consider measuring familiarity with stimuli used. It would also be interesting to establish whether there is an association between recognition of branding or BE characters, and exposure to TV/online advertising, by potentially using proxy measures of advertising exposure, such as the number of TV sets in the home (as in Robinson et al.'s study) or through self-report measures of weekly TV viewing/Internet usage, for example. Furthermore, as familiarity does not necessarily indicate liking, it would be interesting for future research to establish if there is a relationship between recognition of branding or promotional characters, and reported liking of these characters.

Levin and Levin (2010) assessed the relative influence of licensed characters and branding on children's evaluations of food products, whereby children were asked to rate pictures of a variety of healthy (yoghurt and cereal) and unhealthy (potato chips and breakfast tarts) food products. Whilst endorsements from licensed characters and celebrities did not appear to influence evaluations in this study (see sections 1.3.1.1 and 1.3.1.2 for more literature on celebrity endorsers and licensed characters, respectively), brand name familiarity (which is propagated by the use of marketing techniques that increase brand awareness) did. Furthermore, it would be interesting for future research to establish if there is a relationship between familiarity/recognition of branding or promotional characters, and reported liking of these characters. It is reasonable to assume that increased exposure to, and familiarity with, a particular brand or brand-imagery would result in increased liking, this needs to be addressed in the literature. As it is clear that branding, and brand-related imagery and characteristics, have an influence on children's evaluations of foods, they therefore warrant exploration when attempting to understand environmental influences on children's food preferences and choices.

4.1.1.1 Branding and weight status

Research has also revealed that children's weight status may play a role in their response to branded packaging. Forman et al. (2009) compared the ad libitum intake in overweight (OW; *n* = 20) and non-OW (*n* = 23) children during four meals, where foods were either branded or unbranded. Children's food brand awareness was also assessed by testing children's abilities to match foods with their brand logos, and name the brands. They found that OW children consumed an additional 40 kcal during the branded meals that the unbranded, and that non-OW children consumed 45 kcal less during the branded meals. The authors postulate that OW children were more responsive to food branding.

Recent neuroscience studies have also explored the impact of branding on consumers at a neurological level. Bruce et al. (2014) examined children's (aged 10-14 years) brain responses to food logos (*n*=20). Children (50% obese, 50% normal weight; NW) were shown 60 non-food logos and 60 food logos, as well as baseline images, while in an fMRI scanner. In response to the food logos, NW children displayed significantly more brain activation in regions which are commonly associated with cognitive control than obese children. In line with the existing research on the effects of food marketing, such as TV advertising (refer to section 1.4.2.4), this suggests that obese children may be more susceptible or vulnerable to branding, such as food logos, and may be at risk in environments which are densely populated with food-related cues.

4.1.2 Promotional characters

Promotional characters are a key marketing tool for advertisers seeking to engage children with their brand, and between the ages of two and seven years children are increasingly influenced by imagery and symbolism in advertising (Mizerski, 1995; Stutta & Hunnicutt, 1987). Lawrence (2003) suggests that these characters are a tool for fostering a "brand-consumer relationship," (p.43), whereby characters take on personalities which make them relatable and enable them to communicate brand values to the consumer. The concept that consumers can build affective relationships with media characters and personalities in a way that mirror real-life relationships has been termed 'parasocial relationships' (PSR; Horton &

Wohl, 1956). In children, Bond & Calvert (2014) suggest these PSR's signify emotional friendships based on the attractiveness of the characters and the messages that they carry, and children are particularly susceptible to forming these parasocial relationships with media characters (de Droog, 2012; Simone M. de Droog, Buijzen, & Valkenburg, 2012; de Droog, Valkenburg, & Buijzen, 2011; Hoffner, 1996; Valkenburg, 2004). Thus, de Droog et al. (2012) suggest that parasocial relationship theory would predict that familiar characters elicit a positive elaborate affective response, which may subsequently lead children to favour products that display these characters. Therefore, given the extent to which children may bond with these characters, there is a need to understand their influence over dietary outcomes.

In 2007, the UK Office of Communications (Ofcom, 2007) prohibited the use of licensed characters in television advertisements for food or drink products aimed at primary aged children (<16 years), with the exception of fruit and vegetables (CAP, Code of Advertising Practice, 2007). However, BE characters are currently exempt as the regulator believed that prohibiting these characters would cause disproportionate damage to the brands (Ofcom, 2007). From a public health perspective, the continued use of BE characters to market foods to children is a concern, when we consider that studies have shown they are almost entirely used to promote unhealthy foods (Kelly et al., 2010). Children are more likely to select products and brands when they recognise characters, slogans and logos from advertisements, and Batada & Borzekowski (2008) suggest that promotional characters form an integral part of the pathway through which children process the contents of television food advertising and then favourably recall individual elements at the point-of-sale, leading to purchase requests/purchases and consumption.

4.1.2.1 The influence of promotional characters on children's eating behaviours

A variety of promotional characters have been identified in the current body of literature as having a perceptible influence on children's eating behaviours, including preferences, choices and consumption, in favour of the foods which they

are promoting. The relevant research will now be discussed in the following sections.

4.1.2.1.1 Celebrity endorsers

Arguably, celebrity endorsers can be considered a type of promotional character. Boyland et al. (2013) found that the use of a celebrity endorser influenced children's food intake, and that this influence extended beyond their role in the specific endorsed food commercial, prompting increased consumption of the endorsed brand, even when the endorser has been viewed in a non-food context. These findings suggested that the omnipresence of celebrities within the media may reinforce unhealthy eating in children, and whilst the research in this area focused on the effects of celebrity endorsers within television advertisements, the use of celebrity endorsers on food packaging may provide another opportunity for the promotion of these brands, forging a potential link between what children are viewing on television and the products they then subsequently choose.

4.1.2.1.2 Licensed characters

In addition, there is a wealth of literature that addresses the use of promotional characters (specifically licensed and unfamiliar characters) on food packaging and their influence on children's food behaviours. In a between subjects design, Ülger (2008) compared the effects of licensed characters (referred to as cartoon trade characters in their publication) and TV advertising on children's food preferences (reported liking), where children were either exposed to TV advertisements for one of the food items (experimental group) or were not exposed to the advertising (control group). Children in both conditions demonstrated a preference for the food with the licensed characters when compared to the competing food being promoted within the advertisements. The authors suggest that preschool children focus on the attractive features of a product, such as the licensed characters on the packaging, and judge the quality of the foods based on this. Lapierre, Vaala and Linebarger (2011) investigated whether licensed characters and nutrition cues on cereal boxes affected children's subjective taste assessments of the cereal. Children reported a preference for the cereal when it was presented with a licensed character on the box (compared to no character) and also when they were told the

cereal was called Healthy Bits (compared to Sugar Bits); the characters influence was strongest for participants who were told the cereal was called Sugar Bits. This suggests the presence of a licensed character on the packaging influenced children's preference, and that whilst messages encouraging healthy eating may influence young children, the presence of a licensed character on the packaging can potentially offset this effect and override their subjective taste assessments of the foods.

de Droog et al. (2011) investigated the effects of familiar (licensed) characters and an unfamiliar character displayed on food packaging, when compared to no character (control), on children's reported liking and purchase intent of a healthy (chopped banana) versus an unhealthy food (banana confectionery). Whilst they hypothesised that familiar licensed characters would have the greater effect, they found that the use of either character (licensed or unfamiliar) increased both the reported liking and the purchase intent for the healthy food, up to a level similar to that of the unhealthy food. They suggest this finding may be due to the high congruence between the unfamiliar character and the food they were promoting, with the unfamiliar character being a monkey and the food being banana or banana flavoured confectionery. Congruence, and its potential role in mediating the effect of promotional characters, is an aspect of BE characters which may set it apart from other types of promotional character, due to their long-standing and specific association with particular brands and products.

However, the above explanation was not supported by the findings of Smits and Vandebosch (2012), who found similar results across a number of different types of food. The authors compared the effects of a licensed character and a matched, unknown character on food packaging on a series of matched snack food pairs, both healthy (grapes and apples) and unhealthy (cookies and chocolate). They found that whilst the licensed character had a greater effect, the less familiar character also significantly increased appetite of children, intended frequency of consumption and intended frequency of requests for the product. This was true across all foods, demonstrating that the use of either of these characters was capable of promoting the foods, both healthy and unhealthy. This does not support

de Droog et al.'s (2011) findings, as detailed above, and the literature is not clear on the importance of congruence. This needs exploring further and so will be the focus of the current chapter, in particular, Study 2.

Kotler, Schiffman and Hanson (2012) conducted two studies using licensed characters, the first exploring children's self-reported preferences, and the second measuring actual food choice. They found that children indicated a preference for foods that were associated with familiar and liked characters, with a particularly strong effect for sugary or salty foods. Favoured characters were not able to decrease children's interest in these foods when in direct competition with healthier foods. However, when they addressed foods within the same category (e.g. two fruits), branding with a character strongly influenced children's food choice. They also reported that children were more prepared to try more of a healthy food when a favoured character was promoting it, when compared to an unknown or disliked character, which would suggest that long-standing

A well-cited study by Roberto et al. (2010) found that licensed characters influenced children's (*n* = 40) preferences and choices in favour of those foods presented with characters on the packaging. The study and its findings were later replicated by Letona et al. (2014). In addition, Letona et al., using a much larger sample (*n* = 121) and a wider age range than Roberto et al. (7.4 ± 1.9 years and 5.0 ± 0.7 years, respectively), found that younger children were more likely to prefer the food presented with the character on the packaging, and that this effect declined steadily with each increasing school grade, up to Grade 3, where a preference for food presented without the licensed characters emerged. This suggests that younger children may be more susceptible to such promotional techniques.

4.1.2.1.3 Brand equity characters

BE characters are those characters which are created by food manufacturers solely for promoting a particular brand or product and have no identity beyond these associations. Well-known examples of BE characters include Coco the Monkey (for Kellogg's Coco Pops®) and Tony the Tiger (for Kellogg's Frosties®). They are distinct

from licensed characters, whereby characters from popular media are licensed by a company to promote their products, for example, when one of Yoplait® used Dora the Explorer® to promote their yoghurts (see example below).

Figure 4-1. An image of Yoplait® yoghurts employing Dora the Explorer® as a licensed character

It is clear that branding and promotional characters such as celebrity endorsers, licensed characters and other unknown characters have an effect on children's food preferences (reported liking) and choices. What is not clear, however, is the effect of BE characters on diet-related outcomes, in order to inform evidence based policy. BE characters forge a link between both branding and promotional characters, and are used to build emotional relationships which cultivate brand loyalty which may persist into adulthood, and therefore the lack of evidence concerning the impact of BE characters warrants further exploration.

The power of BE characters may lie in the learned associations that consumers make between the character and the food they are associated with, but this is yet to be investigated. These studies will contribute to the policy debate as to whether or not regulations regarding licensed characters on food packaging should justifiably be extended to include the use of BE characters.

4.1.3 Current study

This chapter describes two studies which were conducted using a modified version of the Roberto et al. (2010) design, in order to examine the influence of BE characters on food packaging on both children's food preferences (self-report of

perceived liking) and snack food choices. In the first study, character-product pairs were congruent (characters appeared on products they usually promote) and in the second study, the pairings were incongruent (characters appeared on products they do not promote).

4.1.3.1 Aims

This study aimed to identify whether BE characters on food packaging affect children's food preferences and choices. It also aimed to identify whether the effect (if found) would persist even when character-food associations were incongruent.

4.1.3.2 Hypotheses

Based on previous findings, it was hypothesised that:

> H1: Children will demonstrate a preference for foods presented with BE characters on the packaging, compared to foods in matched packaging without BE characters (for both congruent and incongruent studies).
>
> H2: Children will choose the foods presented with a BE character on the packaging for a snack rather than the foods without a BE character on the packaging, when making within-pair selections and as a final snack choice (for both congruent and incongruent studies).
>
> H3: The children's ratings of liking for each BE character will correlate positively with their recognition scores for each BE character.
>
> H4: There will be a positive correlation between recognition of brand equity characters and media usage (based on reported TV viewing and internet usage).
>
> H5: Children with high levels media usage will be more likely to select the food presented with a BE character present on the packaging for a snack, rather than the matched food without the BE character, when compared to children with low levels of media usage.

4.2 Methods

This section will outline the methods for two experimental studies. Study 1 focused on character-product pairs which were congruent (characters appeared on products they usually promote, for example, Coco the Monkey® on a Coco Pops Cereal Bar®). In Study 2, the pairings were incongruent (characters appeared on products they do not promote, for example, Coco the Monkey® on Pom Bear Potato Snacks®; all permutations appeared).

Methods are described here in brief, see also Chapter 2 for supplementary detail.

4.2 1 Recruitment and Ethics

Data were collected between February 2014 and February 2015. Participants were recruited from four primary schools, two nursery groups and one summer scheme in the North-West of England, UK and 1 primary school in Northern Ireland, UK. Informed consent to carry out the research and for the proposed method of obtaining consent from parents was gained from Head teachers/centre managers. Subsequently, parents were issued a letter detailing the study and asked to return the consent form if they gave permission for their child to participate in the study. Parents were also required to indicate if their child had any history of food related allergies/intolerances, so that such children could be excluded from participation for health and safety reasons. Verbal assent was also obtained from participating children prior to commencing the study, which was witnessed and documented by either the researcher or a member of staff at the school. Children were also given the opportunity to ask questions about the study and informed that they were free to withdraw from the study at any time without having to give reason and without consequence. All children were willing to participate and therefore none were excluded at this point.

Ethical approval for this study was granted in March 2013 by the University of Liverpool Non-invasive Procedures Ethics Sub-committee under reference RETH000617.

4.2.2 Participants

Overall, a total of 209 participants aged 4-8 years (mean 6.9 ± 1.1) were recruited across both studies. Sample size calculations (G* Power; Faul, Erdfelder, Buchner & Lang, 2009) indicated that a sample size of 57 (Study 1) and 114 (Study 2) would give 95% power to identify an effect size of 0.5 at the $p < 0.05$ (two tailed) significance level for a Wilcoxon signed-rank test power to identify an effect size of 0.5 at the $p < 0.05$ (two tailed) significance level for a Wilcoxon signed-rank test (matched pairs).

Power calculations informed the target sample size but as opportunistic sampling was used, the final numbers were 60 in Study 1 and 149 in Study 2. 107 participants (51%) were male and 102 (49%) were female. The raw BMI measurements for this sample ranged from 10.1 to 25.1 kg/m² (mean 16.4 ± 2.2 kg/m²) and using the weight status criteria outlined in section 2.1.4, children were categorised into two weight status groups; normal weight (NW; 81%) and overweight/obese (OWOB; 19%).

Of the 209 participating children, 169 parents (81%) completed the parental questionnaire. Full results of parental questionnaire are reported by study in Table 4-1, detailing demographic and lifestyle measures.

Table 4-1. Demographic and lifestyle characteristics of participants (as a % of completed parental questionnaires; continued overleaf)

	Study 1	Study 2
Completed parental questionnaire, *n* (%)	40 (67)	129 (87)
Age, mean ± SD (range), y	7.2±1.1y (4.1-8.7y)	6.9 ± 1.1y (4.0-8.9y)
Gender, *n (%)*		
Male	26 (43)	81 (54)
Female	34 (57)	68 (46)
BMI, Mean ± SD (range)	15.9±0.2kg/m² (10.1-22 kg/m²)	16.4±2.0kg/m² (11.5±25.1kg/m²)
Ethnicity (%)		
White – British/Irish	83	75
British/Irish	5	19
Black - British/Irish	-	1
Mixed – British/Irish	9	2
White - Other	3	1
Asian	-	2
Parental Education Level (%)		
Post-graduate	26	15
Degree	31	28
A levels	14	21
GCSE	20	27
Other	9	9
Typical weekly Internet usage, mean±SD (range), hrs	3.4±3.6 (0-9)	6.7±7.7 (0-33)
Typical weekly TV viewing, mean±SD (range), hrs	13.2±5.7 (0-39)	14.5±8.1 (2-44)
TV in bedroom (%)	32	45
Channels watched		
Commercial	27	49
Non-commercial	16	10
Both	57	41
How often does child make purchase requests? (%)		
Every day	6	8
Every week	24	19
Sometimes	24	44
Not very often	32	24
Never	0	5
Requests made are for particular brands (%)	22	29

	Study 1	Study 2
How often do you buy your children what they request? (%)		
Every day	16	3
Every week	65	13
Sometimes	19	68
Not very often	0	14
Never	0	2
How much interest do children have over foods which are bought for the family? (%)		
A lot	0	2
Quite a lot	11	14
Some	32	43
Not much	43	36
None	8	5
Children who habitually make solo food and drink purchases (%)	14	14

4.2.3 Design

This study used a mixed measures, counterbalanced design adapted from the study by Roberto et al. (2010). Data for each participant was collected in a single visit. Counterbalancing was used to minimise any potential order effects; food order and placement of the foods within the matched pairs (i.e. BE character on the left or right) was randomized, as were the incongruent food-character permutations assigned to each participant in Study 2.

4.2.3.1 Independent Variables

The main independent variable was the experimental manipulation of the presence or not of a brand equity character on food packaging. Measures of weight status and recognition and liking of the characters were also incorporated as additional independent variables.

Therefore, the independent variables were:

1. Presence of brand equity character on packaging (present or not).
2. Weight status (NW or OWOB).
3. BMI SDS (gender and age appropriate standard deviation score).
4. Recognition of characters used (yes/no and additional recognition score)
5. Liking of characters used (rated using 5-point smiley face Likert scale).
6. Weekly TV viewing (hours; parental-report)
7. Weekly internet usage (hours; parental-report)

4.2.3.2 Dependent Variables

The effects of the experimental manipulation and differences across the participant characteristics stated above were assessed using the following outcome variables:

1. Preference (reported preference and liking on a 5-point smiley face Likert scale)
2. Food choice (selection of package with or without BE character for each individual food and overall snack selection)

4.2.4 Materials

As it was important for the validity of this study that the children recognised and broadly liked the BE characters to be used, pilot work was conducted to establish recognition and liking of various BE characters amongst the target demographic. The results of this informed the selection of the three BE characters and the corresponding foods for use in this study. These are detailed below (see Appendices 2a-2c for more details of the pilot).

Foods were presented in clear packaging with a sticker displaying either only the name of the food or the name of the food and a BE character. In Study 1, the BE character appearing on the packaging was congruent with the food in the packaging (e.g. Coco the Monkey on a Coco Pops® snack bar) and in Study 2, the character-product associations were incongruent (e.g. Coco the Monkey on a Cheestring®, all permutations appeared.

Snack Foods (Company)		Nutritional Information	Brand Equity Character Image
Cheestrings® *(Kerry Foods®)*		*per 20g Cheestring* Calories 61 kcal Total Fat 4.5g Saturates 2.8g Sugars 0g Salt 0.4g	 Cheestring
Coco Pops® *Cereal Bar* *(Kellogg's®)*		*per 20g cereal bar* Calories 83 kcal Total Fat 2g Saturates 2g Sugars 8g Salt 0.1g	 Coco the Monkey
Pom Bear® *Potato Snacks – Original* *(Intersnack®)*		*Per 19g pack* Calories 95 kcal Total Fat 4.8g Saturates 0.5g Sugars <0.5g Salt 0.27g	 Pom Bear

Table 4-2 Table detailing the snack foods used, their nutritional information and the BE character images placed on packaging for the current study

4.2.5 Procedure (see Figure 4-2)

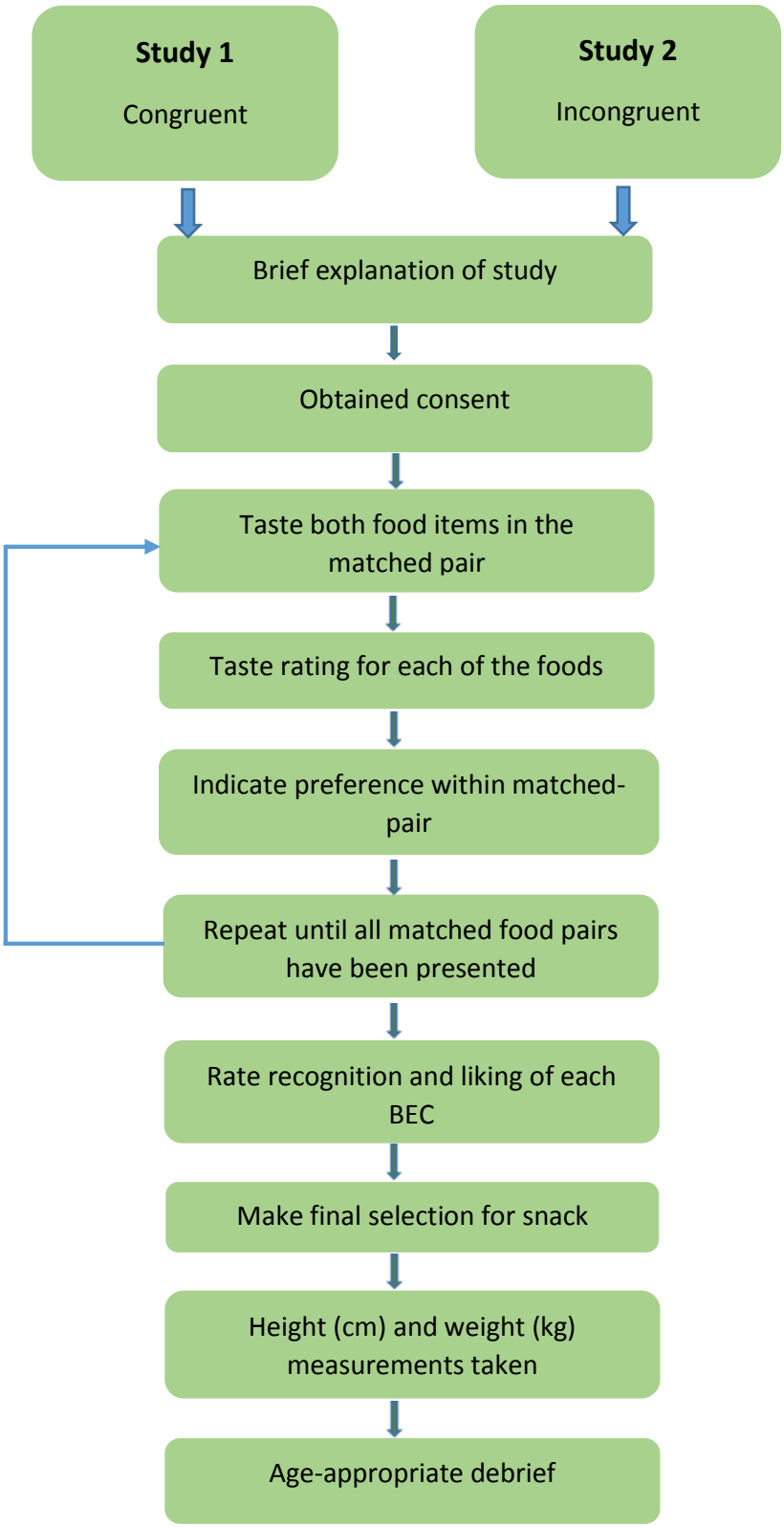
Children were given an age appropriate description of the study and following the consent procedures outlined above, were shown three pairs of food items. Within each pair, the foods were the same but one had a character on the packaging and the other had matched packaging but without a character present.

For each food pair, the children were instructed to try one food, then the other, and asked 'Do they taste the same to you? Or point to the food that tastes best to you.' Secondly, for each food the child was then asked 'Do you love it, like it, it's ok, don't like it or hate it?' which was then repeated for the other food; they were aided in this decision by a smiley face Likert scale (see Appendix 4d). Thirdly, children were asked which of the two items they would choose for a snack.

After completion of these tasks, the children were shown each character individually (image only, no food package) and asked if they recognised and/or liked the character (rated again using the smiley face Likert scale), and were allowed to choose one of their 'final three' as a snack. All of this was recorded by the researcher (see Appendix 4e for copy of the response sheets).

After the experiment was completed each child's height and weight was measured and recorded discreetly. Each child was given an age-appropriate description of the study's purpose and advised they could eat their chosen snack when a teacher/parent/legal guardian advised them it was OK.

Figure 4-2 Flow diagram depicting the study procedure



4.2.6 Statistical Analyses

Data collected did not adhere to the assumptions for parametric data (normality of distribution) therefore non-parametric tests were used (Chi square, Mann-Whitney *U* and Wilcoxon signed-rank tests). Analyses were performed using SPSS v22 for Windows (SPSS Inc., Chicago, US).

For use in analyses, BMI was converted to an age- and gender-appropriate Z score, using the WHO Anthropometric Calculator software (WHO Anthro version 3.2.2., January 2011) and weight status was subsequently defined using age- and gender-specific BMI cut-off points, which are equivalent to adult BMIs of 25 kg/m² (overweight) and 30 kg/m² (obese). These are the criteria as recommended by the World Obesity Federation (Cole et al., 2000).

Children's weekly TV viewing and internet usage were estimated by multiplying the typical weekday hours by five (representing Monday – Friday) and the typical weekend day hours by two (representing Saturday & Sunday) and combining the two to obtain a total weekly score. Where parents gave ambiguous or implausible answers, data were extrapolated conservatively to maximise usable data without potentially inflating effects. For example, one parent reported that their child watched TV for 25 hours on a typical week day. A reasonable assumption was that this individual had misinterpreted the question and given a total for all 5 weekdays so this is how the data was entered for analysis. Where parents stated a range of hours rather than an exact figure, a mid-point was used, for example, 2 – 3 hours was interpreted as 2.5 hours. TV viewing and Internet usage hours were split into high and low groups for comparison, based on a median split of the sample.

An average preference score was calculated for each child, where a preference for the BE character food was coded as +1, no preference as 0, and a preference for the non-brand equity character food as −1.

Total recognition scores for each BE character were obtained for use in analysis, by allocating one point if the child responded 'yes' when asked if they recognised the character, and adding one point for every additional point of recognition children correctly identified (e.g. brand name, character name, TV advertisements, etc).

4.3 Results

Study 1

<u>H1: Children will demonstrate a preference for foods presented with (congruent) BE character on the packaging, compared to foods in matched packaging without BE character.</u>

With regard to food preference, out of 180 responses (60 children x 3 food pairs), 178 valid responses were given (two children refused to sample the Cheestrings). 82 children (46%) correctly identified the items as tasting the same, 58 (33%) preferred the food item with the character present on the packaging and 38 (21%) preferred the food item without the character. These findings were mirrored across each of the food pairs when addressed individually, with the majority of children correctly identifying the pairs as tasting the same, followed by preference for the food with the BE character and finally by the food without the BE character.

Wilcoxon's Signed-Rank Tests demonstrated that participants significantly preferred both Cheestrings® (Z = -3.23, p = .001) and Coco Pops Snack Bars® (Z = -2.25, p = .03) with BE character present on packaging relative to no character present. There was no significant difference in the ratings for Pom-Bear® Potato Snacks for character or no character options (p = .37). See table 4-3 below.

Table 4-3 Children's Taste Preferences based on Likert scale Ratings of Taste

Food Item(s)	Study 1 (*n*=60)		Study 2 (*n*=149)	
	Z[a]	*P*	Z[a]	*P*
Cheestring	-3.225	.001	-3.57	<.001
Coco Pops Snack Bar	-2.245	.025	-2.10	.036
Pom-Bear Potato Snacks	-0.897	.370	-1.95	.052
Combined Total	-2.537	.010	-3.82	<.001

[a] Nonparametric Wilcoxon's signed rank test

H2: Children will choose the foods presented with a (congruent) BE character on the packaging for a snack rather than the foods without a BE character on the packaging, when making within-pair selections and as a final snack choice.

The most popular item overall for the final snack selection was the Coco Pops® snack bar with the corresponding BE character on the packaging. This was followed by Cheestrings® and Pom-Bear® crisps, both with brand equity characters, respectively.

Pearson's Chi-Square was performed to examine the relationship between snack choice and food packaging. Of the 180 possible choice situations, comprised of 60 children making 3 choices each, 179 valid responses were given, with one child failing to make a choice for one of the food items. 69% of the within-pair selections were for foods with the character present on the packaging, compared to 31% who selected the food without the character present representing a non-significant trend in this direction ($\chi^2(2) = 5.53$, $p = 0.06$) (see Table 4-4).

Furthermore, Chi-Square Goodness-of-Fit test was performed on the final snack selections, comprising of 60 children making one final choice. 73% of the children selected a snack food with a character present on the packaging, this was significantly greater than the number selecting a food without a character ($\chi^2(1) = 13.07$, $p < 0.001$) (see Table 4-4 and Figure 4-3).

Table 4-4 Children's Snack Choices

Food Item(s)	Study 1 (*n*=60)		Study 2 (*n*=149)	
	χ^2(df)[a]	*P*	χ^2(df)[a]	*P*
Cheestring	20.76(1)	.000	10.92(1)	.001
Coco Pops Snack Bar	6.67(1)	.010	.25(1)	.619
Pom-Bear Potato Snacks	2.40(1)	.121	4.63(1)	.031
Combined Total	5.53	.060	11.56(1)	.001
Final Snack Choice	13.07(1)	<.001	.01(1)	.935

[a] Pearson's Chi-Square test

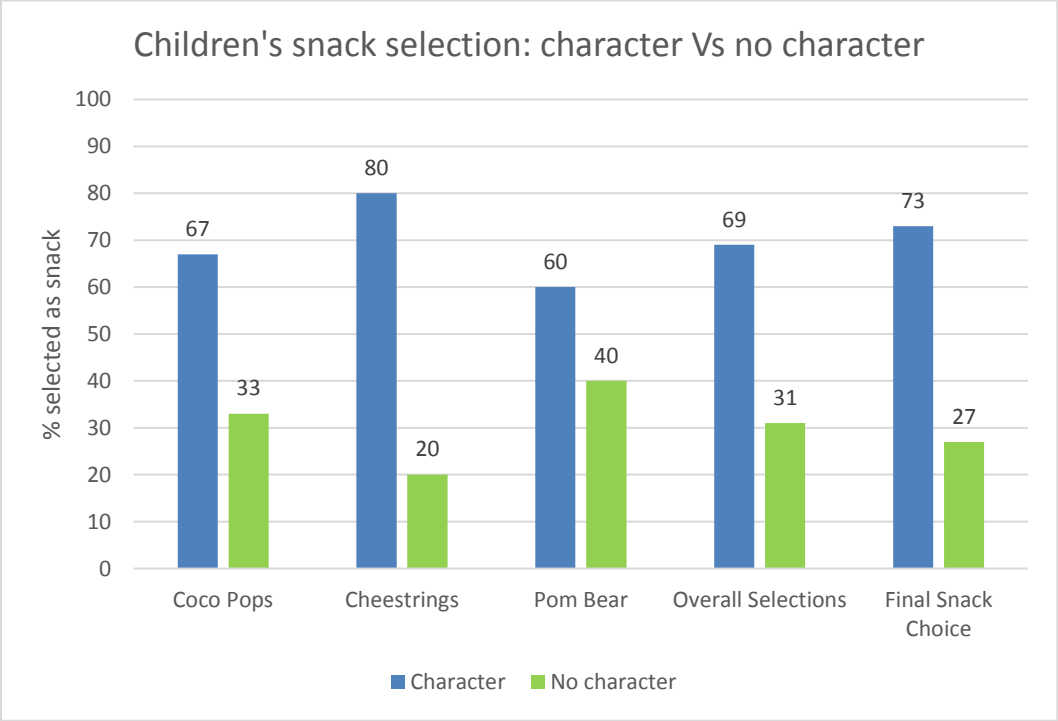


Figure 4-3 Bar chart showing snack selections as a percentage for each food, overall selections and final snack choice: Study 1

H3: The children's ratings of liking for each BE character will correlate positively with their recognition scores for each BE character.

Chi-square analysis was used to establish whether the children's recognition, on a yes/no basis, was related to their ratings of liking for each of the BE characters used. However, no significant relationships were found between recognition and liking of each of the BE characters ($p > .05$).

Furthermore, Spearman's rho was used to establish if a relationship existed between ratings of liking and the extent of character recognition, this time using the total recognition score (see section 4.2.6) for each of the BE characters. Again, no significant relationships were found between recognition scores and children's ratings of liking for each of the BE characters ($p > .05$).

H4: There will be a positive correlation between media usage (based on reported weekly TV viewing and Internet usage) and recognition of BE characters.

Pearson's product-moment correlation coefficient was used to identify whether there was a relationship between weekly TV viewing hours and/or internet usage hours and recognition scores for BE characters, no significant relationships were found for each of the three food items either individually or when using an average recognition score calculated for each participant ($p = > .05$). One outlier (± 3SD) was found for weekly TV viewing hours, however, when they were removed from this analysis, the findings remained non-significant ($p > .05$).

H5: Children with high levels of media usage will be more likely to choose the food presented with a BE character present on the packaging for a snack, rather than the matched food without the BE character, when compared to children with low levels of media usage.

As data were not normally distributed, a Mann-Whitney *U* test was used to establish whether differences on the average preference score (indicating a preference for foods either with or without character) differed between high and

low media usage groups (TV viewing and internet usage). No significant differences were found ($p > .05$).

Pearson's Chi-Square was used to establish whether a relationship existed between snack choice and food packaging, based on the levels of media usage, (high and low TV viewing and Internet usage; see section 4.2.6 for more details). There was a significant difference in snack choice amongst both high and low TV viewing ($p \leq .002$) groups and internet usage groups ($p \leq .006$), with those in the high media usage groups, in both cases, choosing the snack with the character present on the packaging.

Study 2

H1: Children will demonstrate a preference for foods presented with (incongruent) BE characters on the packaging, compared to foods in matched packaging without BE characters.

With regard to food preference, out of 447 responses (149 children x 3 food pairs), 424 valid responses were given. Of these, 196 (46%) children correctly identified the items as tasting the same, 145 (34%) preferred the food item with the character present on the packaging and 85 (20%) preferred the food item without the character. The majority of children correctly identified the food items as tasting the same across each of the food pairs, followed by the food items with the character and, finally, by the food items without the character.

Wilcoxon's Signed-Rank Tests demonstrated that participants significantly preferred two out of the three foods (Cocopops® cereal bars and Cheestrings®) when presented with an incongruent BE character on the packaging ($p < 0.05$), when compared to the matched food with no character on the packaging (see Table 4-3). For the Pom Bear® crisps, analyses indicated a trend that just missed significance in favour of the crisps presented with an incongruent BE character present on the packaging ($p = .052$) (see Table 4-3).

H2: Children will choose the foods presented with a (incongruent) BE character on the packaging for a snack rather than the foods without a BE character on the packaging, when making within-pair selections and as a final snack choice.

Consistent with Study 1, the most popular item overall for the final snack selection was the Coco Pops cereal bar with no character present on the packaging (33.6%), followed by Coco Pops cereal bar with the Pom Bear character and the Cheestring character, respectively. For all three foods, the snack without the character on the packaging was the most popular choice, followed by a similar preference for the two incongruent BE characters (see Table 4-5 for full details).

Food	Character	Frequency of selection (%)
Coco Pops cereal bar	Without character	50 (33.6%)
	Cheestring character	23 (15.4%)
	Pom Bear character	25 (16.8%)
Cheestring	Without character	10 (6.7%)
	Coco Pops character	4 (2.7%)
	Pom Bear character	5 (3.4%)
Pom Bear crisps	Without character	13 (8.7%)
	Coco Pops cereal bar	9 (6.0%)
	Cheestring character	10 (6.7%)

Table 4-5 Study 2: Frequency of selection for the overall snack choice, by food item.

Pearson's Chi-Square was performed to examine the relationship between snack choice and food packaging. Of the 447 possible choice situations, comprised of 149 children making 3 choices each, 424 valid responses were given. Of these possible choices, 247 (58%) of selections were for the food item with the character

present on the packaging, compared to only 177 selections (42%) of the food without the character present (X^2 (1) =11.56, p = 0.001) (see Table 4-4).

A Chi-Square Goodness-of-Fit test was performed on the final snack selections, comprising of 149 children making one final snack choice. There was no significant difference in final snack choice between packages with either a character present or not, with 49.7% of the children choosing the food with the character and 50.3% choosing the food without the character ($p > .05$).

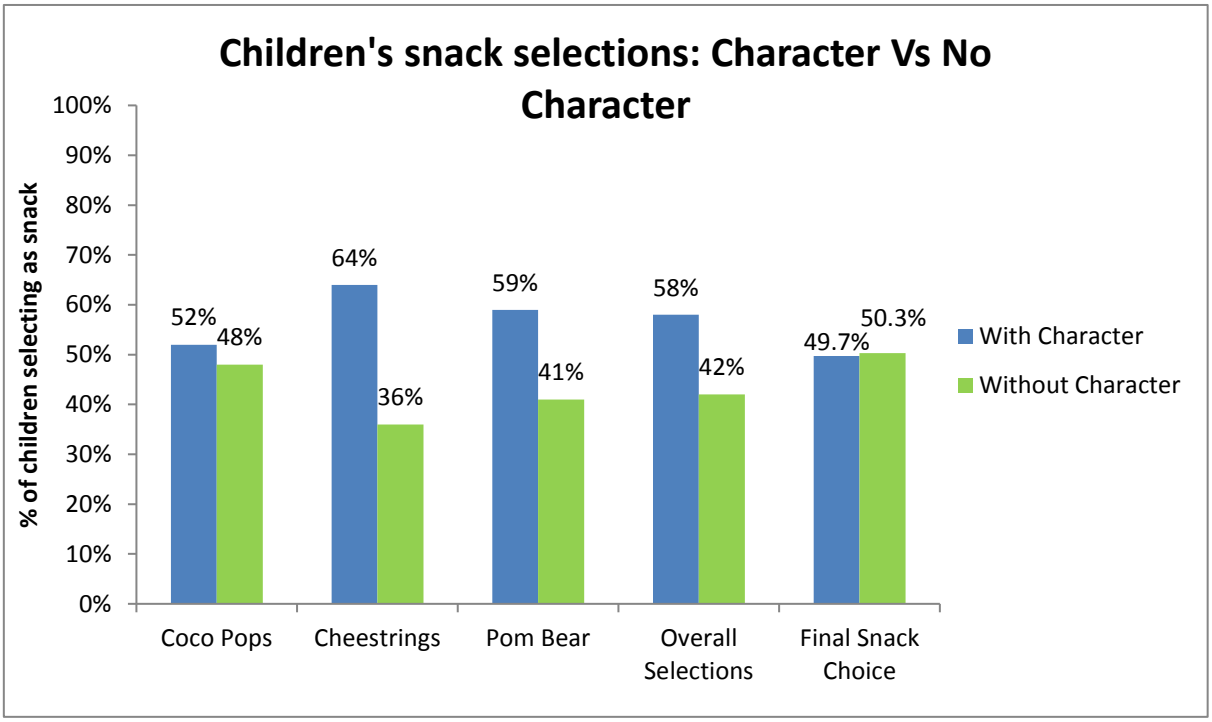


Figure 4-4 Study 2: Bar chart showing snack selections as a percentage for each food, overall selections and final snack choice

<u>H3: The children's ratings of liking for each BE character will correlate positively with their recognition scores for each BE character.</u>

Chi-square analysis was used to establish whether the children's recognition, on a yes/no basis, was related to their ratings of liking for each of the BE characters used. There was a positive correlation between whether the child recognised the character or not and their ratings of liking for Pom Bear only (χ^2 (4) =10.14, p = 0.038). There was a non-significant trend towards a positive association for the Cheestring character (p = .054).

Furthermore, Spearman's rho was used to establish if a relationship existed between the children's ratings of liking and the extent of character recognition, this time using the total recognition score (calculated by allocating 1 point for recognising the character, with an additional point for every additional context in

which they can recall the character e.g. on a crisp packet, TV advertisement etc.) for each of the BE characters. No significant relationships were found ($p > .05$).

H4: There will be a positive correlation between media usage (based on reported weekly TV viewing and internet usage) and recognition of BE characters.

Pearson's product-moment correlation coefficient was used to identify whether there was a relationship between TV viewing hours and recognition scores, however, no significant relationships were found either for any of the three food items individually or when using an average recognition score calculated for each participant ($p > .05$). However, it is worth noting that a non-significant trend emerged for Cheestrings ($p = .068$), with recognition scores increasing along with the number of hours spent viewing TV each week.

Pearson's product-moment correlation coefficient was also used to identify whether there was a relationship between internet usage hours and recognition scores, however, no significant relationships were found for any of the three food items individually or when using an average recognition score calculated for each participant ($p > .05$).

H5: Children with high levels of media usage will be more likely to prefer and choose the food presented with a BE character present on the packaging for a snack, rather than the matched food without the BE character, when compared to children with low levels of media usage.

As data were not normally distributed, a Mann-Whitney *U* test was used to establish whether differences on the average preference score (indicating a preference for foods either with or without character) differed between high and low TV viewing and internet usage groups. No significant differences were found ($p > .05$).

Pearson's Chi-Square was then used to establish whether a relationship existed between final snack choice and food packaging based on the levels of media

usage, based on weekly TV viewing and internet usage (high or low; see section 4.2.6 for more details)

No significant difference was found between either the high and low TV viewing groups or internet usage groups, in relation to overall snack choice, but there was a trend towards significance in both cases, with both the high TV viewing group (p = .06) and the high internet usage groups (p = .054) being more likely to choose the snack with the character present on the packaging.

4.4 Discussion

To our knowledge, this is the first study to assess whether the presence of brand equity characters on food packaging affects children's food preferences and choices. It is also novel to have explored whether any effect is dependent upon the congruency of the food/character associations.

This study demonstrated that BE characters do influence children's food preferences and choices, and that this occurs whether or not the character-product association is congruent. Although the majority of children in both studies correctly identified that both food items tasted the same, when asked to rate their liking of each item it was found that children were still significantly more likely to report preference for the taste of foods with the BE character on the packaging, compared to the same foods without the BE character on the packaging; this applied to all three food/character pairings and also across both studies, for both congruent and incongruent food/character associations. This suggests that the presence of a BE character on the packaging, whether congruent or not, is enough to alter children's perceived liking of how the food tastes, in favour of the food items with a character on the packaging. This is in line with previous research for other character types , which suggested that children are more likely to prefer food with characters on the packaging than those without (de Droog et al., 2011; Kotler et al., 2012; Lapierre et al., 2011; Letona et al., 2014; Roberto et al., 2010; Smits & Vandebosch, 2012; Ülger, 2008; Wansink, Just, & Payne, 2012). Furthermore, the current findings confirm the existing evidence which suggest that branding is a powerful tool for

influencing food choice and preferences in children (Kotler et al., 2012; Levin & Levin, 2010; Robinson, Borzekowski, Matheson, Kraemer, et al., 2007) with the effects of the BE characters being carried beyond the food it is normally advertising.

When placing congruent BE characters on food packaging, it was found that children were not significantly more likely to choose the snack food with the character on the packaging when looking at all of the individual choices made, that is, each child making a choice for each of the three matched pairs. However, when we consider each of the foods individually, children were significantly more likely to select the food with the character on the packaging as a snack compared to the matched food item without the character for two of the three matched pairs used in the study, Cheestring and Coco Pops. It is unclear why the same result was not found for Pom Bear crisps, however, there was a strong, non-significant trend.

An additional consideration, when looking at the anecdotal evidence gathered over the course of the study, was that children repeatedly identified the Pom Bear character as either the 'Haribo Bear' or as 'Pudsey Bear', a mascot for BBC's Children in Need charity which had recently been aired in the UK. This mistake may have inadvertently led them to perceive this character as either an incongruent BE character or as a licensed character, respectively, potentially influencing the outcome for this particular food/character pairing.

Finally, when looking at the final snack selections, children were significantly more likely to choose a snack item with the BE characters on the packaging to take home as a snack. This is a key finding, as it may represent what the child would ultimately request or purchase when given the choice in a real-life setting. However, when the character/food association was incongruent, the findings were somewhat different. When looking at the total of all of the individual choices, each child making three choices, children were significantly more likely to choose the snack with the incongruent brand character when compared to the snack with no character. Again, this supports all the current literature to date which suggests characters influence children's food preferences and choices. It is also in support of the findings for the congruent study. de Droog, Buijzen and Valkenburg

(2012) found that conceptually congruent character-food associations were just as effective as a familiar character-food association at increasing children's automatic affective responses to the foods used. Arguably the three snack foods and the BE characters used in the present study were conceptually congruent, in that they are associated with snack foods which are typically marketed to children, which was enough to affect children's affective responses and subsequent choices.

However, when looking at the final snack choices made for the incongruent study, there was no significant difference between children choosing either the snack with an incongruent character or the snack with no character on the packaging. Interestingly, this is in direct opposition to the findings of the congruent study, the current literature to date and also, most interestingly, the children's own preferences as indicated earlier in study 2, when they rated the snack with the incongruent character as both tasting better than those without the character, and as being their preferred snack. One potential explanation for this finding could be that immediately prior to making their final snack selection the children were asked about their recognition of the characters, which could increase the salience of the incongruence. Perhaps any future studies should use BE characters that are not only incongruent with the food it is presented on, but also incongruent with the other foods in the study to avoid this potential conflict, or reserve questions regarding the characters until the end of the study.

Batada & Borzekowski (2008) reported that children with three or more televisions in their home displayed greater recognition of characters/logos. With this in mind, it was anticipated that increased habitual TV viewing levels would result in more exposure to advertising and branding, and due to the current trend for online advertising and advergaming aimed at children, this would plausibly be the same for the high internet usage groups also. However, no significant differences emerged between the high and low TV viewing groups or internet usage groups when it came to final snack choice for either the congruent or incongruent pairings. Nonetheless, it is worth noting that for the incongruent pairings there were trends towards significance, with both the high TV viewing groups and the high internet usage groups being more likely to select the snack with the character

on the packaging and the low groups being more likely to select the snack without the character on the packaging. This could suggest that the children with the highest levels of TV and internet usage are potentially being exposed to more advertising, which in turn instils a preference for the brand characters. However, no firm conclusions can be made based on the findings of this study and so further research should aim to expand on this line of enquiry. Another possible explanation could be that exposure to BE characters may occur more through exposure to food packaging that to TV advertisements, and perhaps children who regularly attend the supermarket with their parents would show greater recognition of and familiarity with BE characters, and future studies may wish to measure habitual food shopping behaviours.

In the congruent study, 10% of the participants were classified as overweight or obese, and so was a fairly representative sample, falling in line with The Health Survey for England's (2012) estimates that 11% of boys and 10% of girls aged 2-10 are currently overweight or obese. Study 2 had 29% overweight or obese participants, which was somewhat higher than the estimated UK average. However, due to the disparity between the weight status groups, analysis looking at differences across the groups was not suitable. Previous research suggests that a child's weight status (normal weight, overweight, obese) may mediate their responsivity to food advertising (Halford et al., 2008; Halford, Gillespie, Brown, Pontin, & Dovey, 2004) and branding (Forman et al., 2009; Keller et al., 2012). In addition, Keller et al., (2012) found that there were weight status differences in the extent to which congruency between the food image and the brand imagery was important for children's responses to a food brand Stroop task. When foods were paired with incongruent brand imagery (e.g. McDonalds paired with broccoli) it was found that the overweight children took approximately 2 seconds longer, on average, to respond, suggesting a potential cognitive processing bias towards food branding (Keller et al., 2012). Therefore, it may be useful for future research to establish whether or not overweight children respond differently to BE characters paired with incongruent foods than with congruent. Future research should recruit appropriate samples to consider weight status effects.

Previous research has also indicated there is a link between TV and weight status, with Hardy et al. (2012) reporting that overweight/obese children were significantly more likely to have a TV in their bedroom. However, in this study no relationship between BMI z-scores and TV viewing was found. Similarly, there was no relationship between Internet usage and BMI z-scores. It is worth considering that the parental reports of their children's television viewing may not be accurate; there were relatively small numbers of parents who completed these questionnaires and within these responses there was great variability and often very apparent errors were made when reporting daily averages. There is also the risk of socially desirable responding to consider, which may have influenced how the parents responded to the questions posed.

It was hypothesised that children's liking of each of the characters would increase with the extent to which they recognised them, based on their familiarity and learned positive brand associations. However, contrary to these predictions, no relationship was found between these two variables in either study. In addition, this study also aimed to establish if there were any potential relationships between the children's media usage and recognition of the BE characters. No significant results were found for either TV viewing or internet usage, across either study, which perhaps offers some explanation as to why no significant differences in snack choice were found across either of the TV viewing or internet usage groups.

4.4.1 Limitations and future directions

Food preference studies like this cannot include an exhaustive list of all the branded foods which the children may potentially prefer and are most familiar with, and these personal preferences may affect findings. In addition, there may be variation between the amount of exposure children receive to particular brand characters and products, for example, there was no significant difference between selection of the Pom-Bear® potato snacks in Study 1 either with or without the character. This may be due to fewer advertisements and less marketing for Pom-Bear®, compared to Coco Pops® and Cheestrings®. With this in mind, this study aimed to address this issue with the inclusion of the pilot work and whilst it is difficult to find three universally recognised and loved characters, it aimed to ensure that this study

utilised three character/food pairings which were as well-recognised and as well-liked by UK children as possible.

Although the order of the foods being presented was randomized, and the within-pair order of each food was counterbalanced (BE character first or no BE character first), future studies may wish to ensure children rinse their mouths between tasting each item to ensure that lingering tastes do not affect ratings for subsequent foods. Another limitation of the study was that the researcher was not blind to the character manipulation or the study aims, rendering the study at risk from the influence of demand characteristics (the idea that participants may be aware of what the researcher is trying to investigate, or anticipates finding, and what this implies for how participants may be expected to behave).

The study sample was not ethnically diverse, and few children were classified as overweight-obese. Ideally, future studies would try and obtain a more representative sample of UK ethnicity, and specifically recruit equal numbers of normal weight, and overweight-obese participants, in order to allow for comparisons between weight statuses. It would be useful to identify if, in line with existing evidence on marketing, children who are already overweight-obese are more susceptible to this particular persuasive technique.

There have been recent studies which demonstrate, through the use of fMRI, the powerful neural responses to branding and brand-logos in children (Bruce et al., 2014). These help improve our understanding of how children are processing, evaluating and responding to branding. It would be useful for future research to expand upon this knowledge base and assess children's neural responses to promotional characters, such as BE characters, in addition to the behavioural studies which assess eating behaviour outcomes such as preference and choice.

4.4.2 Conclusion

Overall, the results of this study provide evidence that BE characters (both congruent and incongruent) on packaging have an influence on children's food preference and choice, in favour of the foods the characters appear on. This contribution to the relevant body of research may help deepen the knowledge of

clinicians and paediatricians, and guide health services that manage childhood obesity and appetite behaviour in children.

Whilst it is possible that BE characters could be used in a positive way to promote healthier food items to children, as they are currently used predominantly to market HFSS foods it is of particular concern. To our knowledge, this is the first time this influence has been demonstrated using BE characters and these findings parallel the current evidence on the influence of licensed characters on children's food preferences and choices; due to this existing evidence, some countries such as the UK, have regulated the use of these licensed characters in TV advertising. However, to date, there is a distinct difference in regulatory approaches to BE characters. Findings here help to inform the international debate on effective food marketing policy, suggesting that policymakers should extend current regulations to include the use of BE characters if we are to reduce children’s exposure to the marketing of HFSS food and beverages.

Promotional characters are only one aspect of food packaging that may affect children’s eating behaviours. Portion size depictions, as presented on food packaging, are another potential avenue for influencing children’s eating behaviours, and their influence on serving and consumption will be the focus of the proceeding chapter.

Chapter 5: The influence of front-of-pack portion depictions on children's serving sizes and consumption of cereal

5.1 Introduction

As discussed in previous chapters, the marketing of unhealthy foods to children has been established as an important contributor to childhood obesity, with much research highlighting the influence that persuasive techniques have on children's food choices, preferences and consumption. Portion size has also been acknowledged as a contributing factor to the obesogenic environment (Vermeer et al., 2014) and whilst there is much literature to date which establishes the influence of portion sizes on food consumption and energy intake, there is little focus on the impact of more subtle influences on children's eating behaviours, for example, visual cues such as front-of-package portion depictions. As children's self-served portion sizes are influenced by external size-related cues within their environment (Fisher et al, 2013), it is important that we understand their influence on children's eating behaviours. The following sections will discuss the relevant literature to date, which informs the current study.

5.1.1 The Portion Size Effect

Over the past few decades the prevalence of childhood obesity has increased, coinciding with many secular changes within the food environment, of which portion size is one (Rolls, 2014). Across Europe and the US, portion sizes have reportedly been increasing in parallel with increases in body weight (Matthiessen, Fagt, Biltoft-Jensen, Beck, & Ovesen, 2003; Nielsen & Popkin,; Piernas & Popkin, 2011; Young & Nestle, 2002), however, it is unclear whether these increases reflect marketers' responses to customer preferences for larger portions, or whether it is the marketers who are in fact shaping these preferences (Zlatevska et al., 2014).

It has repeatedly been demonstrated in adult populations that larger food portions and package sizes are associated with notable changes in eating behaviour

such as increased food consumption (DiSantis et al., 2013; Mrdjenovic & Levitsky, 2005; Barbara J Rolls et al., 2002; Steenhuis & Vermeer, 2009; Wansink & Cheney, 2005; Wansink et al., 2006) and increases in bite size and eating rate (Almiron-Roig et al., 2015). A meta-analytic review found a medium-sized effect (d = .45) of portion size on consumption (Zlatevska et al., 2014). The authors report that when a portion size is doubled, consumption increases by an average of 35%, and this was true across a range of contexts and foods. However, this effect is curvilinear; as the portions become increasingly large, the increases in consumption begin to taper off. The authors posit that consumption norms may be a principal driver behind the portion size effect. A consumption norm is a perceptual suggestion of what is appropriate, typical and reasonable to consume (Wansink, 2004; Wansink & van Ittersum, 2007), and they are believed to be automatic, occurring outside of conscious awareness (Schwarz, 1996; as cited in Wansink & van Ittersum, 2007). As the meta-analysis revealed a curvilinear effect of portion size on consumption, Zlatevska et al. (2014) suggest that the effect of portion size is potentially lessened, or even eliminated, for much larger portion sizes due to the increasing salience of, and reliance on, internal, physiological cues, as opposed to visual, normative benchmarks such as portion size.

They also report that this effect is weaker amongst certain groups, namely women, children and overweight populations, as well as when non-snack foods are used, and in contexts where more attention is given to the food that is being eaten. A Cochrane review by Hollands et al., (2015) included 69 studies that manipulated food portion size, packaging size or the tableware used to consume the food. These consisted of both between- and within-subject randomised controlled trials, in laboratory or field settings, in both adults and children. The meta-analysis of 86 independent comparisons (from 58 included studies) found a small-moderate effect of portion, packaging and tableware size on the consumption of foods. The authors suggest that if exposure to larger food portions, packages and tableware was reduced across the whole diet, average daily energy consumption from food could be reduced by between 144 and 228 calories amongst UK children and adults,

which when considered cumulatively could have a large impact on caloric intake and weight gain over time.

In a series of controlled studies by Rolls, Roe and Meengs (2006, 2007) it was found that increasing the portion size of all foods significantly increased energy intake of participants, and that this effect was sustained across a 2 day period, and again, in a follow-up study, across an 11 day period. This lends support to the argument that larger portions are associated with excess energy intake, which can in turn contribute to increases in body weight. These reported increases in food intake in relation to larger portions have been shown to occur even when the energy density of the food is altered (Birch & Fisher, 1998; Fisher, Liu, Birch, & Rolls, 2007; Fisher, 2007; Kling, Roe, Keller, & Rolls, 2016; Leahy, Birch, Fisher, & Rolls, 2008; Leahy, Birch, & Rolls, 2008; Looney & Raynor, 2011; Marchiori, Corneille, & Klein, 2012; Fisher, Rolls, & Birch, 2003; Rolls, Engell, & Birch, 2000; Smith, Conroy, Wen, Rui, & Humphries, 2013; discussed further in section 5.1.1.1.3). This suggests that the influence that portion sizes have on consumption may be related to not only perceptual, but also physiological, factors.

The main body of portion size research has focused on adult populations, with relatively less attention given to their influence on children's eating behaviours. When considering the persistent problem of childhood obesity, and the growing body of evidence (as discussed in previous chapters) that suggests children's food choices, preferences and consumption are influenced by a variety of environmental, cultural and social factors, the influence of portion size on children's food behaviours warrants more attention.

5.1.1.1 Portion sizes and children

Epidemiological studies demonstrate a positive correlation between portion sizes consumed and the relative weight status of children (McConahy et al., 2002; Piernas & Popkin, 2011). Birch, Savage, & Fisher (2015) suggest that while a positive correlation exists, the idea that larger portions are *causally* responsible for obesity and weight gain is not supported in these data, postulating that this may in fact reflect reverse causation, whereby children with greater body weight consume

larger portions than children with lower body weight as they have greater energy requirements, and not vice-versa. However, a US survey of preschool children aged 2-5 years (*n*=5447) highlighted that eating behaviours and body weight were both positively related to energy intake, with portion size accounting for between 17-19% of the variance in energy intake, and body weight only accounting for 4% (McConahy, Smiciklas-Wright, Mitchell, & Picciano, 2004).

Birch et al. (2015) suggest two ways to approach the questions regarding the causal role of portion size in obesity; firstly, by adjusting energy intake to reflect differences in body weight, and secondly, by conducting randomised experiments whereby portion size is manipulated and any subsequent effects on consumption and weight status can then be measured. Of these two approaches, the latter is directly relevant to the current study, and thus the associated body of research to date will be discussed in the succeeding sections.

5.1.1.1.1 Laboratory studies

It has been consistently demonstrated that children consume more food when served a larger portion than when served a smaller portion (Fisher, Liu, Birch, & Rolls, 2007; Kral, Kabay, Roe, & Rolls, 2010; Looney & Raynor, 2011; Mathias et al., 2012). In a within-subjects, laboratory based study by Kral et al. (2010), children (*n*=43) were given an evening meal of pasta with tomato sauce, three fruit and vegetable side dishes (broccoli, carrots and applesauce) and milk. This was repeated once a week over a two week period, and the portion size of the side dishes was doubled on one of the two eating occasions. They reported that when the fruit and vegetable portions were doubled, the children consumed 43% more fruit; however, there was no effect on vegetable intake. This may suggest that the portion size effect will only significantly increase the intake of more palatable foods which the children already enjoy consuming.

5.1.1.1.2 Naturalistic Studies

Whilst many studies are based in university laboratories, a large proportion of the evidence relating to portion size effects on children has been collated in childcare centres and preschool/school canteens (Huss, Laurentz, Fisher, McCabe, & Kranz, 2013; Kling et al., 2016; Looney & Raynor, 2011; Smith, Conroy, Wen, Rui, & Humphries, 2013), which contributes to the ecological validity of the findings, whereby children are consuming these foods in as natural an environment as possible. These studies in real-life settings, for the majority, mirror the findings of more controlled, laboratory based studies, demonstrating that these effects translate to, and are applicable to, real world scenarios. A study by Rolls, Engell, & Birch (2000) enlisted children (*n*=32) attending a day-care program. Children were split across 2 classes (16 per group) with mean ages of 3.6 and 5.0 years in each. Children in each age group were provided with lunch in their usual setting, once a week for 3 weeks. Lunch consisted of macaroni and cheese, carrot sticks, applesauce and milk. Only the portion size for the macaroni cheese varied at each time point (smaller than, equal to or larger than recommended serving sizes); these were adjusted to reflect the age groups and foods were presented in the same size bowl. The authors found that the older preschool children consumed significantly more of the macaroni and cheese when provided with a larger portion than with the smaller portion, whereas portion size did not significantly affect food intake for the younger group of children. Total energy intake across the whole meal also reflected a similar pattern to the macaroni and cheese intake, and these differences in response to portion size occurred despite no differences in pre-meal hunger measures. While this study used a small sample, with only 16 children per condition, it was the first experimental study to address and demonstrate the influence of portion sizes on children's intake, and it did so in a real-life setting. Their findings suggest that younger children are able to respond to internal physiological cues for hunger and satiety and subsequently self-regulate their food intake. The effect of these internal cues appears to wane with age, with external factors imposing more influence over food intake in the older children. In particular, it corroborates both their earlier and more recent findings, which have indicated that as children develop, their food intake and eating behaviours are influenced by

various social, cultural and environmental factors (Birch, Savage, & Ventura, 2007; Birch & Fisher, 1995; Birch, 1980), in addition to a vast body of literature from wider research groups, as highlighted thus far within this thesis. In 2013, Fisher et al. (2003) demonstrated a 25% increase in food consumption of 4 year olds, when their main course was double an age-appropriate portion, lending support to the findings of Rolls et al. (2000) that children of this age group are beginning to respond to external cues in the food environment.

One real-life study, however, which failed to find an effect of portion size was a repeated exposure, crossover quasi-experimental study by Huss et al. (2013). Children (2-5 years) were tested during lunchtime at a childcare centre. Children were served two lunches twice a week over 12 weeks (fish or pasta, each with a dessert), which differed both in portion size of the main course (a reference portion or 50% larger portion) and timing of dessert given (either with main course or after). The authors report that providing dessert after the main course increased energy intake for both the main course and the dessert, resulting in a greater energy intake overall, and that this finding was true regardless of the size of the main course served. This is an unusual finding and the authors postulate that this may be due to their randomisation occurring at the group level, by classroom, and not by child, meaning it was not possible to capture variations at the individual level.

Despite limited epidemiological data which assess the influence of portion size on children's consumption over longer periods of time, and subsequent weight status, there is a wealth of empirical evidence which demonstrates that portion size has an acute effect on the consumption behaviour of children of a certain age, in both laboratory-based settings and in real-life settings. The next logical step is to consider the mechanisms and behavioural traits which underpin the portion size effect, and so the existing literature will be discussed.

5.1.2 Appetitive traits

Behavioural studies have shown that obese children are less responsive to internal satiety cues, and are reported to be more sensitive to external food cues than

normal weight children (Fisher et al., 2007; Fisher & Birch, 2002; Jansen et al., 2003). Several studies report that appetitive responses and eating rate strongly increase in obese and overweight children in response to environmental food cues (Carnell & Wardle, 2007; Sleddens et al., 2008; Wardle, Guthrie, Sanderson, & Rapoport, 2001). Behavioural traits such as food responsiveness and enjoyment of food reflect eating in response to environmental food cues, for example pictures of food, and are therefore of particular interest in the current study. These are positive responses to food, which are concerned with food approach, and have been hypothesised to promote food intake, as opposed to alternative appetitive traits such as food fussiness or responsiveness to internal satiety cues, which are believed to reduce intake (Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009). In obesogenic environments, where individuals are presented with numerous opportunities to consume foods which are highly palatable and energy-dense, appetitive traits such as these have the potential to moderate the risk of weight gain (Webber et al., 2009).

Questionnaires such as the Children's Eating Behaviour Questionnaire (CEBQ) have been developed to measure these appetitive traits (discussed in section 5.2.4). In a Dutch sample, Sleddens et al., (2008) found that both food responsiveness and enjoyment of foods were positively associated with a child's BMI z-score, which is in fact consistent with existing research which demonstrates that children with higher BMI scores are highly responsive to environmental food cues (Braet & Van Strien, 1997; Sleddens et al., 2008; Viana, Sinde, & Saxton, 2008; Wardle et al., 2001). Sleddens et al., (2008) also reported that girls had higher levels of food enjoyment than boys, and they argue that as differences in eating behaviours are often detected in teenage years, it is useful to track the development of these differences in eating styles from early childhood onwards. It is important to identify specific eating styles which are implicated in the development and maintenance of overweight, providing insight into behavioural pathways to obesity and offering potentially modifiable traits which can be targeted by the development of informed interventions.

5.1.3 Mechanisms of the portion size effect

The existing literature clearly demonstrates that portion size has a tangible effect on consumption and energy intake in both adults and children. English, Lasschuijt and Keller (2015) suggest that there are two main reasons for understanding the mechanisms which underpin the portion size effect; firstly, if we can identify individual characteristics which lead certain individuals to be more susceptible to the portion size effect, more effective approaches could be developed to target obesity; secondly, a clearer understanding of how portion size influences energy intake could improve the effectiveness of dietary management interventions. A number of studies have sought to increase understanding of the mechanisms via which portion sizes impose their influence, offering a variety of insights and explanations that will be discussed in the following sections.

5.1.3.1 Social Norms

Eating behaviours are believed to develop in childhood as a result of social learning, whereby children are directly influenced by the eating behaviours and preferences of parents, siblings and peers when eating in their company (Birch & Fisher, 1998; Birch et al., 2007; Hendrie et al., 2013; Herman, Roth, & Polivy, 2003; Robinson & Higgs, 2013). This can be explained by Bandura's (1977) Social Learning Theory, which posits that behaviours, both good and bad, are learned from the environment using the process of observational learning; for example, children are surrounded by 'models' who provide examples of behaviour. Children will later imitate the model's observed behaviour; this is known as social modelling. A variety of experimental studies and reviews which focus on social modelling in children, adolescents and adults report that the eating behaviour of peers has a powerful influence on an individual's food intake (Bevelander, Anschütz, & Engels, 2012; Feeney, Polivy, Pliner, & Sullivan, 2011; Herman et al., 2003; Robinson, 2015; Robinson & Higgs, 2013; Vartanian, Sokol, Herman, Polivy, & Bastian, 2013).

Vartanian and colleagues (2013) carried out a series of 3 experiments in which female participants were exposed to low-intake model, high-intake model or no model (control) conditions. In experiments 1 and 2, a cookie taste test was used

as the context, and they employed a remote-confederate manipulation. Experiment 3 used a live confederate, where the context was a task during which participants were given incidental access to the food. In all 3 of the experiments, those in the low-intake conditions ate less than participants in the high-intake conditions, and reported lower perceived norms of an appropriate intake. In addition to this, the authors observed that perceived norms of appropriate intake mediated the effects of the social model on participants' intake of test foods. Thus, the social models appear to provide a norm for eating behaviour which influences food intake. Participants were also more likely to report that their intake was influenced by hunger and taste than by the confederates' behaviour, despite the observed effects of the models. The authors attribute this to participants being unaware of the social models influence on their behaviour. It is believed that people automatically mimic other peoples' eating behaviours, without awareness of doing so; other people's behaviour may be acting as an external behavioural cue (Harris, Bargh, & Brownell, 2009; Johnston, 2002; Tanner, Ferraro, Chartrand, Bettman, & Van Baaren, 2007).

5.1.3.1.1 Perceived Consumption Norms

In addition to observable eating behaviours, beliefs about the eating behaviour of others, known as perceived eating norms, have also been demonstrated to influence eating behaviour in children (Sharps & Robinson, 2015) and adults (Feeney et al., 2011; Robinson, Benwell, & Higgs, 2013; Robinson, Fleming, & Higgs, 2014; Robinson, Sharps, Price, & Dallas, 2014). Robinson, Benwell, & Higgs (2013), in a remote confederate design, led adult, female participants to believe that previous participants had consumed either large or small amounts of food (consumption norms). When compared with a no norm condition (control), participants consumed more cookies when led to believe the consumption norm was to eat a lot of cookies, and less when they believed the consumption norm was to eat fewer cookies. While this consisted of a convenience sample of undergraduate students, and only included female participants, it was the first study to demonstrate that consumption norm information can influence consumption levels (both positively and negatively) in a remote confederate study.

However, there is a relative paucity of research that addresses the influence of perceived consumption norms on children's eating behaviour, with the majority of child-focused research including live confederates/peers. Evidence exists that children's intake of snack foods is adjusted to match that of a peer who was present during this eating experience (Bevelander et al., 2012; Romero, Epstein, & Salvy, 2009). One such study empirically assessed whether children's food intake was influenced by a live confederate's intake, both directly and over time, and whether this was dependent upon weight status (Bevelander et al., 2012). The first session focused on social modelling, where the participants were paired with a same-sex normal weight confederate who was asked to eat either a small or large amount, or nothing at all (control), and asked to complete a puzzle. The second session occurred 2 days later and involved the participants completing the puzzle alone. The authors reported an interaction effect in the social modelling session, which would suggest that overweight children were triggered to overeat when a peer consumed a larger amount, and the normal weight children's intake appeared to be dependent on whether or not the model ate, irrespective of amount. Their findings suggested that the guideline set during the social modelling session remained over time and influenced food intake during the second session, when differences between overweight and normal weight children were no longer significant. The authors posit that peers can therefore set an example of an appropriate food intake amount, or consumption norm, which may have an influence on intake at a later date, or over time

Further to this research, several studies have demonstrated the influence that a remote confederate may have on children's food intake and/or eating behaviours. One such study used a 2 x 2 between-group factorial design with weight status (overweight vs normal weight) and serving size (large vs small) as the between factors (Romero et al., 2009). Both conditions were shown a video with a social model that either selected a large amount of mini-cookies or a small amount of mini-cookies, dependent on condition. Participants were girls aged 8-12 years. The authors report a significant main effect of both condition and weight status, with those who were shown the large serving-size consuming more cookies than

those exposed to the small serving-size video, and overweight girls consuming more cookies than those who were not overweight. However, they did not find a significant interaction between the two, suggesting that peer-modelling had an influence on the snack intake of girls this age range, irrespective of weight status. This is an important finding, as it highlights that children (in this case, 10-11 year old girls), like adults, will conform to perceived consumption norms by matching the eating behaviours of their peers, and that these normative benchmarks are influential enough to impact on behaviour even when indicated by a remote confederate. More research is needed which focuses on the variety of consumption norm indicators which exist, which are often much less overt than the observable consumption behaviours of others, for example, the use of portion size depictions on food packaging, which may be subtly suggesting to consumers what a 'normal' serving should be.

The body of research thus far has tended to focus on snack food intake, with an emphasis on less healthy food items. However, more recently, Sharps & Robinson (2015) employed a remote-confederate design to examine whether children were motivated to eat more vegetables by manipulating perceived consumption norms. Participating children were informed of the amount of carrots other children had eaten by exposing them to a fabricated participant information sheet displaying the amount of carrots previous children had consumed, including four conditions: high intake condition (all), low intake condition (none), no-norm condition (blank) and the control condition (no information sheet). Children in the high intake condition ate significantly more carrots than the children in all other conditions, lending support to the argument that when children believe that other children have eaten a large amount of the food in question, they are influenced to increase their own food intake accordingly.

Sharps and Robinson's (2015) findings were consistent with similar studies in adult populations (Herman et al., 2003; Robinson, Sharps, et al., 2014; Robinson, Thomas, Aveyard, & Higgs, 2014), however, this study differs in that the children in the low intake norm did not reduce their intake relative to the no-norm or control

conditions. This may be due to a floor effect, with the no-norm and control conditions consuming so little of the carrots that it was not possible for this to be reduced in the low-intake group. The use of only carrots as a test food means the findings cannot be generalised to the consumption of all foods and perhaps the inclusion of more palatable foods could have alleviated any existing floor effects. Nonetheless, this further highlights the influence of perceived consumption norms on children's eating behaviours, demonstrating that even in healthier, less palatable foods, by exposing children to subtle, implied consumption norms, their intake of these foods may be significantly increased. This is particularly interesting from a public health perspective, offering the potential for evidence based interventions which increase children's intake of healthier foods by manipulating children's perceived consumption norms.

This evidence base lends support to the idea that perceived eating norms have an effect on peoples' eating behaviour. Furthermore, based on the evidenced effect of remote-confederate designs it would appear that this influence occurs even when the model is not present, and the behaviour of the model is simply alluded to; mere suggestions of eating norms may be enough to influence an individual's behaviour. This conclusion is supported by the experimental findings of Feeney et al. (2011), who randomly assigned participants to either a live or remote model, and compared their intake to participants who ate alone. They reported that participants paired with a model differed significantly from the control group, regardless of whether the model was live or remote, and no significant difference between either of the modelling conditions was found. This advocates that the use of suggested eating norms as an intervention has the potential to positively influence children's perceived consumption norms and subsequent eating behaviours.

The current environment is inherently promoting larger intake through larger portion sizes, but these studies suggest that these effects could be mitigated or counteracted by programmes that encourage age-appropriate consumption norms for children, which are representative of their energy requirements. As

previously detailed, research to date has focused on portion size and social norms through the use of both live- and remote-confederates, but less is understood about whether more subtle suggestions, such as a picture, could work as a visual cue to influence a consumption norm.

5.1.3.2 Visual Cues

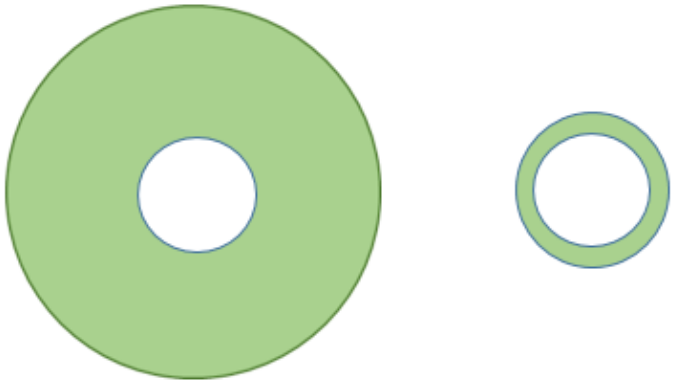
Visual cues are the first sensory stimuli of an eating experience and, as such, are thought to play a key role in influencing consumption and choice (Reisfelt, Gabrielson, Aaslyng, Bjerre, & Møller, 2009). English, Lasschuijt, & Keller (2015) suggest that portion size influences the amount consumed by an individual by providing a visual cue which indicates the amount of food available during a meal, which then affects the succeeding cognitive processes which relate to intake. Alternatively, Kahn and Wansink (2004) argue that visual cues influence consumption norms and expectations, which in turn lessen the individual's need to monitor their own intake. This would suggest that salient visual cues depicting healthy portion sizes could play a role in preventing overconsumption. Visual cues, in the wider sense, are understudied in the portion size literature and may offer greater understanding of how the portion size effect exerts its influence. However, the existing literature has explored the influence of dishware and cutlery size on consumption and the perception of portion sizes, which are discussed in the following section.

5.1.3.2.1 Effect of Dishware and Cutlery Size on Food Intake

Research in adult populations has shown that dishware size has a similar effect on food consumption to that of the portion size of the actual food, with larger plates resulting in greater serving sizes and subsequently greater food consumption (Wansink & van Ittersum, 2013; Wansink et al., 2006; Wansink, van Ittersum, & Payne, 2014). This effect is often attributed to the so-called 'Delboeuf illusion', a visual or optical illusion based on the perceived size of one object in relation to another (see Figure 5-1 for an illustration of the Delboeuf illusion). However, overall, findings have been mixed, with additional studies looking at the effect of dishware size on food intake failing to find any effect (Rolls et al., 2007). A meta-

analysis by Robinson et al. (2014) examined the existing evidence base for the influence of experimentally manipulated dishware sizes on food intake, which included 9 eligible studies from 8 publications. The authors report that while the difference in food intake between large and small dishware conditions was statistically significant, it was only marginally so, eliciting a small effect size, and as such warrants further investigation.

Figure 5-1 Example of the Delboeuf Illusion; the central circle appears smaller when placed inside the large circle, and larger when placed inside the small circle.

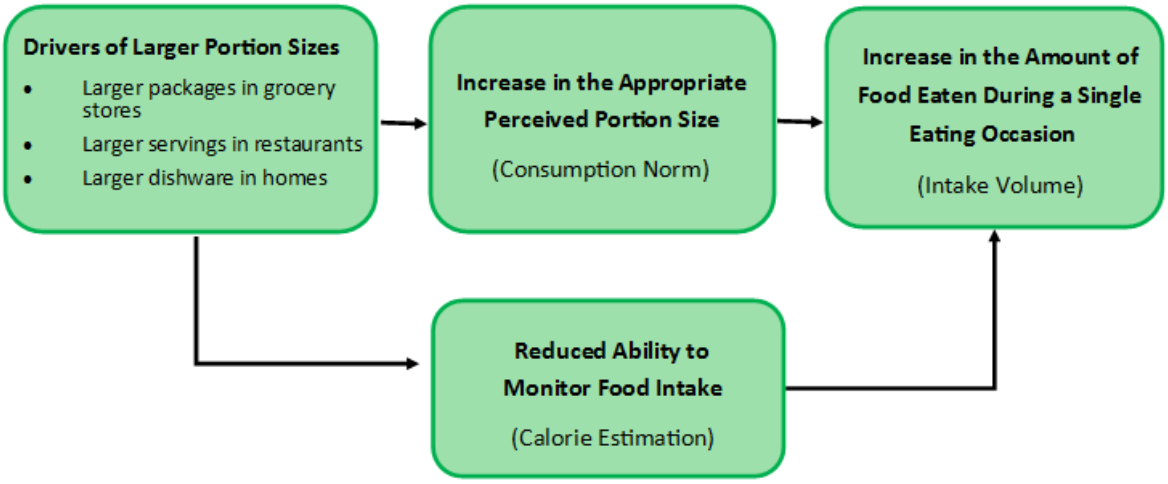


A novel between-subjects study by Wansink, Painter and North (2005) examined whether visual cues related to portion size could influence intake, without altering the participants' estimated intake or satiation. This study used a self-refilling bowl as a biased visual cue, and compared this to a normal bowl (which acted as an accurate visual cue). Participants who ate from the self-refilling bowls consumed more soup than those with the normal bowls. Interestingly, they did not believe they had consumed more and did not report higher satiation that those eating soup from the normal bowls. These findings were unaffected by BMI. This lends support to the idea that the amount of food on a plate/bowl will influence intake via consumption norms and expectations, and lessens an individuals' need to rely on self-monitoring. More recently, in a within-subjects, experimental design in an elementary school, the effects of dishware size on children's (*n*=42) self-served

portion sizes and energy intake at lunch was tested (DiSantis et al., 2013). Children served themselves portions containing more energy when using larger, adult-sized dishware than when using child-sized dishware. This also had an indirect effect on total energy intake during the meal, with every additional calorie they served themselves resulting in an increase of 0.43 calories in total energy consumed during the meal. In addition, we must consider that individual differences are likely to play an important role, as one study demonstrated that whether a child was introverted or extroverted moderated the effect that dishware size had on the food they served themselves (van Ittersum & Wansink, 2013). Individual differences are shown here to be important, but other pertinent factors, for example, trait eating behaviours, have not been investigated as yet, and this is a gap which the current study aims to address (refer back to section 5.1.2 for more detail on appetitive traits).

It has been suggested that dishware acts as a visual reference or guideline for the consumer to determine what is an appropriate amount of food to consume, thus lessening the individual's need to self-monitor their intake (Herman & Polivy, 2005; Kahn & Wansink, 2004). Therefore salient visual cues, which accurately depict a healthy portion size, may play an important role in the prevention of passive overconsumption and further exploration of visual cues is needed before we can fully understand their influence. Another food behaviour which has also been demonstrably influenced by the portion size effect is that of serving behaviour and, as it is inextricably linked to food consumption, will be discussed.

Figure 5-2 Illustration of how larger portion sizes lead to increased consumption



(Wansink & Van Ittersum, 2007)

5.1.3.2 Self-serving

It is believed that encouraging children to self-serve at meal times can have numerous developmental benefits, for example, encouraging autonomy while eating and also developing both social and motor skills (Branen, Fletcher, & Myers, 2009; Fisher, 2007; Sigman-Grant, Christiansen, Branen, Fletcher, & Johnson, 2008). However, as serving behaviour is linked to consumption behaviour, it is also an important avenue for investigation into the portion size effect. For example, two within-subjects experiments examined *ad libitum* intake in children (*n*=63) aged 3-5 years when a main dish of pasta was either pre-plated or children were expected to self-serve (Savage, Haisfield, Fisher, Marini, & Birch, 2012). Children's main dish and overall meal intakes did not differ between pre-plated and self-served conditions overall, or by weight status. However, the authors report that larger self-serve portions resulted in larger intakes. They also noted that the children who self-served themselves larger portions tended to be overweight, and were more responsive to the portion size effect when they were in the pre-plated condition, showing greater increases in intake as the pre-plated portions increased in size. The authors surmised that allowing children to self-serve their pasta portions did not actually reduce intake, however, children who were more responsive to portion size

when the pasta was pre-plated were more likely to serve and consume larger portions of the pasta. This suggests that some children are more vulnerable to the effects of self-serve meals and portion size, and may require guidance for self-serve meal situations.

With increasing food autonomy for older children, it is imperative that we understand the effects portion size may have on children's self-serving and subsequent consumption. Research to date focuses predominantly on children aged between 2 and 6 years old, however, as older, pre-adolescent children presumably exercise more autonomy over their food choices and serving sizes, future research involving self-serve scenarios should aim to establish the influence of portion size on self-serving and subsequent consumption of children aged 7-11 years to expand and strengthen the current literature.

5.1.3.3 Portion Size Cues on Food-Packaging

Portion depictions are often placed on the front of food packaging. They are used as a marketing tool, intended to promote the food by making it look appealing, and may work as a normative reference point for consumers, indicating a suitable amount of the food to consume (see Figure 5-3 below for examples).

Figure 5-3 Examples of serving suggestions on cereal boxes

Arguably, this provides an implicit cue that suggests to the consumer that this is an appropriate portion size, which is biased and in direct conflict with the explicit recommended portion size detailed on the back/side of the box. This contrast is often extreme, with the recommended portion size for Kellogg's Corn Flakes being 30g (or 17g in an individual box, marketed at children), and the portions actually depicted on the front of the cereal box showing large bowls with cereal bursting out, which could potentially mean double or triple the recommended portion (see Figure 5-4 for examples of portion sizes discussed). When we consider the high amounts of sugar in ready-to-eat breakfast cereals (Action on Sugar, 2015; Which?, 2012), the way that the consumption of these cereals is promoted to children is therefore of particular interest.

Figure 5-4 Portions of Kellogg's Corn Flakes; left to right, a recommended child's portion of 17g, a recommended adult portion of 30g, a typical portion as depicted front-of-pack containing 90g

Following on from the wealth of literature discussed which addresses the influence of portion size and visual cues on children's food behaviours;, Neyens, Aerts and Smits (2015) hypothesised that the size of front-of-pack serving suggestion images would impact upon children's consumption of cereal, where the children who were exposed to larger images would consume more cereal than

those exposed to smaller images. In addition they hypothesised that the sugar content of the cereal would also impact consumption of the cereal. In order to test this empirically, they adopted a 2 x 2 x 2 mixed experimental design with image-size manipulation (large vs small), sugar content of cereal (high vs low) and presentation order of the cereals. Children (n=22) aged 4-5 all experienced the four within-subjects conditions (within subjects: image size and sugar content) in different orders (between subjects: presentation order of cereals). Dependent variables included the amount of cereal poured, cereal consumed, and also the amount of milk poured and consumed.

The authors reported a significant main effect of image-size manipulation, with children who were exposed to the larger image both pouring and consuming significantly more cereal and milk than those exposed to the small image, providing evidence that the provision of a reference amount for serving and intake informs children's decisions by signalling an appropriate amount to eat (consumption norm). There was also a significant interaction between image size and sugar content on the amount of cereal consumed, with cereal consumption differing significantly between the large and small image conditions, when the sugar-content of the cereal was low. This would suggest that, like Sharps and Robinson's (2015) study, discussed previously, that using perceived consumption norms may be a useful tool for promoting the intake of less palatable foods. However, no significant main effect of sugar-content of the cereal on consumption of either cereal or milk was found, and no interaction was found between image size and sugar content on the amount of cereal served.

When analyses were run with the addition of BMI and liking of cereals as covariates, no main effects of image manipulation were found. They found no main or first-order effects of BMI, however, interestingly, when running a three-way interaction with BMI, image and sugar content, the amount of cereal consumed was predicted, where children with an average BMI of one standard deviation above average were found to eat more cereal when shown the larger image, when the sugar-content of cereal was low. Like the previous analyses, these results also

indicate that the effect of image size was significant for cereals low in sugar content and not for high, but the pattern of findings followed a similar pattern across both image-size conditions. The authors concluded that the effect of image-size on cereal consumption only occurred when the sugar content of the cereal was low, and so sugar appeared to have a moderating effect on the relationship between the amount of cereal consumed and image-size, however, sugar content of the cereal did not affect consumption in univariate analyses. Based on these findings, it appears that children are influenced by subtle, visual cues on food packaging, and that this particular vein of research warrants further attention.

5.1.4 The Current Study

Cereal boxes often display a serving suggestion picture on the front of the cereal box, with a bowl that is full, often over-flowing, with cereal (see Figure 5-4 above), but no literature to date has established whether altering suggested serving sizes in front-of-pack depictions have any discernible influence on self-served cereal intake in children. As cereal is a common breakfast food for children in the UK and is one of the food groups most heavily marketed to children (Boyland et al., 2011) this study will focus on the influence of front-of-pack serving suggestion depictions on cereal boxes on children's serving sizes and consumption.

5.1.4.1 Aims

The current study aims to assess the effect of a salient, front-of-pack portion size image on self-serving sizes and intake in 7-11 year old children, using a between-subjects design (large Vs small portion size depictions). It will also attempt to identify individual differences which potentially moderate these effects, if found.

5.1.4.1.1 Hypotheses

Based on previous findings, the hypotheses were as follows:

> H1: Children in the large serving suggestion condition will serve themselves more than the children in the small serving suggestion condition.

H2: Children in the large serving suggestion condition will consume more than the children in the small serving suggestion condition.

H3: There will be no difference in responses to condition between male and female children.

H4: Children who are more responsive to food will both serve themselves and consume more than children who are low in responsiveness to food.

H5: Children who are higher in enjoyment of food will both serve themselves and consume more than children who are lower in enjoyment of food.

5.2 Methods

See also Chapter 2.

5.2.1 Recruitment and Ethics

Forty-one primary school students aged 7-11 years were recruited through contact with Head teachers. Participants were recruited from breakfast clubs in 4 primary schools and 1 childcare centre in Merseyside, UK and 1 primary school in Warwickshire, UK. Informed consent to carry out the research and for the proposed method of obtaining consent from parents was gained from Head teachers. Subsequently, parents were issued a letter detailing the study and asked to return the enclosed consent form, parental questionnaire and Child Eating Behaviour Questionnaire (CEBQ) if they gave permission for their child to participate in the study. Parents were required to indicate if their child had any history of food-related allergies/intolerances, so that such children could be excluded from participation for health and safety reasons. Parents were also required to indicate whether their child typically ate breakfast, with only habitual breakfast eaters being recruited for the study. Verbal assent was obtained from participating children prior to commencing the study, which was witnessed and documented by either the researcher or a member of staff at the school. Children were also given the opportunity to ask questions about the study and informed that they were free to withdraw from the study at any time without having to give reason and without

consequence. All children with parental consent to participant were willing to take part and therefore none were excluded at this point.

Ethical approval for this study was granted in October 2014 by the University of Liverpool Non-invasive Procedures Ethics Sub-committee under reference IPHS-1415-028-Generic RETH000643. Data were collected between February 2015 and November 2015. Unique participant codes were used so that individuals would not be identifiable.

5.2.2 Participants

Based on a previous similar study (Neyens et al., 2015) which found a large effect size of 0.9 with a within-subjects design, an initial power calculation aiming for a more conservative, medium-large effect size with a between-subjects design (d = 0.6, 95% power, $p < 0.05$) indicated a sample size of 39 was needed. However, as this was an opportunity sample, 41 participants aged 7-11 years (9.0 ± 1.5y) were recruited. See Table 5-1 for details of participant demographics.

Participants did not differ significantly between conditions on any of the following variables: age, gender, BMI, pre-meal hunger, pre-meal perceived liking of cereal, post-meal ratings of actual cereal liking, habitual breakfast eating or habitual breakfast self-serving ($p > .05$). Of the 41 participants, 37 (90%) returned a parental questionnaire, the results of which are detailed in Table 5-1.

Table 5-1 Table detailing demographic characteristics of children

Demographics	
Age, mean ± SD (range), y	9.0 ± 1.5y (5.3 - 11.9y)
Gender, *n (*%)	
Male	22 (53.7)
Female	19 (46.3)
BMI, Mean ± SD (range)	17.1 ± 2.8kg/m² (12.5 – 23.9kg/m²)
Weight Status, *n* (%)	
NW	34 (82.9)
OWOB	7 (17.1)

Table 5-2 Demographic and lifestyle characteristics of participants (as a % of completed parental questionnaires)

Parental Questionnaire	
Completed, *n* (%)	37 (90)
Mother	29 (70.7)
Father	5 (12.2)
Undisclosed	*7 (17.1)*
Ethnicity, *n* (%)	
British -White	28 (68.3)
British – Yemeni	2 (4.9)
British - Black	1 (2.4)
British - Indian	1 (2.4)
Mixed - Other	1 (2.4)
Undisclosed	*7 (17.1)*
Parental Education Level (%)	
Post-graduate	0 (0)
Degree	3 (7.3)
A levels	15 (36.6)
GCSE	6 (14.6)
Other	8 (19.5)
Undisclosed	*9 (22)*
Typically Eat Breakfast, *n* (%)	
Yes	29 (70.7)
No	8 (19.5)
Undisclosed	*4 (9.8)*

Typically Serve Themselves, *n* (%)	
Yes	14 (34.1)
No	23 (56.1)
Undisclosed	*4 (9.8)*
Child Eating Behaviour Questionnaire (CEBQ) Scores, *Mean* (SD)	
Food responsiveness	12.1 (5.15)
Emotional over-eating	7.08 (2.29)
Enjoyment of food	9.11 (1.67)
Desire to drink	8.86 (3.67)
Satiety responsiveness	14.39 (3.97)
Slowness in eating	11.31 (3.81)
Emotional under-eating	9.61 (3.68)
Food Fussiness	15.17 (3.01)

5.2.3 Design

This study adopted a between-subjects design, with 2 serving-suggestion conditions: 1) an accurate visual cue (which were in accordance with the written gram serving suggestion stated on the pack) and 2) an inaccurate visual cue (which showed a much larger portion size, triple the recommended serving, as is more commonly found on cereal packaging). Data for each participant were collected in a single visit.

5.2.3.1 Independent variables

Weight status and CEBQ scores were included, along with key participant characteristics. Therefore, the specific independent variables were as follows:

1. Condition (large/small portion size depiction)
2. Weight status (NW/OWOB, see section 5.2.5)
3. Gender (Male/Female)
4. Age
5. CEBQ scores

5.2.3.2 Dependent variables

The effects of participant characteristics (detailed above) were assessed by measuring the size of the participants' servings and their subsequent intake of cereal and milk. In addition, calories served and calories consumed were estimated by calculating the calories in the amounts of cereal and milk individually, and also combining them to obtain the total. Therefore, the specific dependent variables were as follows:

1. Cereal served (grams and kcals)
2. Milk served (grams and kcals)
3. Total served (grams and kcals)
4. Cereal consumed (grams and kcals)
5. Milk consumed (grams and kcals)
6. Total consumed (grams and kcals)

5.2.4 Materials

Two different cereal packages were designed (CorelDRAW X7) which varied only by the serving suggestion picture on the front of the box (see Figure 5-5). The cereal box design was novel, created solely for the purpose of this study, and its dimensions were based on those of a 500g Kellogg's Cornflakes® box. The cereal used for the study was Kellogg's Cornflakes® and the study milk was Tesco® Semi-Skimmed. Disposable bowls were used; this was a requirement of one of the participating schools.

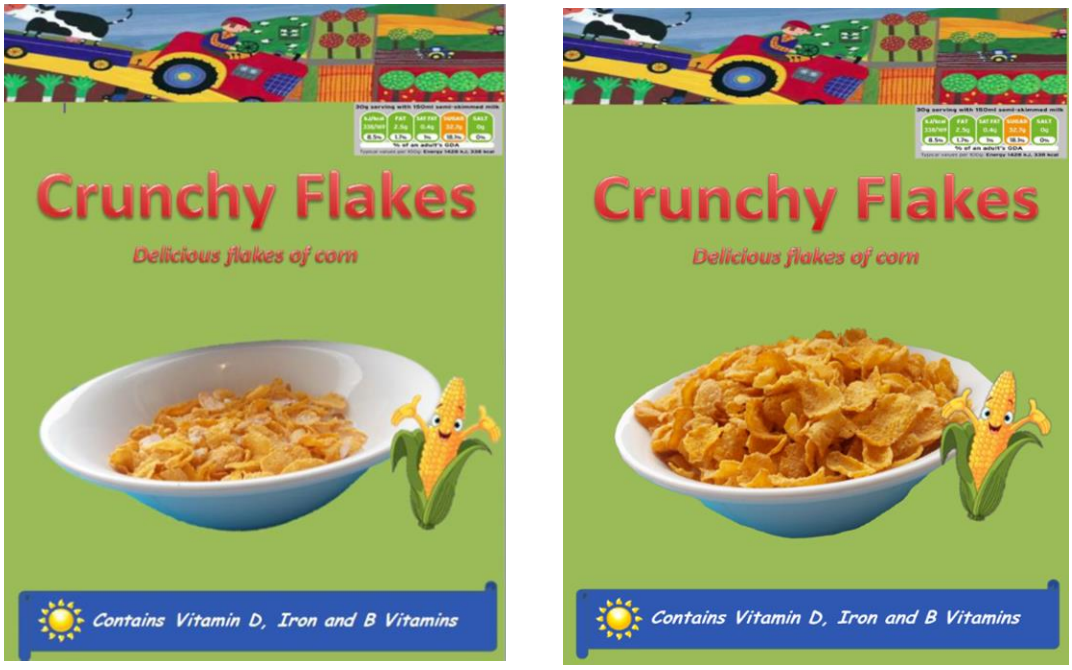


Figure 5-5 Cereal boxes for small and large portion size depiction conditions, respectively

The Child Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, & Rapoport, 2001) was included as part of the Parental Questionnaire (Appendix 5b). This is a 35-item parent-report questionnaire, which assesses the eating styles of children aged 6- 11 years. It includes 8 scales: food responsiveness, food enjoyment, emotional overeating, desire to drink, satiety responsiveness, slowness in eating, emotional undereating and, fussiness. Parents rate children's behaviour and experiences using a 5-point Likert scale: 1 – never, 2 – rarely, 3 – sometimes, 4 – often, 5 – always. The food responsiveness (FR) and enjoyment of food (EF) scales are of particular interest in this study, as they reflect eating in response to environmental food cues.

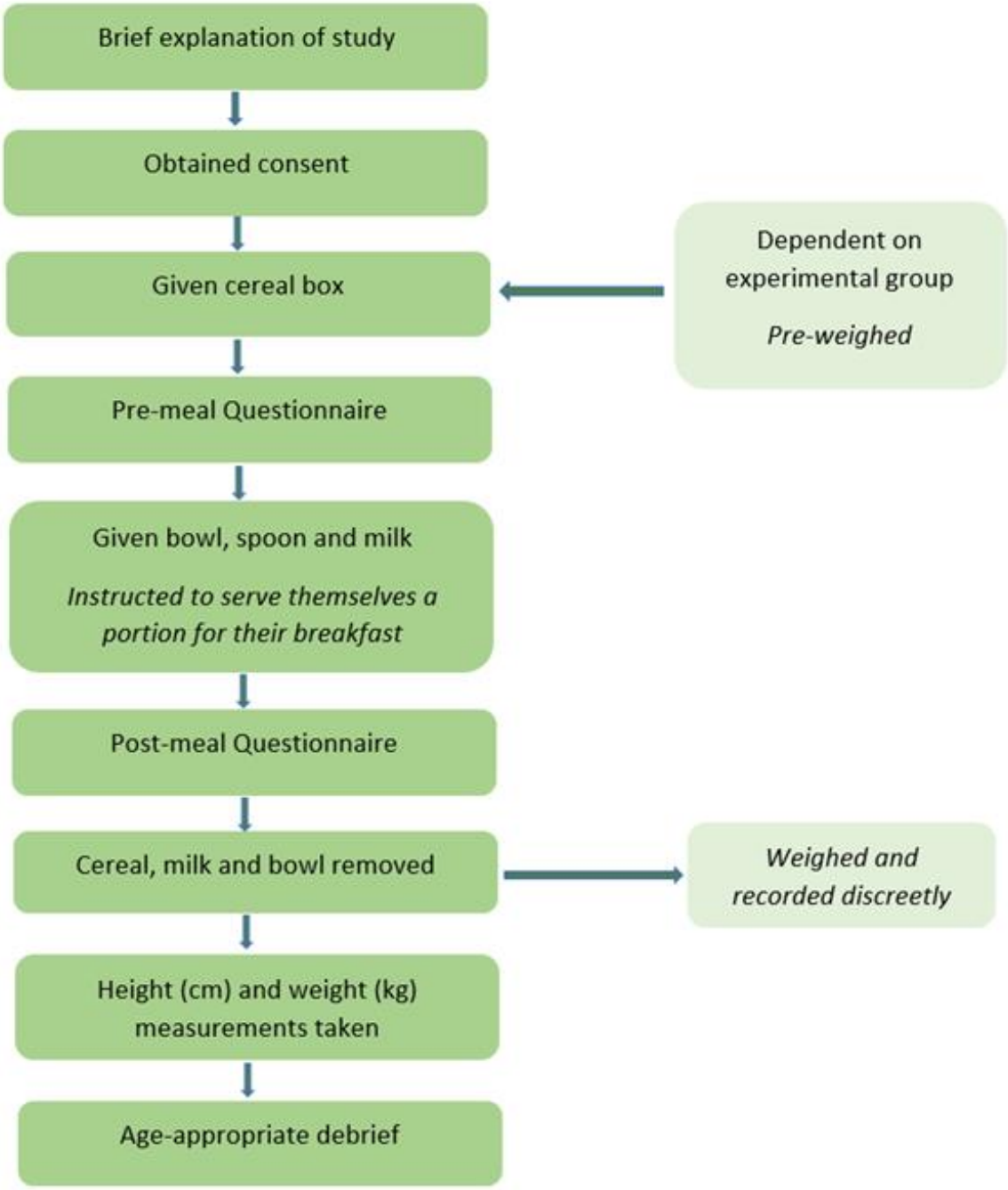
5.2.5 Procedure (see Figure 5-6)

On the test day, children were given a brief, age-appropriate explanation of the study and were asked if they wished to take part. If they did, they were asked to give their verbal assent before commencing with the study tasks. Children were tested individually. They were given the appropriate cereal box (depending on experimental group) and advised to pay attention to the cereal box as they would be asked for their opinion on it. They were then provided with a questionnaire (Appendix 5d), which asked the children to rate, using VAS scales, their hunger, anticipation of cereal liking and opinions on the cereal packaging. Children were then given milk (100g) and a disposable bowl, which, along with the cereal box (500g), had been previously weighed. They were asked to serve themselves a portion which they would consume for their breakfast, so we could subsequently ask them questions about how the cereal tasted. When the participant indicated that they had finished eating, they were asked to complete the post-meal VAS scales to indicate current hunger levels, liking of the cereal taste and packaging (Appendix 5e). The cereal, milk and bowl were removed and weighed discreetly to establish the exact amount served and consumed (grams). If children indicated they were happy to do so, they were then weighed and measured without shoes. This took place individually in a separate room with a member of staff present. To finish, children were given an age appropriate debrief and asked not to discuss this with their peers until after the study had finished.

Outcome data were checked to ensure assumptions for parametric data were met. Data for milk served and milk consumed was not normally distributed but, as the test is generally considered to be robust enough, they were included in the model. All comparisons were two-tailed and significance was taken as $p < .05$ (with Bonferroni adjustments for multiple comparisons). Where assumptions of sphericity were violated, degrees of freedom were corrected using a Greenhouse-Geisser correction. Analyses were completed using SPSS v22 for Windows (SPSS Inc., Chicago, US).

For use in analyses, BMI was converted to an age- and gender-appropriate Z score, using the WHO Anthropometric Calculator software (WHO Anthro version 3.2.2., January 2011) and weight status was subsequently defined using age- and gender-specific BMI cut-off points, which are equivalent to adult BMIs of 25 kg/m² (overweight) and 30 kg/m² (obese). These are the criteria as recommended by the World Obesity Federation (Cole et al., 2000).

Figure 5-6 Flow diagram depicting the study test day procedure



5.3 Results

Manipulation Check

Overall, 63% of children believed the image of the portion on the cereal box depicted a correct portion size, 20% believed there was not enough and 17% believed there was too much cereal. When split by condition, of those shown the small portion size depiction, 50% thought it was the right amount, 35% thought there was not enough and 15% thought there was too much cereal in the bowl. In the large condition, 76% believed it was the right amount, 5% believed there was not enough cereal and 19% believed there was too much.

A one-way ANOVA was conducted on children's beliefs about whether or not the portion size depiction shown contained an appropriate amount of cereal. There was no significant main effect of condition (F(1,39) = 3.4, p = .07), showing there was no difference between conditions with regards to accepting the manipulations as serving norms, and therefore the manipulation can be considered to have been successful.

<u>Hypothesis 1: Children in the large serving suggestion condition will serve themselves more than children in the small serving suggestion condition</u>.

A one-way multivariate analysis of variance determined the effect of condition (large vs small) on children's serving sizes (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories). Overall the model was significant (F(2,32) = 4.44, p = .010, partial η^2 = .30). There was a significant main effect of condition (large vs small portion size depiction) on the weight of cereal served (g), F(1,33) = 5.40, p = .026, partial η^2 = .14). Children in the large portion condition served themselves more cereal (*M = 25.15*, SE = 1.99), than children in the small portion condition (M = 18.15, SE = 2.11). There was also a main effect of cereal served (calories), F(1,33) = 5.40, p = .026, η^2 = .14, with children in the large portion condition serving themselves more (*M = 100.59*, SE = 7.97) than the children in the small portion condition (M = 72.59, SE = 8.44). Finally, there was a significant main effect on the overall calories that children served themselves, F(1,33) = 5.72, p = .023, partial η^2 = .15, with the children in the large portion

condition serving themselves more cereal (M = 134.88, SE = 8.16) than the children in the small portion condition. (M = 105.42, SE = 8.63). There was no significant main effect on milk served in grams (p = .818) or calories (p = .818), or on the total weight served in grams (p = .426). The overall model was not influenced by BMI z-scores, pre-meal ratings of hunger or expected liking of cereal when these factors are included as covariates (ps > .117).

Hypothesis 2: Children in the large serving suggestion condition will consume more than the children in the small serving suggestion condition.

A one-way multivariate analysis of variance determined the effect of condition (large vs small) on children's consumption (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories). Overall the model was significant, $F(2,32) = 3.68$, $p = .036$, partial $\eta^2 = .19$. There was a significant main effect of condition (large vs small serving suggestion) on the weight of cereal (g) that children consumed, $F(1,33) = 7.37$, $p = .010$, partial $\eta^2 = .18$. Children in the large portion condition consumed more cereal (*M = 15.93*, SE = 1.46), than children in the small portion condition (M = 9.94, SE = 1.54). There was also a significant main effect of cereal consumed (calories), $F(1,33) = 7.37$, $p = .010$, partial $\eta^2 = .18$, with children in the large portion condition consumed more cereal (M = 63.71, SE = 5.84) than children in the small portion condition (M = 39.77, SE = 6.18). Finally, there was a significant main effect of the overall calories children consumed, $F(1,33) = 7.02$, $p = .012$, partial $\eta^2 = .18$, with children in the large portion condition (M = 91.91, SE = 8.00) consuming more calories overall than the children in the small portion condition (M = 59.88, SE = 8.47). No significant main effect of milk consumed in either grams (p = .059) or calories (p = .161) was found, and no effect of total weight in grams consumed (p = .080). The overall model was not influenced by BMI z-scores, pre-meal ratings of hunger or expected liking of cereal when these factors are included as covariates (ps > .257). [1]

[1]A Pearson product-moment correlation was run to determine the relationship between the amount of cereal served and the amount of cereal consumed. There was a moderate, positive correlation between cereal served and consumed, which was statistically significant (r = .431, n = 40, P = .005).

Hypothesis 3: There will be no difference in responses to condition between male and female children.

A two-way multivariate analysis of variance determined whether an interaction existed between condition (large vs small) and gender (male vs female) on children's serving (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories). Overall, the model showed no main effect of gender (p = .507) or gender by condition interactions (p = .717). Gender has no impact on any of the consumption variables (ps > .301).

A two-way multivariate analysis of variance determined whether an interaction existed between condition (large vs small) and gender (male vs female) on children's consumption (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories). Overall, the model showed no main effect of gender (p = .423) or gender by condition interactions (p = .455). Gender has no impact on any of the consumption variables (ps > .432).

Hypothesis 4: Children who are more responsive to food will serve or consume more than children who are low in responsiveness to food.

A two-way multivariate analysis of variance examined whether an interaction between condition (large vs small) and responsiveness to food (median split: high vs low) on children's serving (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories) existed. Overall, the model displayed no significant main effect of food responsiveness (p = .328) and no interaction effect between responsiveness to food and condition on the combined serving variables (p = .281). Food responsiveness had no impact on any of the individual serving variables (ps > .151).

A two-way multivariate analysis of variance examined whether an interaction between condition (large vs small) and responsiveness to food (median split: high vs low) on children's consumption (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories) existed. Overall, the model displayed no significant main effect of food responsiveness (p = .442) and

no interaction effect between responsiveness to food and condition on the combined serving variables (p = .817). Food responsiveness had no impact on any of the individual serving variables (ps > .198).

Hypothesis 5: Children who have higher enjoyment of food scores will serve themselves more than children who have lower enjoyment of food scores.

A two-way multivariate analysis of variance examined whether an interaction between condition (large vs small) and enjoyment of food (median split: high vs low) on children's servings (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories) existed. Overall, the model displayed no significant main effect of enjoyment of food (p = .270) and no interaction effect between enjoyment of food and condition on the combined dependent variables (p = .467). Enjoyment of food had no impact on any of the individual serving variables (ps > .136).

A two-way multivariate analysis of variance examined whether an interaction between condition (large vs small) and enjoyment of food (median split: high vs low) on children's consumption (cereal in grams, cereal in calories, milk in grams, milk in calories, total weight in grams, total calories) existed. Overall, the model displayed no significant main effect of enjoyment of food (p = .522) and no interaction effect between enjoyment of food and condition on the combined dependent variables (p = .359). Enjoyment of food had no impact on any of the individual serving variables (ps > .255).

5.4 Discussion

To our knowledge, this is the first study to empirically assess whether altering the amount of food depicted on the front of a food package will influence how much of that food children self-serve, and subsequently consume.

Confirming our first hypothesis, our results provide evidence for a main effect of serving-suggestion size on children's serving sizes, whereby children served themselves significantly more cereal and total calories overall when exposed to the large portion size depiction condition, when compared to those in the

smaller portion size depiction condition. This finding is supported by the existing wealth of empirical support for a portion size effect, and also for the effect of external visual cues on children's food behaviours.

However, one way in which this study differed from Neyens et al. (2015), as there was no significant difference in the amount of milk that children served. This may be due to a ceiling effect occurring, whereby a large majority of children poured the entire 100g portion of milk into their cereal, regardless of condition. As participants were young children, we did not wish to give them large servings of milk, which they may spill. Future studies should consider providing larger portions of milk from which to self-serve, which would allow for more variability. Nonetheless, milk serving was a secondary outcome and not the key focus of this study and so does not detract from the current study's overall findings.

Our second hypothesis was also supported, with children in the larger serving-suggestion condition consuming more cereal and total calories than children in the smaller serving-suggestion condition. As with milk serving sizes, milk consumption did not differ significantly between conditions. Despite a trend in the data, which was approaching significance, with children in the larger condition consuming more milk on average than those in the smaller condition, this effect disappeared when corrections for multiple comparisons were applied. By supporting our first two hypotheses, we lend support to the previous research by Neyens et al. (2015) who found a significant main effect of the size of the front-of-pack image on children's serving and consumption of cereal, demonstrating that even subtle external cues can have an influence on children's eating behaviours. In terms of real-world application, it could be suggested that in childcare settings like this, or indeed within the home, that children are not exposed to the food packaging when self-serving, so as to reduce the influence of such portion size depictions.

No significant main effect of gender or significant interactions between condition and gender were found for any of the outcomes, disproving our third hypothesis, which predicted that females would have a stronger response to this manipulation

than males. Much of the existing literature addressing the relationship between the portion size effect and social norms in adult populations has focused on females (Robinson, Benwell & Higgs, 2013; Vartanian et al., 2013). However, this study adds to the child-focused literature, which has not highlighted any significant differences between male and female children's responses to the portion size effect or, in particular, to the effect of social norms relating to portion size. This may suggest that no differences exist in child populations and that these differences develop later in life, when women become more susceptible to social pressures and a desire to conform to social norms. It would be interesting for future research to include a wider age range to attempt to uncover at what age gender differences begin to emerge, and also to include additional psychological measures that may help to identify the mechanisms through which these gender differences occur.

Our fourth and fifth hypotheses focused on the food responsiveness and enjoyment of food scales of the CEBQ, both of which refer to children's eating in response to environmental food cues (Sleddens et al., 2008). As it has been argued that children's self-served portions are influenced by external, size-related cues within their environment, we had anticipated that children with higher scores in both of these scales would display a greater response to the manipulations with regards to both self-served portions and intake. However, no significant differences or interactions were uncovered in the data. It may be that this study was not sufficiently powered to detect any existing differences and that the median split to establish high and low scores may have resulted in a loss of sensitivity within the data, with moderate scorers diluting the effect. Future studies should aim to use larger numbers and creating high and low groups using upper and lower thirds, rather than a median split, as with the current study, to ensure the groups are sufficiently distinct.

The current study provides evidence that subtle environmental cues, such as the implicit front-of-pack depiction of a serving norm, can have a tangible effect on children's perceived consumption norms and subsequent eating behaviours. These portion depictions are misleading to vulnerable, young consumers who are still seeking external validation for their food decisions. It is supported in the existing

literature by several studies that clearly demonstrate the influence of external, environmental cues on eating behaviours (Neyens et al., 2013, Wansink, van Ittersum & Payne, 2014). When combined, these findings suggest that policy, with regards to the marketing and promotion of foods to children, should regulate the use of front-of-pack portion depictions for less healthy foods as a tool for reducing their consumption.

DiSantis et al. (2013) found that children with larger dishware served themselves more than children with smaller dishware, which had an indirect effect on energy intake at lunch, with every additional calorie served resulting in an increase of 0.43 calories in energy consumed during the meal. The current study found that the amount of cereal children served themselves was moderately, positively correlated with the amount of cereal they subsequently consumed. Whilst this does not establish the direction of the relationship, it does suggest that an association exists between these two outcomes, and that external cues such as front-of-package depictions of food servings may inadvertently be having an effect on the consumption of foods by exerting influence over children's self-serving behaviour.

The current study was carried out in a breakfast club setting, where children regularly consume their breakfast, which typically included cereal. This naturalistic environment leads to higher levels of ecological validity. However, arguably this also leads to less control; it is possible that the children were influenced by aspects of that particular environment that the current study could not anticipate or control for. To eliminate the children influencing one another's decisions, they were tested individually. This was deemed normal practice by the breakfast club staff, as children usually arrived one at a time and were encouraged to sit at a table alone and eat their breakfast before joining the other children to play games in another area of the breakfast club. In addition, the current study had no control over whether children had previously consumed breakfast at home. However, hunger ratings were taken and included as a covariate in the models, in an attempt to control for any influence hunger may have had over children's behaviour.

Interestingly, in the smaller condition, only 50% of children thought that the amount of cereal depicted was the correct amount, compared to 76% in the larger condition. Despite the smaller condition depicting the recommended serving size, 35% of children actually believed that this serving was not enough. This could suggest that children's perceived norms of an appropriate cereal portion have already been influenced due to ongoing exposure to these front-of-pack depictions. There was no significant difference in acceptance of the manipulation between conditions, with the majority of children in both conditions stating that they believed the portion depicted on the cereal box was an appropriate serving size.

5.4.1 Future directions

There are many additional ways in which to adjust the existing paradigm to expand upon the current knowledge base. If children are susceptible to these subtle and implicit marketing cues, perhaps they could be encouraged to make additional healthier choices via these on-package images, beyond just portion control. For example, future studies could assess whether placing additional breakfast items alongside the cereal portions depicted on the food packaging, such as fruit or yoghurt, could encourage children to select more of these healthier items from an *ad libitum* breakfast.

Moreover, there may be further adaptations to the current paradigms which could improve our knowledge and understanding regarding the influence of food packaging, by drawing from the wider literature on food cue responsiveness. The idea that eating behaviour is often guided by responses to food cues, rather than physiological need has been well evidenced (Lowe & Butryn, 2007; Schüz, Schüz, & Ferguson, 2015). Snack foods, or foods consumed outside of main meal occasions, seem to be influenced more by food-related cues than main meals (Cleobury & Tapper, 2014). With this in mind, it would be useful to expand upon the current study, which addresses only breakfast cereal, by looking at whether this effect translates to a variety of meal occasions, snacks and food types. As snack foods consumed by children are predominantly non-nutritious (Boyer, Laurentz, McCabe, & Kranz, 2012), reducing snack intake is a possible weight management strategy

and so establishing ways to encourage appropriate portion control when snacking may provide a useful intervention from a weight management perspective.

A meta-analysis by Zlatevska et al. (2014) reported a curvilinear effect of portion size, whereby as portions become increasingly large, consumption levels begin to taper off, however, this is in adult populations only and so the point at which this effect begins to wane in child populations should be established empirically. Furthermore, as adults have been serving and consuming their food habitually, over the course of a lifetime, it would be reasonable to assume that such a subtle manipulation would have little effect on their engrained norms regarding what constitutes a suitable portion, and so this would be interesting to establish. Therefore, it would be useful to include a larger age range, from childhood through to adult populations, so as to identify at which age children take note of these suggestive food images, and whether or not this effect is carried through to adulthood. This could have read-world application, for example, recommending that children of a certain age are not permitted to serve their own portions.

A wealth of literature exists which supports the idea that observing other people eating creates an implicit eating norm, which makes food choices or amounts consumed seem more or less acceptable to the individual (Prinsen, de Ridder, & de Vet, 2013). However, not every individual responds to these external food cues in the same way, with some cues being more pertinent to certain people (Lowe & Butryn, 2007), and so individual differences in the effects of external food cues is of particular interest to psychologists.

This study was interested in children's individual differences in responsiveness to this particular external, food-related cue (front-of-pack portion size depictions). Using the Child Eating Behaviour Questionnaire (CEBQ), focus was given to the appetitive traits of food responsiveness and enjoyment of food, which are behavioural traits that reflect eating in response to environmental food cues, and therefore were of particular interest in this study. Interestingly, we found no effect of either trait on children's responsiveness to condition. This was a novel aspect of the study, however, it is in contrast with the wider body of literature

which would suggest that a tendency to eat in response to environmental food cues would result in a greater effect of this particular manipulation. Further research should consider that this study may not have been sufficiently powered to detect any existing differences across these traits and that the median split to establish high and low scores may have resulted in a loss of sensitivity within the data, with moderate scorers diluting the effect.

As discussed in section 5.1.3.2.1, Van Ittersum and Wansink (2013) found that introversion or extroversion of a child moderated the effect that dishware size had on the food which they served themselves. The current study did not address individual differences in personality, perhaps further exploration of personality traits may prove useful in uncovering why individuals respond differently to these food-related cues, which in turn can help identify those who are more susceptible to food-related cues and inform the direction of future policy and intervention.

Future studies should aim to assess more directly whether or not serving-suggestion manipulations actually affect children's perceived consumption norms; for example, by asking children to rate portion size depictions as appropriate servings pre- and post-manipulation. In addition, they should aim to extend the literature to date and establish whether or not children listen to internal, physiological cues and regulate their intake throughout the day or whether, when influenced to consume more calories at breakfast, this will have an additive effect on their daily intake, potentially leading to excess energy intake over time. Neyens et al. (2015) found that sugar content of cereal had a moderating effect on children's consumption, with those in the large serving –suggestion image condition being influenced to eat significantly more cereal when the sugar content of the cereal was low, suggesting that this manipulation encouraged consumption for the less palatable options. The cereal used was Kellogg's Cornflakes® and, while this was generally accepted by the children, it would be interesting to establish whether any differences are found when more palatable foods are used. If this finding was replicated, it may indicate that serving-suggestion depictions could be a marketing tool to increase the uptake of more healthful, less palatable foods in children.

Chapter Six: An online intervention study investigating whether children can learn to understand and use traffic light food labels to identify healthier food choices

6.1 Introduction

The previous chapter described a study in which children's food preferences and choices were influenced by the presence of brand equity characters on food packaging, highlighting the influence that on-package marketing techniques can have on children's food-related decisions. The current chapter will focus on the use of nutritional labelling, which is another front-of-package marketing technique that is used to influence consumers' choices. Despite evidence to suggest that children do make food choices and have an influence over family purchases (refer to section 5.1.1 below for more information), the factors which influence their ability to make a healthy food choice are not yet understood.

6.1.1 Children as Consumers

Children are increasingly targeted by marketers as they play both an active role as consumers in their own right, in addition to having an influence over family purchases (Caruana & Vassallo, 2013). Research suggests children have a strong influence over a variety of different family and child-targeted purchases (Belch, Belch, & Ceresino, 1985; Chaudhary & Gupta, 2013), with one review highlighting that children have a particular influence over products for which they will be the primary consumer, for example, foods such as breakfast cereals or snack foods (Mangleburg, 1990). Pre-adolescent children in particular are believed to be active and independent consumers (McNeal, 1992), with arguably more influence and more spending power than any previous generations (Lindstrom, 2003). Therefore, it seems appropriate for interventions to aim to improve children's nutritional knowledge and comprehension of nutritional labels, with a specific focus on pre-adolescent children, in order to empower them to make informed food choices.

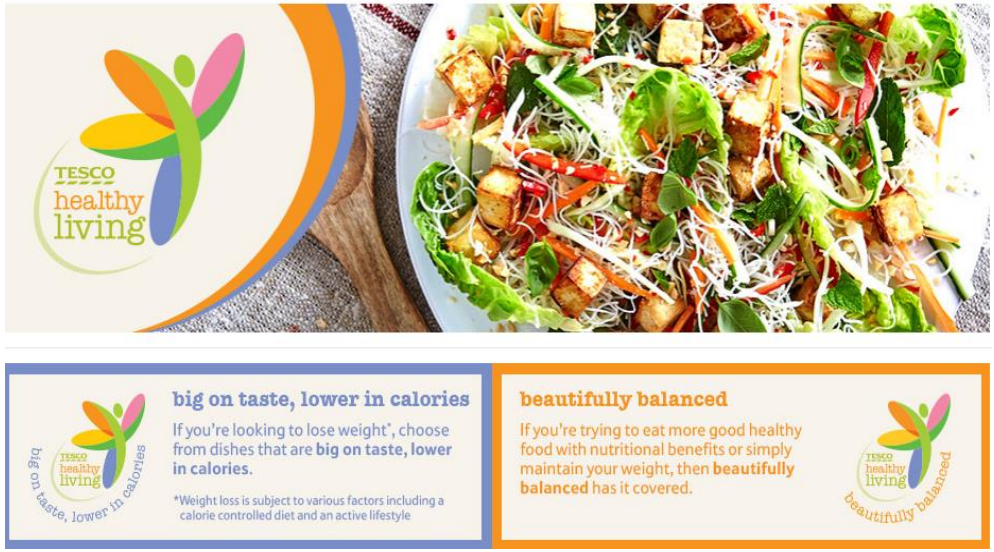
6.1.2 Food Choice and Labelling

Environmental factors are considered to be important determinants of purchasing and consumption decisions (Ranjani et al., 2014; Swinburn et al., 1999); thus the point-of-purchase offers an additional opportunity to alter these judgements. Four main point-of-purchase strategies have been identified that could plausibly influence the likelihood of a consumer opting for a 'healthier' choice: i) providing product health information; ii) increasing availability of healthier food products; iii) increasing the promotion of healthier food products; and iv) reducing the cost of healthier foods (Glanz & Yaroch, 2004). The present study will focus on the first strategy identified, the use of nutritional labelling on food packaging to influence purchasing and food choice behaviours, with the following sections providing necessary context on choice in the current food environment, and how categorisation and nutritional labelling (specifically Traffic Light Labelling (TLL)) may influence these choices.

The current food environment is characterised by an excessive amount of choice, in which food packaging can often be misleading. Companies employ marketing techniques that may mislead consumers to perceive food products as healthy choices, despite potentially being high in fat, salt and/or sugar (HFSS); for example, the use of nutrition claims (such as 'low fat', 'high in fibre', 'sugar free' or 'reduced salt'), health claims on food packaging (such as 'Vitamin D and calcium for strong bones' on Yoplait® yoghurts) or giving their products suggestive names such as Kellogg's Fruit 'n Fibre®, Sainsbury's Be Good To Yourself ® range or Tesco's Healthy Living® range (see Figure 6-1 for examples). The European Commission issued Regulation (EC) No 1924/2006 which states that food labelling in the EU must be clear, accurate and based on scientific evidence. However, whilst these claims and product names are not technically untrue and fall within EU regulations, they may lead to consumers drawing misleading inferences about the products and overestimating their healthfulness. This is referred to as the 'health halo effect' (Chandon & Wansink, 2007; Ebneter et al., 2013; Williams, 2005) which is a cognitive bias whereby, when learning of a perceived healthy attribute of a food item, people apply a health halo to the food as a whole, potentially leading to over-

consumption and a greater perception of the foods healthiness. An example of this would be believing Kellogg's Fruit Winders® are healthy, as the title contains the word 'fruit' and the packaging claims that the product is both 'made from fruit' and contains 'no artificial colours or flavours', when in reality this product is actually considered to be unhealthy (based on the FSA TLL system), as it is high (/red) in sugar and medium (/amber) in both fat and saturated fat (FSA, 2013). Such marketing techniques may make it difficult for consumers to make healthier choices, and so nutritional labelling is employed with the intention of enabling both easier and informed decision making for consumers. Modelling studies have suggested that nutritional labelling systems are both cost-effective to implement, when compared to other initiatives such as a proposed 'junk-food tax', and have the potential to lead to significant benefits in health at a population level (Gortmaker et al., 2011; Sacks, Veerman, Moodie, & Swinburn, 2011). Therefore, they are a pertinent area of research when trying to identify public health strategies to positively influence food choice, purchasing and consumption.

Figure 6-1 Examples of nutrition and health claims on food packaging, and suggestive names of food products/ranges



6.1.3 Categorisation and Food Choice

One potential research area which warrants consideration, within the context of food labelling, is categorisation and food choice. People tend to pre-judge and categorise foods according to simple, heuristic principles, for example, healthy or unhealthy (Oakes & Slotterback, 2004). Paquette (2005) argues that one of the primary factors influencing food choice is the perceived healthiness of the food and so it is important that we not only establish how these judgements are formed, but there is also a need to develop and introduce strategies, based on valid and reliable empirical findings, which enable consumers to make accurate judgements about the foods they are going to purchase and consume.

Categorisation is a major conceptual skill for young children and refers to their ability to classify relevant items together (Nguyen, 2008). A series of studies have demonstrated that children as young as 4 years are able to form and use various types of categorisation such as script (for example, breakfast foods or party foods), taxonomic (for example, fruits or vegetables) and evaluative categories (for example, healthy or unhealthy, delicious or disgusting) in order to categorise foods (Nguyen, 2008; Nguyen, McCullough, & Noble, 2012; Nguyen & Murphy, 2003). Until the last decade, evaluative categories were mostly overlooked within this literature. Critically however, they are perhaps the most pertinent form of categorisation in the context of food choice and behaviour as they refer to children's abilities in mentally assessing and organising foods by grouping together items that have been assigned the same value-laden assessments. Nguyen (2008) found that children's abilities to evaluate foods as either 'healthy' or 'junky' improved distinctly with age, with 3, 4 and 7 year olds correctly categorising foods 59%, 73% and 78% of the time, respectively. These evaluations can shape food choice, informing children of which foods they should approach and which they should avoid (Nguyen, 2008; Nguyen & McCullough, 2009; Nguyen & Murphy, 2003).

In terms of adults, Ross & Murphy (1999) found that taxonomic categories are used to make inferences about the biochemical makeup of food (as these foods share the same makeup or ingredients), and script categories to make situational

inferences about when foods should be eaten. Following on from this, more recent research in children reported that children aged 4 and 7 years were able to use evaluative categories to make both biochemical makeup and situational inferences about foods (Nguyen & Murphy, 2003). Children may make these evaluations and inferences about the foods in a number of ways, for example, by examining their value, by making content discriminations or by relating them to previous knowledge and experience (Nguyen, 2008). However, it is this previous knowledge and experience that the current study will aim to circumvent, by selecting matched foods which are as similar as possible across these categories, for example, using two types of yoghurt. This means they would fall into the same evaluative, script and taxonomic categories, thus encouraging children to use the Traffic Light Labelling (TLL) system to make their judgements regarding which item from each matched food pair is healthiest, and not relying on previously learned categorisations to inform their responses.

In Nguyen's 2008 study, it was highlighted that by 7 years of age the majority of children (94%), like the adults, could offer some explanation as to why they had categorised the foods as either healthy or junky, showing some understanding of the meanings of these categories. Considering the lesser developed cognitions of children below 7 years (Caruana & Vassallo, 2013), it would be logical to assume that children's abilities to evaluate foods would continue to improve in accuracy between the age of 7 and adulthood. However, to my knowledge, evidence for this is currently absent from the literature. When we consider both the increasing ability of children to evaluate and understand the connotations behind these evaluations from 7 years of age, as evidenced by Nguyen (2008), and the increasing autonomy over food choice that occurs in pre-adolescence, referring to their ability to make decisions, self-regulate and conform (Bassett, Chapman, & Beagan, 2008), between the ages of 7 and 11 years could arguably be an important period in which to introduce new tools to aid these evaluations and encourage informed healthy food choice behaviours which may persist into adulthood.

6.1.4 Nutritional labelling

As previously mentioned, EU regulation, implemented since 2007, establishes the rights of consumers to accurate and honest nutritional information that is based on scientific evidence. From December 2016, new nutritional labelling requirements will become mandatory under the Food Information to Consumers' Regulation (EU) No 1169/2011 which aims to benefit the consumer by enforcing clear, comprehensible and legible labelling of foods. Nutritional labelling has been defined by Vasiljevic and colleagues (2015) as "information being given about at least one nutrient in either relative or absolute terms, where the information is visible at the point of purchase and consumption choice" (p. 56). In recent years, nutritional information in table form, that is usually found on the back of food packages, has been used in addition to various formats of supplementary front-of-pack (FOP) signposting (Schor, Maniscalco, Tuttle, & Reinhardt Kapsak, 2010), with a growing body of evidence to support their use. A FOP format has long been considered a more effective format for delivery of nutritional information, being most easily understood by consumers, when used in addition to the traditional nutritional table that is usually present on the back of food packaging (Geiger, Wyse, Parent, & Hansen, 1991; Scott & Worsley, 1994). It is estimated that consumers spend, on average, only 4-10 seconds when selecting products in a supermarket (Pettigrew, Pescud and Donovan, 2011) and as such, a clear and quick labelling system that is universally understood is imperative.

Worldwide, there are a variety of FOP systems in place, including, but not limited to, the 'Smart Choices' check mark system which is used by various food manufacturers worldwide (Vyth et al., 2009; Lupton et al., 2010), the 'Keyhole' system in Sweden (Larsson, Lissner & Wilhelmsen, 1999), the 'Heart symbol' in Finland (Kinnuken, 2000) and 'Pick the Tick' in Australia and New Zealand (Mhurchu & Gorton, 2007). In the UK, the 'Traffic Light Labelling' (TLL) system, developed by the Food Standards Agency (UK FSA; NHS, 2010) is most commonly used, in addition to the Guideline Daily Amount (GDA; FSA, 2009). Although not a statutory requirement, various food manufacturers in the UK and the USA have also agreed,

voluntarily, to place the calories per serving and percentage daily calories on the front of their food packaging (Switt, 2007).

Figure 6-2 Examples of various FOP labelling systems from around the world; left to right, the 'Heart' symbol, the 'Keyhole' system, 'Smart Choices' system and 'Pick the Tick'.

Many nutritional labels require high levels of literacy and numeracy to interpret correctly (Rothman et al., 2006). Black and Rayner (1992; as cited in Balcombe, Fraser, & Falco, 2010) noted that consumers struggled to process nutritional information when shown several nutrients concurrently, and a study conducted in New Zealand reported that consumers often made choices based on the fat content of the food alone, disregarding the other nutritional levels (Mhurchu & Gorton, 2007), suggesting that consumers may employ a simple, heuristic process to help them navigate complicated nutritional information. With this in mind, there is much support for a simple, uniform food labelling system, with the aim to empower consumers to make informed food choices (Hieke &

Wilczynski, 2012), however, there is also much discord and debate in the literature regarding what this labelling system should be.

To address comprehension and ease of use, an online questionnaire in Australia tested the ability of adult participants' to use seven different nutrition labelling types, with access to a nutrition information panel on the back for each, to identify the healthier item from nine pairs of commonly purchased food products. Participants were able to correctly identify the healthier item 80% of the time, with no significant differences between label types for accuracy, reliance on the additional nutrition information or speed of use. They also reported that the schemes which displayed only energy information or limited numerical information with regards to nutrient type/content performed poorly, along with the nutrition information panel alone (control) (Watson et al., 2014). Research in adults has demonstrated that there are varying preferences of labelling format depending on the choice context and that the reported use of nutritional labels is typically higher than consumers' actual use (Cowburn & Stockley, 2005; Crockett, Hollands, Jebb, & Marteau, 2011; Graham & Jeffery, 2011; Grunert & Wills, 2007; Malam et al., 2009). The majority of research on nutritional labelling focuses on attitudes, semi-structured interviews and self-reported use of nutritional labels (Gregori et al., 2014; Klatt et al., 2008; McLean & Hoek, 2014; Vemula, Gavaravarapu, Mendu, Mathur, & Avula, 2014; Watson et al., 2014). Interviews and self-reported data are open to social desirability biases and inaccuracy and, as previously asserted, are generally not representative of actual use. The body of research offers relatively little in the way of objective, empirical evidence which assesses the influence of nutritional labelling on actual purchasing behaviour, focusing predominantly on experimental or self-reported data (Volkova & Ni Mhurchu, 2015), and that which exists offers mixed results. Of these studies, many have focused on a colour-based system (Levy, Riis, Sonnenberg, Barraclough, & Thorndike, 2012; Gary Sacks, Rayner, & Swinburn, 2009; Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012); these will be discussed further in section 5.1.5.

6.1.4.1 Visual attention to nutritional labels

Alongside research using the designs as detailed above (i.e. interviews and self-report surveys), numerous studies have used eye tracking as a more objective measure of visual attention to nutritional labels (Graham, Heidrick, & Hodgin, 2015; Graham & Jeffery, 2011; Miller et al., 2015). These have included computer-based, simulated grocery shopping tasks (Graham & Jeffery, 2011; Miller et al., 2015) or mock grocery stores in university labs (Graham et al., 2015). For example, Graham, Heidrick and Hodgin (2015) measured the visual attention of 123 parents and one of their children (aged 6-9 years) to both nutrition labels on the back of a food package and FOP nutritional labels on six foods. This took place in a university lab which had been turned into a mock grocery store. They found that participants were more likely to view FOP labels than those on the back of the packaging, lending support to the previous literature which demonstrates that individuals will exert very little effort when making decisions regarding food choices (Grunert & Wills, 2007). They highlight, however, that whilst FOP labels were viewed significantly more than the nutrition labels on the back of the package, this effect was driven by signs in the grocery aisle which highlighted and explained the labelling system, which was unfamiliar to the US population. For participants who did not see these signs, the difference disappeared. We could posit that this effect may hold in a UK population, who may not require the use of these additional in-store signs, as it is a commonly used approach which should already be familiar to the general population, however, this is speculation and further research is needed to establish if this is in fact the case. Whilst eye-tracking studies have provided an objective measure of visual attention as a measure of nutritional labelling use, we must be cautious when interpreting the findings. These were simulated shopping experiences which are not necessarily true representations of the influence of nutritional labels on an individual's actual purchasing behaviour in real-life situations.

6.1.4.2 The effect of nutritional labelling on choice at point-of-purchase

In terms of literature specific to point-of-purchase behaviours, a US study examined the effect of a storewide point-of-purchase intervention called 'Guiding Stars',

where a 3-tiered star logo was placed on the shelf-label for foods and drinks (Sutherland, Kaley, & Fischer, 2010). This natural experimental design included actual sales data pre-implementation of the system and at 1- and 2-year follow up points. The study reported significant changes in food purchasing immediately after the introduction of the 'Guiding Stars' system, and that this remained significant both 1 and 2 years later. An extensive survey of aggregate sales data in the US between 2005-2007 (102 food categories, 150 stores) found that the introduction of nutrition ratings on packaging led customers to purchase a more nutritious range of products, however, it did so by reducing purchases of less nutritious foods, and not by increasing the purchasing of foods with a more nutritious composition (Cawley et al., 2015). Whilst this was a long-term study, with a variety of categories and stores, it is worth noting that findings are based on a single supermarket chain.

Aschemann-Witzel et al. (2013) carried out a choice experiment in Germany and Poland, to establish whether various FOP nutrition labels influenced the healthfulness of food choices. The labels used included GDA, colour coding schemes and text (high, medium, low levels of each nutrients). All labels used were presented on both savoury and sweet snacks, and referred to the calorie content of the foods, in addition to four negative nutrients. Participants (*n*=1000) were asked to choose from a set of 10 products and then again from a set of 20 products. Foods selected were more healthful, on average, in the 20-product phase (compared to the 10-product phase) and the authors report that this effect was stronger than if making a random selection. Colour coding (in Germany only) and text based labels resulted in healthier choices when consumers were instructed to select healthier food products, but had no influence on their choices when asked to select food products based on their preferences. Thus, the authors concluded that the presence of these FOP labels did not affect levels of motivation to make healthier choices. Authors also indicated that using colour-coded labels increased consumers' perceived capability to make healthier choices (colour coded labels will be discussed further in section 5.1.5). It is worth noting that the colour coding influenced choice in a forced healthfulness situation in Germany, but not in Poland. The authors speculate that this may be due to familiarity working as an external

influence, as at the time of this study TLL systems were being publicly debated in the German media.

6.1.4.3 Nutritional labelling in food-service settings

Nutritional labelling also appears to be gaining momentum in cafeteria and restaurant settings, with research reporting that consumers now expect nutritional information when in restaurants, in order to make informed choices (Cranage, Conklin, & Lambert, 2004; Din, Zahari, & Shariff, 2012; Mills & Thomas, 2008; Thomas & Mills, 2006). However, there is a relatively small area of research exploring the impact of nutritional labelling on actual consumer choice in such settings. Cranage, Conklin and Lambert (2004) reported that the provision of nutritional information on restaurant menus influenced healthier choices, for example, lower fat main dishes were ordered more often, and higher fat main dishes less often, when nutritional information was provided (Cranage, Conklin & Lambert, 2004), as well as more vegetable and salad based side dishes, and less French fries and desserts being ordered, even when nutritional information was provided for only the hot main dishes. Conversely, a study in the Netherlands investigated the influence of the 'Choices' nutrition logo on cafeteria menu selections, in a cluster randomised controlled trial (Vyth et al., 2011). In intervention cafeterias (*n*=13) the 'Choices' logo was used to promote healthier eating across a 3 week period and sales data was collected in order to compare it to control cafeterias (*n*=12), which offered the same menu but without the 'Choices' logo. They found no nutritionally meaningful intervention effects in the sales data.

6.1.4.4 Individual differences and the use of nutritional labels

Research has demonstrated that various individual differences can contribute to the use of nutritional labels, for example, socio-demographic factors such as age (Misra, 2007) and gender (Levi, Chan, & Pence, 2006). Whilst some research has considered age differences, the majority of research has been carried out in adult populations with little consideration given to children as potential consumers. In addition, nutritional labelling has also been shown to have differing effects on various socio-economic groups (Crockett, Jebb, Hankins, & Marteau, 2014). A positive association exists between concern about health and nutrition, and

nutritional label use (Satia, Galanko, & Neuhouser, 2005). However, interestingly, a study by Graham and Laska (2012) reported that nutritional label use partially mediated the relationship between attitudes towards healthy eating and actual quality of diet in a college student population. This could potentially suggest that while those who display low levels of concern about their health may not actively seek out nutritional labels, if it is there in plain sight on the front of the package, it has the potential to positively influence their food choices. Most people will view the nutritional information if it is readily available (Graham & Jeffery, 2011), lending further support to front-of-package nutritional labelling systems as a means of communicating information which may influence consumer choices at a population level. However, we must be cautious and remember that the population used by Graham and Laska (2012) is not representative of the general population as a whole, due to their high levels of education.

Education is closely linked to socio-economic status (SES) and income, and one study reported that the self-reported use of nutritional labelling in US adults increased with higher levels of education and income, and that this nutritional label use was positively associated with healthier food consumption (Ollberding, Wolf, & Contento, 2010). Previous nutritional education, such as how to use nutritional labels, has also been established as a predictor of less frequent use of nutritional labels (Guthrie, Fox, Cleveland, & Welsh, 1995; Misra, 2007). Existing health inequalities is a pertinent topic in public health debates surrounding nutrition and healthy eating strategies, particularly in children, therefore it would be interesting for future research to establish whether those who begin in a disadvantaged position (for example, low health motivation/nutritional education/income) can be educated on the use of nutritional labels with the intention to close, or at least narrow, the inequality gap in nutritional labelling use.

6.1.4.5 Reformulation of foods

It is worth noting that, as well as potentially informing consumer choice, the use of/requirement for nutritional labels can also incentivise and encourage product reformulation. Crucially, companies may be more likely to reformulate existing products and to develop healthier new products in order to facilitate the use of a

label with a more favourable health profile. For example, in New Zealand, a study by Young & Swinburn (2002) found that the 'Pick the Tick' logo encouraged a reduction of sodium across breakfast cereals, breads and margarines. Furthermore, Vyth et al. (2010) found that the Choices logo (used in The Netherlands) encouraged companies to reformulate existing products and develop new products which were healthier, especially with regards to levels of sodium and dietary fibre. Conversely, due to the voluntary nature of FOP nutritional labelling, companies may be selective about which labelling format they choose to use and the foods they choose to place them on. For example, analyses of 5500 food products released in the UK between 2003-2009, found that for ready-prepared meals, pastries and meat products, an increase in sodium levels meant there was less chance of the food products using a TLL system, relative to GDA labels or no FOP label at all (Van Camp, Souza Monteiro, & Hooker, 2010). However, this finding was significant only for sodium levels. Nonetheless, it highlights the need for a uniform FOP labelling system such as TLL in order to ensure standardised and consistent portrayals of the healthiness of food products, which could aid easier and informed decision making for consumers, prevent the manipulation of FOP labels by industry and encourage positive reformulation of foods which are less healthy.

6.1.5 Colour-based Nutritional Labelling Systems

Research into colour suggests that people associate certain colours with certain emotions and therefore colours hold the potential to influence food-choice behaviours. In a study by Gilbert, Fridlund and Lucchina (2016), it was found that colour-association palettes varied dramatically across emotions, with red appearing as the dominant colour for negative emotions such as angry, tense, irritated and anxious, and green being associated more often with more positive emotions such as energised, alert, happy, refreshed and healthy. Research into the use of colour-based nutritional labels in adult populations, on the whole, has demonstrated their efficacy in encouraging healthier food choices, but despite this growing body of research, colour coded labels have remained a point of contention in debates about labelling best practice, with industry opposition arguing that this over-simplified approach could potentially demonise or elevate foods inappropriately, for example,

demonising milk which carries certain nutritional benefits, but elevating diet soft drinks which do not (Jones & Richardson, 2007). Notably however, there has been relatively little focus in the literature on children and adolescents as potential consumers and label users.

A laboratory study by Temple et al. (2011) found that when using green labels to denote healthier foods and red to denote unhealthier foods, there was a significant reduction in consumption of red-labelled foods and an increase in consumption of green-labelled foods. A more recent paper by Schuldt (2013) assessed the automatic influences of coloured nutritional labels on participants' perceptions of food healthiness, hypothesising that green nutritional labels would lead participants to infer that these items were healthier than those with red nutritional labels. This hypothesis was developed from the idea of embodied cognition, where green is perceived as an indicator of safety and equates to a 'go' signal, and red as an indication of danger, which signals a 'stop' response. Schuldt (2013) reported that participants were more likely to perceive the same chocolate bar as healthier when it was presented with a green nutritional label, when compared to red or to white (neutral) nutritional labels. However, Vasiljevic, Pechey & Marteau (2015) failed to replicate these findings when they assessed the impact of colour on nutritional labels and injunctive norms on snack food choices; finding that emoticon labels yielded stronger effects than coloured labels on participants perceptions of the taste and healthiness of snack foods.

Similar findings were demonstrated in cafeteria studies, where labelling unhealthy foods red and healthy foods green resulted in healthier purchases of food and beverages (Levy, Riis, Sonnenberg, Barraclough, & Thorndike, 2012; Thorndike, Sonnenberg, Riis, Barraclough, & Levy, 2012). A survey of military dining facilities reported that 47% of respondents indicated that they used the facility's Go-for-Green, colour-coded system when making their food choices (Arsenault, Singleton, & Funderburk, 2014). They were also more likely to be on a diet and taking additional supplements, indicating that this system may appeal more to those with an existing interest in their health. More objective measures also lend support to the use of TLL, reporting that colour increased the participants' attention

to the FOP labels (Becker, Bello, Sundar, Peltier, & Bix, 2015) and that, when tracking eye movements for standard nutritional labels the eye movements of the participants lacked focus and their healthiness ratings lacked accuracy, however, the TLL guided the eye movements of the participants to the important nutrients and improved the accuracy of their ratings of healthiness (Jones & Richardson, 2007). This could suggest that coloured labels are more likely to capture the attention of a consumer in a real-world setting and indicate which nutrients are important enough to require their attention when making their decision.

6.1.5.1 Traffic Light Labelling System in the UK

A further example of a colour-based labelling system in place in the UK, as previously mentioned, is the TLL system, as recommended by the UK Government (FSA, 2013), whereby colours are used to denote the levels of fat, salt and sugar in foods, with red, amber and green representing high, medium and low levels, respectively. As compulsory labelling was not included in the European Food Information Regulations 2014, it cannot therefore be made compulsory in the UK. However, many manufacturers have voluntarily agreed to sign up to this scheme, for example, Nestle®, McCain's® and Pepsi® (see Figure 6-3 below for examples).

Figure 6-3 Examples of TLL from manufacturers who have signed up to the voluntary TLL scheme (Nestle®, McCain's® and Pepsi®, left to right).

To date, there has been much research in support of the feasibility and cost-effectiveness of TLL as a tool for obesity prevention (Lobstein & Davies, 2008; Sacks,

Veerman, Moodie & Swinburn, 2011). Feunekes, Gortemaker, Willems, Lion, & van den Kommer (2008), in a survey across four European countries, report that, despite the TLL system not differentiating as well as other nutritional labelling systems when it came to identifying healthy and less healthy foods, it was generally well liked, understood and consumers considered it to be a credible source of information. Kelly et al., (2009) found the TLL to be the most effective labelling system in assisting adult consumers to identify healthier foods, when compared to other methods of food labelling, such as the Percentage Daily Intake system. Furthermore, Balcombe et al. (2010) reported finding significant heterogeneity in the responses and attitudes of consumers towards the TLL system across socio-economic levels, suggesting it is widely accepted and applicable. An empirical online study of undergraduate students (*n*=2002) found that TLL helped to reduce the complexity of decision making and participants rated its usability as high (Hieke & Wilczynski, 2012).

However, as with nutritional labelling in general, data on the impact of TLL on actual consumer purchases is somewhat limited, with a focus on attitudes towards, and comprehension of, TLL systems. One study employed a TLL system in a sports facility cafeteria and found that sales of green-labelled foods increased and sales of red-labelled foods decreased, when compared to baseline (Olstad, Vermeer, McCargar, Prowse, & Raine, 2015). A longitudinal study employing the use of a traffic light colour-coded system in a cafeteria, in conjunction with choice architecture strategies (that is, displaying the healthier foods in more accessible places) found that the selection of red (unhealthy) foods decreased and green (healthy) foods increased over a 24 month period, demonstrating that the use of traffic light colour coded labels has the potential to promote long-term changes in population eating behaviour (Thorndike, Riis, Sonnenberg, & Levy, 2014).

However, despite support for TLL in aiding consumers to identify healthier items, several studies in the UK and Australia found that TLL did not actually translate to healthier food purchases in supermarket settings (Sacks et al., 2009; Sacks, Tikellis, Millar, & Swinburn, 2011). In 2007, sales data from Sainsbury's® in the UK was assessed for differences in sales of ready meals and pre-packed

sandwiches for 4 weeks before and after the introduction of their TLL system. They accounted for product life-span, promotions and seasonality and found that the introduction of the TLL system on packaging had no significant effect on the relative healthfulness of sales, within-product (Sacks, Rayner, & Swinburn, 2009). In this instance, it may be that the TLL system was still in its infancy in the 4 weeks following its introduction, and follow-up assessments across a longer period of time were needed. This study refers only to sales data, and does not provide any indication of the size of the labels placed on the food packaging, nor does it report any measurement of whether customers actually noticed the new TLLs. In addition, they only looked at two types of foods, which is not representative of the influence of TLL on the entire consumer experience as a whole.

Theoretical models in this field suggest that the actual use of nutritional labelling relies on a number of factors, including consumer liking, understanding of the meaning underpinning the labels and the use of the label over time (Grunert & Wills, 2007). As previously mentioned, TLL are reportedly well liked amongst consumers and so this study will test children's understanding and ability to use them effectively. The logical next step for this research strand, if it is found that children can in fact use the TLL system effectively, would then be to measure the actual use of TLL in real-world settings, as this is underexplored.

6.1.5.2 Children and Traffic Light Labelling

The existing evidence base surrounding the comprehension and use of TLL focuses predominantly on adults, with a lack of research addressing children's experiences of TLL. A school-based intervention in the UK evaluated (using a pre- and post-test design) the impact of a TLL nutrition tool on the knowledge, attitudes and behaviour of children aged 5-7 years. Children's knowledge improved significantly after nutrition education and positive attitude scores and asking behaviour decreased for red foods, however, it also decreased for green foods. Refusals of red foods also increased (Ellis & Ellis, 2007). The decline in positive attitudes towards and asking behaviours for green foods might suggest that children misunderstood some of the information they were given and so it is important that further research is carried out to understand if children can be successfully taught to

understand the application of TLL as a tool to aid their decision making. As TLL have been adopted in the UK, and given the current childhood obesity problem and the influence which children have over family purchases as well as their own (as previously highlighted in section 5.1.1), it is important that more research is carried out which expands upon the current literature, in order to fully understand the impact of TLL on children's food choices.

6.1.6 Educational Interventions for Healthy Food Choices in Children

There is an ongoing interest in the development of interventions which encourage positive behaviour change. Patterns of behaviour such as the use of nutritional labels and food choice are potentially modifiable and therefore provide the opportunity to develop interventions that encourage positive behaviour change. However, before we can fully understand the impact of nutritional labelling on actual behaviour, more research is needed which establishes whether children can comprehend and apply nutritional labelling techniques, and, if not, whether this is a skill which they can learn and apply effectively. Childhood is a critical age for developing eating habits which span a lifetime and addressing behavioural risk factors for the onset of obesity (Birch & Anzman, 2010) and the treatment of obesity through lifestyle changes during adult life is extremely difficult (Hill, 2009). Therefore, educational and behavioural interventions which target healthy food behaviours during childhood may prove to be a useful tool in the prevention of obesity and warrant attention.

To date, there have been many educational and behavioural interventions with children which address various factors that contribute to obesity, such as healthy food choices and increasing physical activity (Ellis & Ellis, 2007; Gibson et al., 2012; Kastorini et al., 2016; Lakshman, Sharp, Ong, & Forouhi, 2010; Llargues et al., 2011). These studies and reviews report varied results, with encouraging the uptake of positive health behaviours being more successful than discouraging negative behaviours, and finding a combination of factors more effective than trying to encourage a single behaviour change. A meta-analysis, focusing on the efficacy of lifestyle interventions aimed at encouraging healthy lifestyle behaviours to prevent paediatric obesity, reported small changes in target behaviours post-

intervention and stressed that trials which evaluate promising interventions over longer timeframes, measuring responsive outcomes, are needed (Kamath et al., 2008). However, as discussed, before we can establish whether TLL education has an effect on measurable outcomes such as food choice or BMI, we must first establish that they can be applied correctly.

A review of computer and internet-based interventions aiming to improve children and adolescent eating behaviours and/or diet related physical outcomes reported that the majority of interventions resulted in statistically significant positive changes in the targeted behaviours. Considering children's increasing computer literacy and access to the internet, with around 80% of 8-11 year olds using an internet connected PC, laptop or netbook in the home (Ofcom, 2014), the use of online/computer based interventions appears to be an appropriate method for targeting children of this age. However, the review also reported that those studies which included follow-up measures post-intervention (ranging from 3–18months) did not find that these changes were maintained and recommend that these interventions be administered along with maintenance efforts (Hamel & Robbins, 2013). Future studies which hope to establish whether these interventions have an effect on actual behaviour should aim to adopt a pre-and post-intervention design, preferably with a later follow-up point, in order to establish whether changes occurred and were then maintained.

With the previous literatures in mind, to my knowledge, no previous research has tested an online educational intervention which focuses on educating children on the use of TLL and so this study aimed to assess whether this was a feasible approach, thus indicating any potential efficacy, in order to support and inform larger scale trials of a similar nature.

6.1.7 Aims

The current study aims to assess whether or not children aged 7-11 can effectively use traffic light labelling to identify healthier food choices, across a range of food types and products. In addition, it will also assess the acute and longer term effectiveness of an educational presentation which aims to increase the accuracy of

children when identifying healthier food items, when presented with pairs of similar food products.

6.1.7.1 Hypotheses

H1: Scores on the traffic light labelling task would be significantly higher than baseline at the immediate post-intervention assessment.

H2: Scores on the traffic light labelling task would be significantly higher at the two week follow-up than at both baseline and post-intervention assessments.

H3: There would be no significant difference between the scores of the higher and lower baseline performers at post-intervention and two week follow-up assessments.

H4: Older children will perform better at all time points than younger children

6.2 Methods

This section will outline the methods for an online feasibility study aimed at first assessing children's ability to use traffic light labels on food packaging to identify healthier food items, and subsequently assessing the effectiveness of an online intervention aimed at improving their ability to use traffic light labels.

See also Chapter 2.

6.2.1 Recruitment and Ethics

UK children aged 7-11 years were recruited. This age range was selected with the increasing food choice autonomy of pre-teen children in mind (Bassett, Chapmen & Beagan, 2008). Recruitment was carried out online using social media, parenting websites and also via word-of-mouth. Interested parents were asked to contact the researcher by email, where they were issued a link to the study website. When clicking on the website link, parents were provided with information about the study. If they chose to continue, they were asked to provide informed consent on their children's behalf and also to confirm they had received verbal assent from the

children. Parents were also informed that if they or their child wished to withdraw from the study they were free to do so at any point, without having to give reason and without consequence. Participants were awarded a £20 online shopping voucher upon completion of the study, which was issued by email to the corresponding email address supplied by parents.

Ethical approval for this study was granted in February 2015 by the University of Liverpool Non-invasive Procedures Ethics Sub-committee under the reference IPHS-1415-140.

6.2.2 Participants

Fifty-one children were recruited, aged 7-11 years (mean 9.1yrs ± 1.5yrs; 28 (54.9%) were male). Outliers (defined as scores that were 2 or more SD away from the sample mean at any time point) were removed from analysis for that time point.

Sample size calculations (G* Power Power; Faul, Erdfelder, Buchner & Lang, 2009) indicated that a sample size of 44 would have 95% power to identify an effect size of 0.25 at the $p < 0.05$ (two tailed) significance level for a repeated measures, within factors ANOVA. To account for drop outs (given the repeated nature of the study and the lack of face-to-face contact) we recruited at 15% above this level, resulting in a final sample size of 51 children.

6.2.3 Data Collection, Confidentiality

Data were collected between May 2015 and July 2015 using Qualtrics® software (www.qualtrics.com). All data were collected online and stored electronically on a password- and virus-protected computer. Parents were asked to create a unique participant code, combining the first 2 letters of the child's name, the month they were born in and the last 2 letters of their surname. This ensured that individual children would not be identifiable, and that should parents forget their code they could be prompted.

6.2.4 Design

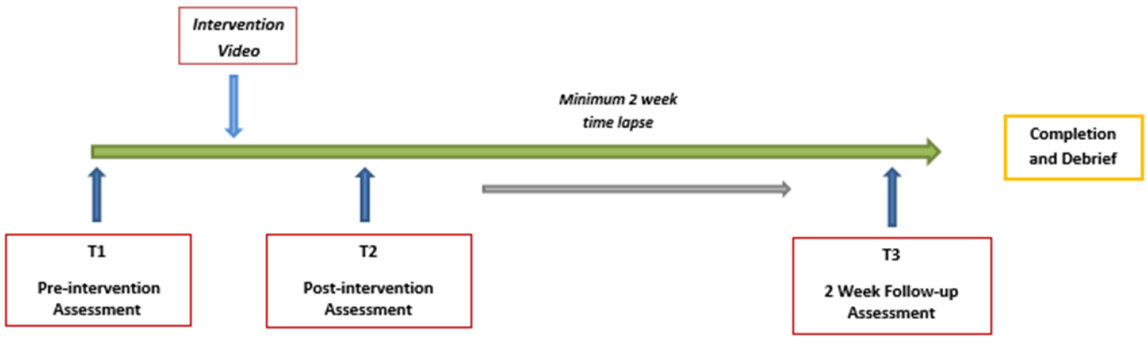
A within-subjects, repeated measures design was employed. The study was conducted fully online using Qualtrics® and measures of accuracy (which refers to

children's ability to identify the healthier food item within each matched pair, assessed as a total score with a maximum of 30; hereinafter referred to as their accuracy) were taken at three data collection points on two separate study days; T1 refers to a baseline measure of accuracy, T2 refers to a measure of accuracy taken immediately post-intervention and T3 refers to a follow-up measure taken a minimum of 2 weeks after exposure to the intervention, up to a maximum of 3 weeks (see Figure 6-4 for study timeline).

This study design takes into account evidenced assumptions regarding learning and recall of information, with the two week follow-up period allowing any short-term recall effects to subside and permitting us to assess deeper learning (Ellis & Ellis, 2007; Epstein, McKenzie, Valoski, Klein, & Wing, 1994).

The within-pair order of food items was counterbalanced (for each matched-pair, half the children saw the healthier item on the left, the other half on the right) and the question order was randomised. Children were not given feedback on their answers during the experiment.

Figure 6-4 Flow diagram depicting the study timeline



6.2.4.1 Independent variables

The specific independent variables included were:

1. Age
2. Gender

6.2.4.2 Dependent Variables

The effect of the intervention on children's ability to differentiate between food items using traffic light labels was assessed by measuring their accuracy when correctly identifying the healthier item from the matched food pairs, both pre-intervention (baseline) and immediately post-intervention, in order to see if the intervention had an effect on accuracy, and again at a two week follow-up to assess whether this accuracy was maintained. Therefore, the specific dependent variables were:

1. Ability to identify healthier food item from matched pairs (assessed as a total score of correctly selected items)
    - Pre-intervention assessment (T1)
    - Immediate post-intervention assessment (T2)
    - 2 week post-intervention follow-up assessment (T3)

6.2.5 Food Pairs

Sixty foods and drinks were included in the study (consisting of 30 matched food pairs; see Table 6-1). Five pairings from each of the following six food groups were included to provide a wide range of food items; 1) soft drinks, 2) confectionery, 3) dairy, 4) fruit and vegetables, 5) meat and 6) carbohydrate.

To ensure the nutritional profiles for the foods differed, a simple scoring technique was applied, whereby red was awarded 4 points, amber was awarded 2 points and green was awarded 0 points. A score difference was calculated for each food pair by subtracting the score for the healthiest item from the score for the least healthy item. All pairs differed by between 2-8 points, out of a maximum possible difference of 12 points (see Table 6-1 for full list of study foods and points).

Table 6-1 List of study foods (listed by pair) with traffic light score for each item and score difference. Foods are presented by food group; dairy, carbohydrate, snack foods, fruit & vegetables, meat and drinks, respectively.

	Food Pairs				Score
Food Group	***Most healthy***	***Score***	***Least Healthy***	***Score***	***Difference***
Dairy	Fage Total 0% Greek Yogurt	0	Tesco Greek Style Natural Yogurts	8	8
	Tesco Value Cottage Cheese	2	Tesco Value Soft Cheese	10	8
	Nestle Aero Chocolate Mousse	8	Tesco Finest Sicilian Lemon Mousse	10	2
	Tesco Skimmed Milk	2	Tesco Whole Milk	6	4
	Tesco Everyday Value Mozzarella	10	Cathedral City Mature Cheddar	12	2
Carbohydrate	Tesco British Maris Piper Potatoes	0	Tesco Mashed Potato	4	4
	McCain Ready Baked Jacket Potatoes	0	Tesco Jacket Potatoes with Cheese & Bacon	6	6
	Sainsbury's Wholewheat Fusilli Pasta	0	Sainsbury's Carbonara Tortelloni Pasta	8	8
	Tesco Microwave Wholegrain Rice	0	Uncle Ben's Microwave Egg Fried Rice	4	4
	Tesco Stonebaked Ciabatta	4	Tesco Garlic Ciabatta	8	4
Snack Foods	Tesco Unsalted Mixed Nuts	8	KP Jumbo Honey Roast Nut Mix	12	4
	Green & Blacks Dark Chocolate	10	Galaxy Chocolate	12	2
	Walkers Star Crisps Salt & Vinegar	6	Walkers Crinkles Crisps Salt & Vinegar	10	4
	YooMoo Frozen Yogurt Strawberry	4	Haagen-Dazs Strawberries & Cream Ice-Cream	10	6
	Go Ahead Yogurt Breaks Raspberry	10	Tracker Crunchy Peanut Bars	14	4

Food Group	Food Pairs				Score Difference
	Most healthy	***Score***	***Least Healthy***	***Score***	
Fruit and Vegetables	Tesco Soft Dried Apricots	4	Whitworths Banana Chips	12	8
	Aunt Bessie's Carrot & Swede mash	2	Tesco Sweet Carrot & Swede Mash	6	4
	Tesco Pineapple Chunks	2	Del Monte Pineapple Slices	4	2
	Birds Eye Petits Pois	0	Batchelor's Mushy Peas	2	2
	Tesco Creamy Caesar Salad	6	Tesco Creamy Coleslaw	8	2
Meat	Tesco Back Bacon Rashers	8	Tesco Streaky Bacon Rashers	12	4
	Tesco British Beef Diced	4	Tesco British Beef Mince	8	4
	Tesco Butchers Choice Turkey Sausages	6	Tesco Butchers Choice Pork & Leek Sausages	10	4
	Tesco Sweet Chilli Chicken Breasts	4	Tesco Mexican Nacho Chicken Breast Fillets	6	2
	Tesco Finest Beef Steak Burgers	8	Tesco Peppered Beef Grillsteaks	10	2
Beverages	Alpro Almond Milk	0	Yazoo Strawberry Milk Drink	6	6
	Volvic Sparkling Water	0	Highland Spring Sparkling Water with Elderflower	2	2
	Volvic Water – Lemon & Lime	0	Volvic Water - Strawberry	4	4
	Robinsons Orange Squash	0	Fanta Orange	4	4
	Sprite Zero	0	Sprite	4	4

6.2.6 Intervention Video

The intervention video was brief, lasting approximately 4 minutes. It was created on Microsoft Powerpoint® and was uploaded to YouTube® where it could be accessed online using a unique URL. It included basic healthy eating advice and instructions regarding the use of TLL (see Appendix 6c for copies of the slides presented and a transcript of the voice-over).

6.2.7 Procedure (see Figure 6-4)

On the first test day, parents were issued a link to the study by email. They read the study information, provided a unique participant code for their child and completed the consent form. They were then prompted on screen to let the child begin completion of the online task. Parents were asked to support the child when using the online system if necessary, but not to assist children when selecting their responses.

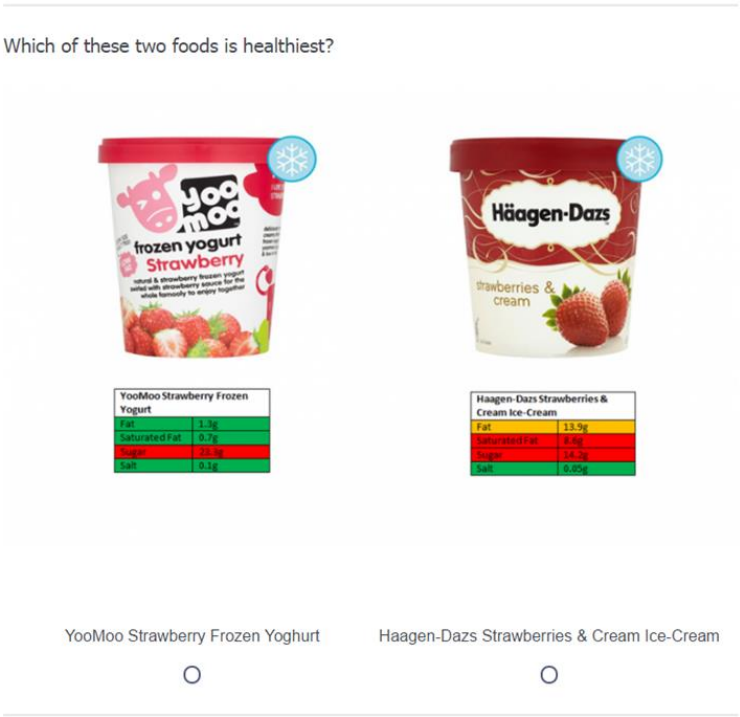
Each food pair was presented on screen together side-by-side with the corresponding traffic light displayed below (see Figure 6-5 for an example). Children were then asked 'Which of these two foods is the healthiest?' and selected their answer by clicking on the answer below the appropriate picture, before moving on to the next question. Children could not move onto the next question until they had answered the previous one and did not receive any feedback on their responses throughout the study. After answering all 30 questions T1 was complete and children were then presented with a link to the intervention video. After watching the video, children were then presented with T2 and asked to complete the task once more. Upon completion of this, participants were advised that this phase of the study was complete and that parents/guardians would receive an email reminder in two weeks with a link to the final stage of the study.

After 2 weeks parents/guardians of participating children were issued an email with the link to T3 and were advised to complete the study as soon as was convenient for them, provided it was within one week of receiving the email, after which point they would be excluded from the study. After 48 hours a second

reminder email was sent to parents/legal guardians of those children who had not yet completed the second phase of the study.

Upon clicking on the link provided participants were taken to T3, where they were asked to input their unique participant code. After the study questions at T3 were complete, both parents and children were presented with debriefing material. Parents of participants who completed the study were then asked to provide an email address to which a £20 online shopping voucher could be issued.

Figure 6-5 An example of an assessment question as displayed on Qualtrics®



6.2.8 Statistical Analyses

Data from the traffic light labelling task did not adhere to the assumptions for parametric data (normality of distribution) and so scores were log transformed to reduce skewness. For clarity, all subsequent analyses reported were run using the transformed data and all means reported refer to the original data. All comparisons were two-tailed and significance was taken at $p < .05$ (with Bonferroni adjustments

for multiple comparisons). Where assumptions of sphericity were violated, degrees of freedom were corrected using a Greenhouse-Geisser correction. Analyses were completed using SPSS v22 for Windows (SPSS Inc., Chicago, US).

6.3 Results

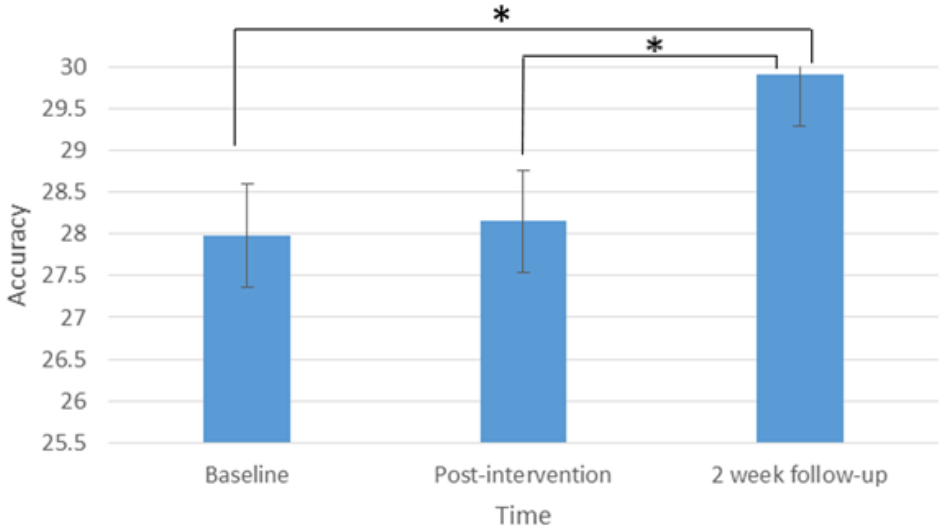
Sixty parents expressed interest in participating and were issued with a link to the study by email, of which 52 proceeded to the study information and consent form. All participants who reached this point were willing to give consent for their child to take part. The retention rate for this study was 100%, with all participants completing all three time points and complying with the time restrictions applied to each assessment.

H1: Scores on the traffic light labelling task would be significantly higher than baseline at the immediate post-intervention assessment.

A repeated measures ANOVA, with accuracy scores across 3 time points as the within-subjects factor, determined that mean scores differed significantly between time points, $F(1.3, 58.52) = 13.33$, $p < .001$, $\eta^2 = .23$). Using pairwise comparisons an increase from baseline scores was seen immediately post-intervention (27.98 ± 0.41 vs 28.15 ± 0.24, respectively), however, this finding was not significant ($p > .99$)

H2: Scores on the traffic light labelling task would be significantly higher at the two week follow-up than at both baseline and post-intervention assessments.

The overall model was significant (as stated above for H1). Pairwise comparisons revealed that the mean accuracy score at the two week follow up (29.9 ± 0.5) was significantly greater than both baseline (27.98 ± 0.41) and immediately post-intervention (28.15 ± 0.24), MDs > 1.71, SEs < 0.24, *ps* < .001.



*Denotes significant differences at the level $p < .001$

Figure 6-6 Bar chart showing mean accuracy scores (healthy items correctly identified) across each time point

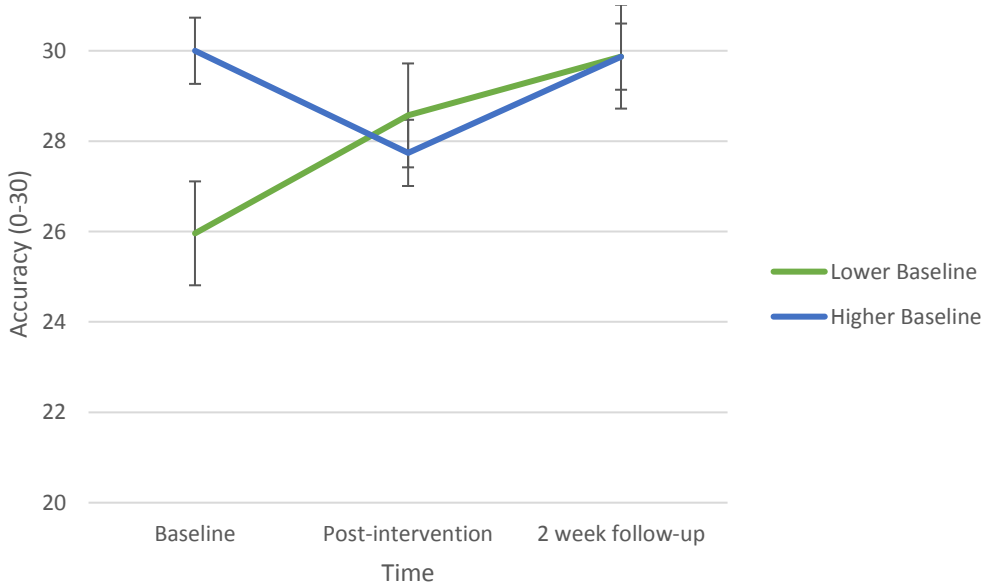


Figure 6-7 Line chart displaying mean accuracy scores (0-30) at each time point for higher and lower performers at baseline (based on a median split). Error bars represent standard errors.

H4: Older children will perform better at all time points than younger children

As this study recruited children aged 7-11 years, to establish whether there were any differences in performance between the younger and older children (based on a median split), a two-way 2 (age: old v young) x 3 (time: baseline, post-intervention and two week follow-up) mixed factorial ANOVA was employed. This revealed a significant main effect of time (refer to H1) but no significant effect of age (p = .643), and no interaction between time and age (p = .486).

Exploratory analyses

To establish whether differences in assessment scores existed between the varying degrees of difficulty, mean accuracy scores were calculated for each participant at each difficulty level, across each of the 3 time-points. The difficulty of the questions were then rated using the score difference (see section 5.2.5 above for details); >6 as easy (n=9), 4 as moderate (n=14) and 2 as difficult (n=7) and coded in SPSS as 1-3, respectively. We then examined if age influenced any effects of either difficulty or time.

A two-way 3 (time: baseline, post-intervention and follow-up) x 3 (difficulty: low, moderate, high) x 2 (age: older vs younger, median split) mixed ANOVA revealed a significant main effect of time (as reported in Hypothesis 1), a significant main effect of difficulty rating (F (1.40, 69.87 = 22.71, p < .001,) = 14.6, p <.001, η^2 .31), with accuracy increasing for each difficulty level (Easy: M = 0.84, SE = 0.01; Moderate: M = 0.95, SE = 0.01; Difficult: M = 0.90, SE = 0.01). The mean moderate accuracy differed from both easy and difficult accuracy scores (MDs > .052, SEs < 0.01, ps < .001). There was also a significant interaction between time and difficulty (F (1.81, 90.24) = 11.92, p < .001, η^2 = .19). The means reveal that the lowest score occurred for the most difficult questions at baseline, and the highest scores were found for the moderately difficult questions at the two-week follow-up (see Table 6-2 below). When adding age as a variable, no significant main effect of age (p =

.519) and no significant interactions between age and either time (p = .967) or question difficulty (p = .834) were found.

Question Difficulty Rating	*Time point*	*Mean*	*Standard Error*
Easy	Baseline	0.81	0.04
	Post-intervention	0.92	0.02
	Two-week follow-up	0.80	0.01
Moderate	Baseline	0.91	0.01
	Post-intervention	0.95	0.01
	Two-week follow-up	0.91	0.01
Difficult	Baseline	0.98	0.01
	Post-intervention	1.0	0.00
	Two-week follow-up	1.0	0.01

Table 6-2 Mean scores and standard error at each time point (baseline, post-intervention and two-week follow-up), displayed by question difficulty rating (easy, moderate, difficult)

6.4 Discussion

To my knowledge, this is the first study to examine whether children are able to correctly identify healthier foods using the FOP TLL system. In addition, it is also the first study to examine the efficacy and feasibility of an online educational intervention that aims to increase children's accuracy when using TLL. This study offers a novel experimental paradigm, which appears to be sensitive to the experimental manipulation, and demonstrates not only prolonged effects, but also highlights existing differences between groups, which in turn offers potential avenues for further research and development.

The baseline measure of children's accuracy (when identifying the healthier choice from a pair of foods) highlights that the mean score was 28 out of a possible 30, meaning, on average, children were correct 93% of the time. While this was a surprising finding, being much higher than anticipated, it lends support to the UK Government's recommendation of TLL as their preferred system, demonstrating that they may provide a clear and easily understood avenue for conveying nutritional information to consumers of all ages. This is supported by previous literature which reports that TLL were most useful when respondents were asked to choose the healthier item when confronted with a pair (Which?, 2006)

Aschemann-Witzel et al. (2013) found that, when colour coding was employed, participants perceived themselves to have a higher capability of choosing healthy foods when they were asked to make healthy choices. They explain the importance of this finding using Social Cognitive Theory, which posits that if an individual perceives their capabilities to be improving, this will raise their perceived self-efficacy, which is important for positive behaviour change (Bandura, 2004). Thus, TLL systems might be a useful tool for improving perceived self-efficacy at an individual level, leading to healthier food decisions. Future studies may wish to measure perceived self-efficacy as a way to further understand the mechanisms behind these food-based decisions.

When assessing the effectiveness of the intervention, two additional measures of children's accuracy were taken, both immediately after viewing the educational presentation and at a two week follow-up assessment. Whilst accuracy scores did increase at each of these subsequent time points, the mean score immediately post-intervention was not significantly greater than at baseline. Given the age of the participants, it is reasonable to suspect that this finding may be due to boredom or fatigue effects caused by being asked to complete the task twice in one sitting, in addition to watching the presentation. The study had hoped to avoid fatigue effects and boredom by limiting the task to 30 matched pairs and keeping the presentation brief and engaging for children, however, it may still have been too demanding despite these efforts. At the two week follow-up assessment, mean scores increased again to approximately 30, with the majority of children offering

correct responses 100% of the time. This was significantly higher than at both baseline and immediately post-intervention, suggesting that the intervention may have had a positive effect on the children's accuracy when identifying healthier foods, however, this effect may have taken time to develop. Unsolicited responses from parents (via email) provided anecdotal evidence, which suggested that children were keen to practice these behaviours with their parents, both at home and in supermarket settings, over the course of the study, potentially further reinforcing and consolidating their new knowledge. Similarly, parents may have been encouraging children and engaging with the process, knowing that children had recently learned this particular skill. This could be explained by the Experiential Learning Theory, which suggests that learning is "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p.38), and that the process of learning requires active involvement in the learning experience and time for the individual to reflect on what they have learned. This is supported in the existing literature by a meta-analysis by Dudley, Cotton, & Peralta (2015) which reported that experiential learning strategies were associated with the largest effects across a variety of healthy eating outcomes in primary school-aged children. Future studies should aim to include measures of parental engagement, and also establish whether or not children practiced their new skill in real-life settings, in order to establish whether these factors mediate the impact of the intervention. If this was found to be the case, this would be a useful strategy to promote within future interventions.

Whilst increases in accuracy were small, when participants were split into high and low baseline performers, it becomes apparent that the intervention had the greatest effect on those who performed poorly at baseline, bringing their mean score level with those who were already displaying high levels of accuracy prior to the intervention. The small increases in accuracy could be explained by a potential ceiling effect, whereby a large proportion of the participating children already displayed high levels of accuracy at baseline and improved to around 100% accuracy when identifying the healthier foods. This suggests that the intervention

could be useful at increasing knowledge and understanding in children who were less informed to begin with, thus bridging the gap.

This particular type of intervention may lend itself to healthy eating sessions in school settings, where it can be easily integrated into existing platforms. There is existing literature that shows that lower socio-economic status groups are less likely to understand and use nutritional labels (Crockett et al., 2014; Grunert & Wills, 2007), therefore, this intervention could potentially have an impact on reducing existing health inequalities with regards to the use of nutritional labels, as it is an intervention that works best on the exact group that the intervention would like to target. In addition, parents that are interested in health promotion and healthy eating tend to be from higher SES backgrounds, with less educated persons being less motivated to adopt healthy behaviours, often due to jobs which offered little opportunity for learning, resulting in a lack of knowledge or access to information about health risks (Pampel, Krueger, & Denney, 2010).

An additional factor to consider is that this study was carried out online, and often those with regular online access are often associated with higher SES, meaning this study may not have reached low SES children. Perhaps the effects of this intervention would be amplified in a lower SES population. However, as this study did not specifically measure SES this is merely speculation, and so future studies should aim to recruit larger samples and include measures of SES, such as post code, parental education/income, or school attended, to allow for such comparisons. It may also be beneficial to intentionally recruit equal numbers of both low and high SES participants with the intention of comparison, to further explore these individual differences. This may be more easily facilitated if the intervention was implemented in schools, as this would provide the opportunity to target schools in specific areas and regions, based on SES. There are school-based indicators of SES, such as free school meals and school catchment areas, which could inform such decisions.

Surprisingly, there were also significant differences over time in the high baseline performers, with a significant decline immediately post-intervention, and a

subsequent significant increase in scores again at the 2 week follow-up. However, when we look at differences between baseline performance and the two week follow-up, no significant differences exist on the whole. It could be posited that the drop at the post-intervention assessment could be explained by fatigue or boredom, as this particular group of children may have found that the task was not challenging to them, and therefore not engaging. This could then have led to the significant increase at the two week follow-up, which may merely reflect their renewed interest, bringing their scores back in line with their original baseline performance again. Future studies might leave a period of time between the completion of baseline measures and the intervention period in order to help explain this present finding.

The FSA Strategy Report 2015-2020 suggested that lack of confidence and frustration were one of the main obstacles consumers faced when using nutritional labelling, so by increasing their familiarity with and confidence in using labels from a young age, we could optimise their use across the lifespan. As previously mentioned, theoretical models in this field suggest that the actual use of nutritional labelling relies on a number of factors, which included consumers liking and understanding of the meaning underpinning the labels and also the use of the label over time (Grunert & Wills, 2007). Whilst this study has addressed whether children can understand and effectively apply TLL to their decision making, future research should aim to address the extent to which children habitually use labels in their real-world food choices and identify potential barriers and individual differences which might contribute to or, alternatively, hinder their use.

The existing literature on evaluative categories suggests children are able to assign foods to categories such as healthy and unhealthy based on inferences drawn from existing knowledge. By using foods which were consistent across script, taxonomic and/or evaluative categories, this meant children could not rely on using their existing knowledge about these categories to conclude which item was healthiest and were encouraged to use the TLL provided, for example, two varieties of a similar product, such as Tesco Baked Potatoes® and McCain Frozen Baked Potatoes®. These potatoes are both dinner foods (script), they are both vegetables

(taxonomic) and they are both in the healthy category (evaluative). If chocolate cake and bread, for example, had been compared, the categories would not be consistent and children could draw upon their knowledge that chocolate cake is an indulgent treat that is only eaten on special occasions and so is considered unhealthy, thus selecting bread as the healthier item without needing to engage with the TLL on the food packaging.

By using foods which were categorically similar it was hoped that this design would mimic a real-world, point-of-sale decision whereby similar products, which fulfil similar needs, appear side by side in supermarket settings. It is unlikely that a child, or any consumer for that matter, would enter a shop to purchase a packet of crisps but instead decide to purchase a packet of strawberries, based on their nutritional labels. The focus here is to encourage healthier food choices amongst similar foods, which is a more likely scenario than discouraging a consumer from eating unhealthy food on the whole. By teaching children how to use the TLL system, they are being given a tool to go beyond inductive inferences, where they draw a conclusion about a product based on known information, and are given the knowledge and skills to make quick and healthier decisions at the point-of-purchase, which may encourage small, yet sustainable, changes over time. In response to criticisms of the current literature (Volkova & Ni Mhurchu, 2015), which often restricts studies to a small number of product categories (Sacks, Rayner, & Swinburn, 2009; Sacks, Tikellis, Millar, & Swinburn, 2011), this study used a wide range of products covering the six main food categories (meat, carbohydrate, fruit and vegetables, dairy, snack foods and beverages).

In terms of practicability, using an online intervention is an easy and cost-effective way of administering an intervention. Compliance rates were high, with all children who completed the baseline measure completing both subsequent time points of the study. It has the potential to be far-reaching, due to children's increasing computer literacy and access to the internet, with Ofcom (2014) reporting that in the UK, eight in every ten 8-11 year olds use an internet connected PC, laptop or netbook in the home. In addition, it could easily be incorporated into any existing healthy eating curriculums in school settings, where children have

regular access to computers or where they could be simply shown the short video and asked to complete some tasks by hand. The parents of children, although not specifically asked for feedback on the usability of the intervention, provided anecdotal evidence by email that suggested the children readily understood the content of the video and the task that was set, and that they also enjoyed completing the study and applying this new skill.

6.4.1 Limitations and Future Directions

This study was not without its limitations. Children were asked to choose between two similar food products and so further research is needed with more comprehensive tasks, incorporating more than two choices, which may be more representative of a real-life situation, where generally many options are available to consumers at the point of purchase. It may also reduce the likelihood of children simply guessing the correct response, which may provide an explanation for the high rates of accuracy at baseline. Perhaps using a battery of differing choice paradigms may make the intervention more engaging for children, and could negate the potential fatigue effects, which may explain the post-intervention drop in performance. Various food choice related tasks could be incorporated which provide opportunities for more stimulating, interactive learning, such as food ranking tasks with playing cards, the development of an interactive games or simulated shopping tasks.

The study could be developed further by incorporating various types of nutritional labelling as, whilst TLL are the recommended and most common labelling system in the UK, they are not the only system in use. It would be useful to establish more child friendly labelling systems for foods which are marketed to children, for example, Vasiljevic et al. (2015) found that labels based on injunctive norms in the form of emoticon labels conveying normative approval or disapproval had stronger effects on perceptions of healthiness of snacks than colour labels in an adult sample. Perhaps tools such as emoticons might be useful for supporting and encouraging healthier food choices amongst children and are worth investigation.

This was a short-term study, with a two week follow-up period. Van ’t Riet (2013) found that health information interventions, on the whole, were more effective when implemented over longer periods of time, preferably over a year in length, especially when carried out in conjunction with additional activities. Future studies could look to incorporate this small intervention into existing larger scale interventions and assess whether this knowledge is retained over longer periods of time and whether it has an influence on actual behaviour.

Retention and compliance rates were high, and while this is generally a positive feature of an intervention, this may indicate that our participants already displayed high levels of interest and motivation and may not be representative of the general population or, specifically, of the group which this intervention is targeting. In addition, we used convenience sampling methods, which may have led to bias in our sample, with only parents who were more interested in improving their children’s nutritional knowledge agreeing to participate.

As this study cannot make claims about children's actual use of TLL, future research is needed that will establish whether TLL on food packaging has a demonstrable effect on children’s intended purchases, actual purchases and objective food choices and behaviours. Understanding how to accurately use TLL does not necessarily lead to their use, as highlighted by the discrepancy between levels of understanding of nutritional labelling and their actual use in adults (Grunert & Wills, 2007). Nonetheless, even without an evidence base suggesting the public health benefits of using TLL, Ludwig & Brownell (2009) would still argue there is an ethical basis for ensuring that consumers have easy access to this information when selecting foods.

Whilst this study tried to ensure no overlap of food categorisations, children’s past experiences and knowledge are not always accurate, and we cannot assume that they automatically assign these matched pairs to the same categories. These inferences can lead to incorrect evaluations of foods, for example, if children know that strawberries are healthy, they may conclude that Häagen-Dazs® strawberry cheesecake flavoured ice cream is therefore a healthy option too. This

relates to the halo effect, as discussed in the introduction (see section 5.1.2). Perhaps future studies should include pilot work which establishes that children viewed these foods as categorically similar, by asking children to assign the study foods to taxonomic, script and evaluative categories. In addition, as the halo effect is likely to exist, it is possible to adapt the current research paradigm specifically to examine this, and is something future research should consider.

As this was an online study, not administered in a controlled setting, it is hard to state without doubt that parents did not assist the children when making their decisions, despite requesting that they did not do so. As this was a feasibility study, limited measures were taken. Future studies should expand upon this research to include additional baseline measures which may help to explain the differences in baseline performance, for example, parental education, SES or children's existing knowledge of/engagement with TLL or nutrition in general (whether at home or in school) prior to the intervention. It would also be useful to assess whether parental engagement and practice post-intervention had an effect on children's performance at the two week follow-up, by including measures of this in future, larger-scale studies. If it was found that parental engagement positively affects the outcomes of the intervention, this could provide a way to optimise its application in a real-world setting.

Future studies should also consider both the merits and downfalls of using repeated measures designs. By adopting this within-subjects design, this study hoped to reduce extraneous variables, and by counterbalancing the order of the items being displayed within-pair, in addition to randomising the order of the pairs being presented, it aimed to avoid potential order effects. Nonetheless, repeated measures designs have the potential to incur fatigue effects, especially in children and so the participant load should be kept to a minimum.

While this online study has provided a useful basis for future studies, it is apparent that online interventions are not the best option in this instance for a variety of reasons, for example, they can be boring and not engaging for children, and they may appeal to or target predominantly higher SES populations, as

previously discussed. There is also less experimental control with an online study, with no way to determine the level of parental involvement in completing tasks. School-based interventions would allow for better characterisation of participants, and the opportunity to collect larger data sets. Lower SES groups could be targeted, and it would allow for us to test improvements to the paradigm tasks, in addition to developing further novel tasks. Schools may also provide more ecological validity, as children are generally accustomed to learning, engaging and completing tasks in this type of environment. Furthermore, objective measures of choice and consumption could be implemented, to establish whether or not this newfound knowledge will directly impact on children's actual food behaviours, for example, by providing a selection of pre-packaged *ad libitum* lunch options, both pre- and post-intervention. With this in mind, the logical next step for this intervention would be to develop a more interactive and engaging, school-compatible intervention which, once empirically assessed, could be easily incorporated into schools existing healthy eating activities and curriculum.

6.4.2 Conclusion

In summary, this study has demonstrated that not only are TLL readily understood by children, lending support to their recommendation and use, but by the introduction of a simple and brief intervention that is easily administered online we could ensure that those children who are at a disadvantage in terms of comprehension and application of TLL at baseline are brought up to a level of accuracy in line with their higher performing peers. Considering the wealth of consumer choices that are available to children and the increasing autonomy they experience as they approach adolescence (Bassett et al., 2008), interventions such as this one could provide a cost-effective and efficient manner in which to educate children on nutritional labelling, helping aid healthier food choice decisions with implications not only for child health but eating habits throughout the lifespan.

Chapter Seven: Synthesis of research findings

7.1 Introduction

This thesis includes the only analysis to date of the exposure to, and power of, promotional techniques that specifically target children on food packaging in the UK. In addition, this thesis examined the influence of food packaging and on-package promotional techniques (brand equity characters, portion size depictions, and nutritional information in the form of traffic light labelling) on children's food behaviours (including food preference and choice, serving and consumption, and food evaluations).

The key findings of the experimental work described in chapters 3-6 of this thesis can be divided into three related areas: the exposure to, and power of, food package-based promotional techniques aimed at children in UK supermarkets; the effects of acute, experimental exposure to on-package promotional techniques on children's food-related behaviours and the effect of an online intervention on children's ability to accurately use traffic light labelling (TLL) to evaluate foods. This chapter will gather the research findings of this thesis into these spheres, and will discuss the original contributions that this thesis makes to the field, integrating them with the current body of literature. In addition, consideration will be given to the limitations of the current research, and the potential for further development and future research in this area.

7.1.1 Power of, and exposure to, food package-based promotional techniques

This novel study, described in detail in Chapter 3, was the first to assess food packaging-based promotional techniques in UK supermarkets, and furthermore did so in a particularly comprehensive manner - assessing several stores and time points across a 5-month period. All stores were found to have a high proportion of child-specific food products available, and this was true across all stores surveyed, regardless of location. In addition, no significant differences were found in the amount of child-focused products available at each of the time points surveyed

either, which was contrary to predictions. Due to the introduction of novelty or seasonal products during festive periods such as Halloween in October, or Christmas in December, it was expected that there would be higher levels of child-focused foods, in particular confectionery, available during these periods. The lack of such a finding may be due to the fact that supermarkets have a limited amount of space, and so regular products are temporarily removed from shelves to allow for the promotion of these seasonal items, and so the numbers of child-focused products does not change considerably.

As expected, the majority or products marketed to children were classified as unhealthy, based on their FSA nutrient profiling score (see section 3.2.3 for details), and would therefore not be permitted to be advertised to children on TV. There were no significant differences in the nutritional quality of the child-focused foods at each of the time points, indicating that they were predominantly and consistently of poor nutritional quality.

Previous content analysis of supermarkets in Canada (Elliott, 2008; 2012) indicated that the child-focused market was dominated by fruit snacks, drinks, cereal and dairy, and that while cereal was still a dominant food group, it had begun to decline, not due to less cereal being promoted to children, but because of an increase in the promotion of other food types. The current study supports these previous findings somewhat, indicating that non-alcoholic beverages were the most common food-type which was promoted to children, followed by confectionery and cereal, respectively. As expected, and in line with previous findings (Elliott, 2008; 2012), the least heavily marketed food type was fruit and vegetables. This appeared to remain consistent over time, as there were no differences in the dominance of various food groups at each time point.

As expected, promotional characters such as BE characters and celebrity endorsers were predominantly used to promote unhealthy foods to children, with BE characters being the most dominant form of promotional character in use in the current study. This finding was expected, due to the current lack of restrictions surrounding the use of BE characters, which is generally treated as equivalent to a

logo or brand imagery rather than a marketing technique that could be subject to restrictions along with marketing found in other forms of non-broadcast media. Therefore, BE characters provide an opportunity for companies who wish to promote foods of poor nutritional quality to children, which is currently unrestricted. Furthermore, these promotional techniques such as licensed characters, or images of children, being used to promote healthy and unhealthy foods were approximately equal. As licensed characters are subject to restrictions for use within TV advertising, it may be that companies are moving towards less regulated techniques such as featuring BE characters in their marketing. This allows for a more integrated marketing approach, whereby companies can use them freely on various platforms, such as TV and online advertising, in addition to placement on food-packaging. The impact and use of BE characters will be discussed further along in the current chapter, in relation to the experimental work described in Chapter 4.

The existing body of literature often refers to 'fun foods' as the main aspect of child-specific food products (Elliott, 2008; 2012), and in addition to elements such as promotional characters, this also includes the use of novel shaped foods and novel food-packaging. It was predicted that these novelty food items would be more commonly found in October and December, due to the predicted increase in novelty, seasonal items. However, while the frequency of these promotional techniques did increase, with more novel shaped foods in October and December than in August, and more novelty packaging in October than in December or August, these differences were not found to be statistically significant.

Front-of-pack (FOP) nutritional labelling was also assessed, and it was predicted that they would be used predominantly on healthier food products that were marketed to children, and that companies would fail to place these on the packaging of less healthy items as it highlights their poor nutritional quality. A positive finding was that FOP nutritional labelling was used on the majority of child-specific foods surveyed, and they were not used on significantly more healthy foods than unhealthy (based on FSA nutrient profiling scores), which is a promising result from a public health perspective. As expected, Traffic Light Labelling (TLL) was the

most popular form of FOP nutritional labelling on the child-specific food products. This was predicted, due to it being the UK Government's current recommended nutritional labelling system, and was the focus of Chapter 6. However, the survey indicated that Guideline Daily Amounts (GDA), energy and combined (GDA and colour coding) were also present on child-focused food products, although to a much lesser extent than TLL (ranging from 20.4-23.1%, 18.4-19.0% and 0.5-0.6%, respectively).

7.1.1.1 Future directions for research

The current study assessed each store three times (August, October and December) across a period of 5 months. Future studies may wish to expand upon the current study, by including additional time points which span the whole year to allow for a more complete overview of the current UK supermarket foodscape and any seasonal variation that may exist. In addition, this data collection should be repeated in years to come, so that comparisons over time can be made. Ongoing monitoring of the current UK foodscape is essential for moulding policy change and intervention at a societal level, which should support healthier food behaviours in individuals.

Data collection was completed in 4 large Tesco® stores, meaning a reliable and representative dataset, however, comparisons between different stores which share the UK market with Tesco® may offer additional insights into the UK foodscape, and offer a more comprehensive account of both the exposure to, and power of, persuasive techniques used to promote foods to children at the point-of-sale.

The data collection itself is a lengthy process, and so other alternative methods of data collection may be adopted. For example, using supermarket websites to monitor their products and promotions, or obtaining sales data directly from supermarkets themselves. However, these methods are not without limitations either. Websites, for example, have the potential to display outdated information and pictures, it is difficult to assess the food packaging in great detail,

and various aspects such as the products location within the store could be assessed using these methods. However, by reducing the time spent in store, this may allow for the inclusion of more variables, for example, it would be interesting to look at additional factors such as the use of child-friendly fonts or brightly coloured food packaging. The nature of promotional techniques is constantly evolving and so future studies should reflect this.

There is much scope for empirical research which expands upon the power and exposure of food packaging techniques identified in Chapter 3. From an experimental perspective, establishing whether or not children are able to recognise and/or recall the various food packages and the persuasive techniques employed upon them may be a logical next step. Furthermore, it would be useful to empirically assess whether these techniques have any palpable influence on children's purchase requests when in store with their parents, or on children's actual purchases. This could provide some insight into the potentially pervasive nature of these promotions, and most importantly, their influence on actual consumer behaviours. As highlighted throughout this thesis, a number of factors have been identified which may mediate the impact of marketing techniques on children's eating behaviours (such as preference, choice and consumption); for example, weight status (Forman, Halford, Summe, MacDougall, & Keller, 2009; Halford et al., 2008; Halford, Gillespie, Brown, Pontin, & Dovey, 2004), in addition to individual differences such as appetitive children (Fisher et al., 2007; Fisher & Birch, 2002; Jansen et al., 2003) and personality traits (van Ittersum & Wansink, 2013). Experimental research which addresses the impact of food packaging and promotional techniques on purchasing behaviours, and potential mediators of this impact, would greatly enhance the existing body of literature.

7.2 Effects of acute, experimental exposure to on-package promotional techniques

7.2.1 Food preference and choice

One aim of this thesis was to assess the effects of acute, experimental exposure to various on-package promotional techniques on children's food preferences and choices. This was the primary focus of Chapter 4, which assessed specifically the use of brand equity (BE) characters on food packaging, and found that children were more likely to demonstrate a preference for foods which were presented with a BE character displayed on the packaging, when compared with a matched food presented without a BE character; this was true for two out of three matched food pairs when the food character associations were congruent (that is, when BE characters were presented on foods they are typically used to promote). While this was true for only one of the three matched food pairs when the food character associations were incongruent, it is worth noting that the results were approaching significance for the remaining matched food pairs.

In addition, when asked to make a choice and select a food they would consume as a snack, the children were more likely to choose a food item with a BE character than one without a BE character, with a vast majority (73%) selecting a food with a BE character when food pairings were congruent. Interestingly, however, when the food pairings were incongruent no difference was found between children choosing a snack food with or without a BE character. This thesis adds to the current body of literature, by consolidating existing literature that suggests that both branding (Keller et al., 2012; Levin & Levin, 2010; Robinson, Borzekowski, Matheson, & Kraemer, 2007) and promotional characters (de Droog et al., 2012; Kotler et al., 2012; Lapierre et al., 2011; Letona et al., 2014; Roberto et al., 2010; Tim Smits & Vandebosch, 2012; Ülger, 2008) can positively influence the preferences and choices of children in favour of the foods they are promoting. Specifically, this thesis addresses a gap in the current literature by demonstrating that BE characters have a similar influence to other promotional characters, which are currently subject to restrictions based on these influences. This suggests that BE

characters, like other promotional characters, should be subject to restrictions when promoting food to children, given that they predominantly promote unhealthy foods (see Chapter 3; Kelly et al., 2010). Furthermore, by demonstrating that this effect still exists when the food-character associations were incongruent (children preferred the foods presented with a BE character on the packaging, even when that BE character is not ordinarily associated with that particular product), it provides evidence of the 'beyond-brand' nature of these promotional characters. The 'beyond-brand' effect refers to the influence of food promotion at both a brand, and category level; that is, promotion of a particular brand can influence food-behaviours and outcomes in favour of the brand that is promoted, but also for foods which are in the same food category (Halford et al., 2008; Hastings, Mcdermott, Angus, Stead, & Thomson, 2006), meaning that the marketing of less healthful brands has the potential to perpetuate and encourage diet-related outcomes which favour categorically similar foods of equally poor nutritional quality.

There are several ways in which BE characters differ from licensed characters, with the association of the BE character being limited to a particular brand/product and licensed characters having a myriad of potential platforms via which associations can be formed (eg, TV shows, movies, food packaging, toys, and/or cereal bowls). This multifaceted approach could potentially lead to a much stronger perceived relationship between a consumer and the licensed character. Considering these differences, it is interesting that the effects of these two promotional character types (brand equity and licensed) on children's food choices and preferences seem to be so similar. This may suggest that the learned associations between the character and the product are not the driving factor behind the influence of promotional characters, but rather the simple presence of any well-liked and/or recognized character on the food packaging results in preference.

Batada and Borzekowski (2008) found that children with three or more television sets in their homes displayed greater recognition of characters and logos,

which suggests that increased habitual TV viewing would result in increased exposure to advertising and branding techniques. Due to the current trend for online advertising and advergaming, high Internet usage would plausibly result in the same increased exposure to marketing. Therefore, Chapter 3 also investigated whether increased exposure to TV and online advertising (with weekly TV viewing and internet usage hours used as a proxy measure) would have any effect on children's snack choices. No difference was found between high and low TV viewers or Internet users (based on median splits of the sample) for either congruent or incongruent pairings. However, it is worth noting that differences in high TV viewing and Internet usage groups were approaching significance for the incongruent pairings, with high groups for both TV viewing and Internet usage being more likely to select the snack with the BE character, and low groups being more likely to select the snack without. Furthermore, no positive correlation was identified between character recognition and liking, which was contrary to prediction.

Arguably, although these acute, experimental exposures are not necessarily representative of real life situations, when we consider that these food choices and expressions of preference may potentially occur several times a day at various eating events, the collective effect of children's repeated exposure to these promotional techniques and their influence on children's dietary decisions over time has the potential to contribute to poor dietary outcomes, such as positive energy balance and subsequent weight gain, or lower intake of fruit and vegetables, due to the high number of HFSS foods these BE characters predominantly promote.

As the findings of Chapter 3 suggest, BE characters are a popular method of food packaging promotional technique on child-specific foods, and rather worryingly, they are being used to predominantly promote less healthy foods. Food preferences are key determinants of actual dietary intake in children (Birch, 1998) and so environmental factors that potentially impact upon these food preferences should be considered in the fight against childhood obesity. They are of particular concern when these factors negatively impact upon dietary outcomes by increasing preference for HFSS foods. Promotional activities exploit children's innate food

preferences for sweet foods and foods with high fat content (which induce positive post-ingestive signals), which can result in increased intake of energy, resulting in possible weight gain and obesity, amongst other associated health problems.

The use of BE characters on food packaging has been demonstrated in the current thesis to have persuasive power, and therefore also provides an opportunity to promote healthier food choices and preferences, in a way that will appeal to children. Some experimental studies exist to date which demonstrate the use of promotional characters on healthier food items, for example, the use of licensed characters can increase reported liking and purchase intent for healthier foods, up to a similar level to that of the unhealthy foods (de Droog et al., 2011). Smits and Vandebosch (2012) reported that adding spokes-characters (another term for BE characters) to a food product can increase children's wished-for frequency of consumption and the expected number of purchase requests for these products, which was true for both healthy and unhealthy foods, and also for both familiar and unfamiliar spokes-characters. These studies place the use of promotional characters to promote healthier choices to children in a favourable light. However, two studies by Kotler, Schiffman and Hanson (2012), looking at, firstly, children's self-reported preferences and secondly, their actual food choice, found that children preferred foods that were associated with familiar and liked characters, with a particularly strong effect for sugary and salty foods. Placing favoured characters on healthier foods was not able to reduce children's preference for sugary and salty foods when these foods were in direct competition, but children did display within category preference (e.g. choosing between two fruits) for foods with the character present. However, one positive finding was that children were more likely to consume more of a healthy food presented with a favoured character, when compared to a disliked or an unknown character. One reason why the current study did not include healthier snack foods as stimuli is that BE characters are not generally used to promote healthier food choices in the UK and therefore no suitable character and snack food pairings existed which would represent familiar and well-liked BE characters. However, the findings of Smits and Vandebosch (2012) suggest that while familiar spokes-characters had a greater

effect, unknown characters were also capable of promoting both healthy and unhealthy food products and so it is not essential that these BE characters are long-standing, familiar and well-liked in order to encourage healthier choices.

As food preferences are more easily modifiable in childhood, developing preferences for healthier foods in earlier life may lay the foundations for the continuing development of food preferences across the lifespan, with the potential for healthier preferences and subsequent healthier choices in adulthood (Ventura & Worobey, 2013). On the whole, the findings of previous research as discussed are tentative, and therefore the use of promotional characters to promote healthier choices needs to be further explored before definitive conclusions can be made regarding their effectiveness when promoting healthier foods to children.

7.2.1.1 Future directions for research

The research described in Chapter 4 adopted an experimental approach to investigate the effects of acute, experimental exposure to BE characters on food packaging, using actual existing BE characters and their associated snack foods as stimuli. This work has generated research questions that could be addressed by further experimental studies. Although weight status differences in response to the BE characters could not be tested in the current study, due to relatively few overweight and obese participants, these differences have been found to exist in similar research which addresses the responsiveness of children to food cues. One early study assessed differences between lean, overweight and obese children's abilities to recognise food and non-food related adverts, and whether recognition was related to their subsequent consumption of sweet and savoury, high and low fat snack foods. Obese children recognised significantly more of the food adverts, which correlated with the amount of food they ate after exposure to these advertisements, demonstrating children's heightened awareness of food related cues, such as TV advertising (Halford, Gillespie, Brown, Pontin, & Dovey, 2004). A subsequent study looked specifically at branding (Forman et al., 2009), and found that overweight children consumed significantly more calories from branded than unbranded meals, compared to non-overweight children who ate significantly less

during the branded meals than the unbranded meals, thus demonstrating a greater responsiveness to food branding in the overweight children. These findings suggest that overweight children may be more susceptible to cues such as branding which are abundant in the obesogenic environment.

As overweight children have been demonstrated to overeat in response to food cues, compared to normal weight children, it is important to establish whether food cues such as the placement of BE characters on food packaging will also elicit a different response amongst different weight statuses in children. The current study (Chapter 4) of this thesis used a convenience sample, however, future studies should aim to recruit larger numbers of overweight and obese children to allow for statistical comparisons to be made. If individual differences in responsiveness to certain food related cues are found, these can be used to guide the development of interventions which may shield those who are more susceptible to these external cues

Parasocial relationships are a possible mechanism of the effect of BE characters on children's food preferences and choices. Future research may wish to further explore this mechanism, by measuring the extent of existing parasocial relationships. Schramm and Hartmann (2008) developed the Parasocial Interaction (PSI)-Process Scales which could be applied directly after TV exposure in order to measure parasocial processing during an individual's media exposure. However, this tool was developed for, and validated in, an adult population. It would be useful for future research to adapt this scale for application within a child population, so as this potential mechanism of the BE character effect can be further explored. This scale would have a wider application than just the influence of BE characters, being relevant to a variety of media personalities, including the use of celebrity endorsements, licensed characters and also the current rise in reality TV stars and YouTube® celebrities.

7.2.2 Serving size and consumption

In children, food preference often leads to food choice, but an additional factor to consider is how much food children will actually consume. Over-consumption has the potential to result in positive energy balance, weight gain and health risks, particularly when it is HFSS foods, like those which are predominantly marketed to children, which are overconsumed. Chapter 5 was concerned with how on-package depictions of portion sizes may act as a visual cue, influencing how much food children served themselves and subsequently consumed.

The existing body of evidence has consistently demonstrated that children will consume more food when served a larger portion than when served a smaller portion (Fisher, Liu, Birch, & Rolls, 2007; Huss, Laurentz, Fisher, McCabe, & Kranz, 2013; Kling, Roe, Keller, & Rolls, 2016; Kral, Kabay, Roe, & Rolls, 2010; Looney & Raynor, 2011; Mathias et al., 2012; Smith, Conroy, Wen, Rui, & Humphries, 2013), and so factors which may influence children's self-serve portions are of interest, as it is plausible that similar effects would result. As predicted, the current study found a moderate, positive correlation between the amount of cereal children served themselves and the amount of cereal they then consumed, showing that self-served amounts are a valid measure of intake.

The main predictions for this study were that children allocated to the larger portion size depiction condition (in which the portion depicted on the cereal box actually reflected three times the recommended serving size) would both serve and consume more cereal than those in the smaller condition, which was found to be the case. Children in the large portion condition both served and consumed more cereal than the children in the small portion condition, irrespective of BMI z-scores, pre-meal ratings of hunger or anticipated liking of the cereal. There was also a significant main effect of portion size depiction condition on the total calories served and consumed, with children in the larger portion condition serving and consuming more calories than those in the smaller portion condition across the entire meal (including cereal and milk). In addition, no significant main effects were found on the combined calories for the entire meal, or milk served or consumed

(kcals and grams). However, this may reflect a ceiling effect whereby the majority of children poured themselves the full amount of milk that they were offered, irrespective of how much cereal they had served themselves. However, overall these findings corroborate the existing body of literature which, as previously highlighted, demonstrates that portion size has an acute effect on the consumption behaviour of children. Furthermore, it corroborates the additional literature discussed in Chapter 5, which suggests that visual cues can influence perceived consumption norms and subsequent intake in acute, experimental studies.

The subtle manipulation in the current study appears to have a tangible effect on children's serving sizes and consumption, and therefore provides an opportunity for intervention. In particular, these findings support those of Neyens, Aerts, & Smits (2015), who also found that by exposing children (*n*=22, Belgian children aged 4-5 years) to a large image-size on the front of a cereal box, children served and consumed more cereal and milk, than when exposed to a small image-size. These findings suggest that by providing a clear visual reference to inform children's decisions, in the form of a front-of-pack portion size depiction, it is possible to signal to the child what an appropriate amount to consume is, and influence both their serving size and subsequent consumption.

There is a wealth of literature which suggests that children's eating behaviours are developed as a result of social learning, and are directly influenced by the behaviours and preference of others, such as peers, parents and siblings, when eating in their company (Birch & Fisher, 1998; Birch et al., 2007; Hendrie et al., 2013; Herman, Roth, & Polivy, 2003; Robinson & Higgs, 2013). A variety of experimental studies and reviews which focus on social modelling in children, adolescents and adults report that an individual's food intake is greatly influenced by the eating behaviours of peers, which is referred to in the literature as social modelling (Bevelander, Anschütz, & Engels, 2012; Feeney, Polivy, Pliner, & Sullivan, 2011; Herman et al., 2003; Robinson, 2015; Robinson & Higgs, 2013; Vartanian, Sokol, Herman, Polivy, & Bastian, 2013). It is clear that children respond to these environmental cues, and so it is possible that the portion size depiction on the front

of the cereal box acts like a remote peer, providing a visual cue to the child of what is an appropriate amount to serve and consume. Appropriateness has been suggested as a potential mediator of the portion size effect, where people accept the portion that they are served as being appropriate, and they eat accordingly. However, as variations exist in individual consumption responses to serving sizes, where people do not always finish the entire portion which they are served, Herman, Policy, Pliner and Vartanian (2015) suggest that visual cues may not only assist people in assessing an appropriate amount to consume, but may also be encouraging intake in a more mindless and automatic manner.

While the differences between the amounts of cereal served and consumed were small (with 7g/26.5 kcals more being served in the large condition than the small, and 5.99g/2.66 kcals more being consumed in the large condition than in the small), over time these small differences would accumulate. If a child were to consume an extra 22.6 kcals at every breakfast meal, this could potentially result in consuming an additional 8249 kcals over the course of a year. Hill, Wyatt and Peters (2012) have conservatively estimated, using longitudinal and cross-sectional data sets, that average weight gain was due to a positive energy balance of approximately 15 kcal per day, at the 90th percentile of weight gain this was approximately 50 kcal per day. Under the assumption that excess energy is stored with 50% efficiency, they were able to predict that weight gain in 90% of the adult population was preventable by reducing positive energy balance by approximately 100 kcal per day. Furthermore, Wang, Gortmaker, Sobol and Kuntz (2006) estimated that, in children and adolescents, weight gain could be prevented by a reduction in positive energy balance of approximately 150 kcal per day.

When considering the findings of the current study, external cues to over-consume may not be limited to breakfast and may extend to other meals, and so the number of kcals over-consumed each day could further increase, potentially resulting in positive energy balance and subsequent weight gain over time. In addition to visual cues such as those assessed, children are also exposed to various

other forms of portion-related information, such as recommended serving sizes and pre-packaged servings, which may additionally impact upon their consumption.

Livingstone and Helsper (2006) believe that these subtle and implicit marketing cues, such as images on food-packaging, are designed to unconsciously affect young children, and the current study has provided further support for these claims. Policy makers should consider regulating aspects of food packaging, such as front-of-pack images, in order to reduce over-consumption and help children to better regulate their own intake.

7.2.2.1 Future directions for research

Further research is needed to expand upon the current research paradigm. One possibility would be introducing additional conditions with varying portion sizes, to establish if there is a cut-off point (higher or lower) at which this manipulation no longer has an influence on children's serving and consumption. A meta-analysis by Zlatevska et al. (2014) reported a curvilinear effect of portion size, whereby as portions become increasingly large, consumption levels begin to taper off, however, this is in adult populations only and so the point at which this effect begins to wane in child populations should be established empirically.

Furthermore, as adults have been serving and consuming their food habitually, over the course of a lifetime, it would be reasonable to assume that such a subtle manipulation would have little effect on their engrained norms regarding what constitutes a suitable portion, and so this would be interesting to establish. Therefore, including a larger age range, from childhood through to adult populations, could help to identify at which age children take note of these suggestive food images, and whether or not this effect is carried through to adulthood.

There are many additional ways in which to adjust the existing paradigm to expand upon the current knowledge base. If children are susceptible to these subtle and implicit marketing cues, perhaps they could be encouraged to make additional healthier choices via these on-package images, beyond just portion control. For

example, future studies could assess whether including images of additional breakfast items alongside the cereal portions depicted, such as fruit or yoghurt, could encourage children to select more of these healthier items from an *ad libitum* breakfast.

Moreover, there may be further adaptations to the current paradigms which could improve our knowledge and understanding regarding the influence of food packaging, by drawing from the wider literature on food cue responsiveness. The idea that eating behaviour is often guided by responses to food cues, rather than physiological need has been well evidenced (Lowe & Butryn, 2007; Schüz et al., 2015). Snack foods, or foods consumed outside of main meal occasions, seem to be influenced more by food-related cues than main meals (Cleobury & Tapper, 2014). With this in mind, it would be useful to expand upon the current study, which addresses only breakfast cereal, by looking at whether this effect translates to a variety of meal occasions, snacks and food types. As snack foods are often HFSS, and have been implicated as a contributory factor in the obesity epidemic (Farley, Baker, Futrell, & Rice, 2010), reducing snack intake is a possible weight management strategy and so establishing ways to encourage appropriate portion control when snacking may provide a useful intervention from a weight management perspective.

An existing body of evidence suggests that observing other people eating creates an implicit eating norm, which makes food choices or amounts consumed seem more or less acceptable to the individual (Prinsen et al., 2013). However, not every individual responds to these external food cues in the same way, with some cues being more pertinent to certain individuals (Lowe & Butryn, 2007), and so individual differences in the effects of external food cues is of particular interest to psychologists.

This study was interested in children's individual differences in responsiveness to this particular external, food-related cue (front-of-pack portion size depictions). Using the Child Eating Behaviour Questionnaire (CEBQ), focus was given to the appetitive traits of food responsiveness and enjoyment of food, which

are behavioural traits that reflect eating in response to environmental food cues, and therefore were of particular interest in this study. Interestingly, we found no effect of either trait on children's responsiveness to condition. This was a novel aspect of the study, however, it is in contrast with the wider body of literature which would suggest that a tendency to eat in response to environmental food cues would result in a greater effect of this particular manipulation. Further research should consider that this study may not have been sufficiently powered to detect any existing differences across these traits and that the median split to establish high and low scores may have resulted in a loss of sensitivity within the data, with moderate scorers diluting the effect.

7.2.3 Food evaluations

Chapter 6 used a repeated measures design to assess children's ability to use a front-of-pack nutritional labelling system, in this case, Traffic Light Labelling (TLL). Measures of children's accuracy when using TLL to identify the healthier item from a matched food pair, were taken at baseline (pre-intervention), immediately post-intervention, and again at a two-week follow-up post-intervention.

The majority of children scored highly at baseline, with 93% being the mean accuracy result pre-intervention, which was much higher than predicted. While investigating children's ability to employ TLL is novel in the literature, these findings corroborate the existing adult literature regarding the use of TLL, for example, Which? (2006) found that TLL were most useful when individuals were confronted with a pair of foods from which they were asked to identify the healthier item. In addition, research has suggested that when colour coding was employed, participants perceived themselves to be more capable of selecting healthier foods when instructed to (Aschemann-Witzel et al., 2013). The baseline accuracy scores lend support to the UK Government's recommendations that TLL be the preferred nutritional labelling system in the UK, and as Chapter 3 highlighted, they are the most commonly used nutritional labelling system on child-focused foods in the UK supermarket. It would appear that these are a clear and easily understood avenue

to convey the relevant nutritional labelling in a meaningful way to consumers of all ages.

Chapter 6 was concerned with the effects of a brief, online intervention at increasing children's ability to accurately apply TLL to make within-pair food evaluations (needing to select the healthier item from a series of pairs). Two post-intervention measures were taken, one immediately post-intervention and one at a two-week follow-up, in order to assess whether any effects would last. While accuracy did increase at each subsequent time point, it was only at the two-week follow-up that statistically significant differences in accuracy scores, compared to both baseline and immediately post-intervention, were detected. It is interesting that immediately post-intervention there were no significant increases in accuracy relative to baseline. This may be due to fatigue effects, as children had already completed this task pre-intervention and subsequently watched the intervention video. However, at the two-week follow-up, the mean accuracy score was 100%, which was significantly greater than at both baseline and immediately post-intervention, indicating that the intervention did improve children's accuracy when applying TLL in food evaluation scenarios.

Experiential Learning Theory would suggest that learning is "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p.38), and it could be argued that children learn better when they are actively involved in the process, and have time to reflect on what they have learned. While this explanation is speculative, and based on limited anecdotal evidence provided by parents with regards to children's engagement with TLL post-intervention in supermarkets and in the home, this theory of learning is supported in the existing literature. A meta-analysis by Dudley, Cotton and Peralta (2015) reported that experiential learning strategies were associated with the largest effects across a variety of healthy eating outcomes in primary school-aged children.

The TLL intervention was found to have the greatest effect on low baseline performers, that is, the children in the low accuracy group at initial testing, bringing their scores in line with the children who performed best at baseline. The

intervention may therefore appears most useful at bridging the gap in performance and increasing the knowledge and comprehension of TLL in those children who started at a lower baseline. In other words, this type of intervention may be appropriate to target those who are most in need of such support. Existing health inequalities are a pertinent topic in public health debates surrounding nutrition and healthy eating strategies, particularly in children, and so the development of interventions which can close, or reduce, the inequality gap in nutritional labelling use may provide a useful tool in the fight against childhood obesity.

7.2.3.1 Future directions for research

Given that TLL are the dominant nutritional labelling system on child-focused foods, as evidenced in Chapter 3, and are the recommended system here in the UK, they are an obvious choice for investigation as the findings have real-world relevance for public health. However, they are not the only system in use. It would be useful for future research to develop the existing paradigm to assess whether children are able to accurately employ additional types of nutritional labelling which are currently used in the UK, so as to further understand what children can successfully comprehend and apply when evaluating the healthiness of foods. Furthermore, the current study used matched food pairs, which could be expanded upon to include more than two options, to avoid children simply guessing the correct answer.

While asking children to select the healthier item from food pairings is technically asking them to make a choice, in this instance it only represents children's ability to accurately apply the TLL system and is not necessarily representative of the actual food choice they would make. The logical next step in this field of research is to establish whether or not children's ability to correctly interpret and apply TLL would translate to having a tangible effect on their actual food choices. Future studies may wish to empirically test this, for example, by providing children with *ad libitum* meals with a variety of pre-packaged foods presented with TLL labels, both pre- and post-intervention, to assess any changes in children's selections and consumption.

Bandura's (2004) Social Cognitive Theory would suggest that an individual's perceived self-efficacy can be raised if they perceive their capabilities as improving, and so with this in mind, TLL systems may be a useful public health tool which improves self-efficacy levels at an individual level, resulting in subsequent healthier decisions. The Food Standards Agency Strategy Report 2015-2020 suggested that lack of confidence and frustration were some of the main obstacles consumers faced when using nutritional labelling, and so improving perceived self-efficacy could be a useful tool for intervention. With this in mind, future studies may wish to measure children's perceived self-efficacy as a way to further understand the mechanisms behind these food-based decisions and evaluations.

Based on the theory that children learn better through experiential learning (see previous section), there is also the possibility of further developing the current paradigm to involve a battery of more engaging and interactive tasks to assess their ability to use TLL, such as simulated shopping tasks and games. Moreover, future studies should attempt to measure and quantify parental engagement and children's engagement with these skills in real-life settings, in order to establish whether these factors mediate the impact of the intervention.

Online research limits the amount of experimental control one has, but as this was a feasibility study the tools and findings provide us with the basis for developing an intervention further into a more workable and fruitful model. This type of intervention may work well in school settings, if the paradigm were adapted to form part of the school's healthy eating curriculum. School based research would allow for more data collection, which would permit more in-depth analysis of individual differences, for example, the influence of socioeconomic differences.

Furthermore, high and low accuracy groups at baseline were defined using a median split of the population. While some differences were detected, these were subtle. The median split may have resulted in a loss of sensitivity with the data, but due to the relatively small number of participants in this particular study a tertiary split would not have been suitable. Future studies could recruit a larger sample, so as to more clearly define high and low accuracy groups.

7.3 Final summary

In summary, this thesis has added to the current knowledge surrounding the influence of on-package promotional techniques on children's eating behaviours. Specifically, it has addressed the power of, and exposure to, food packaging promotional techniques in a UK supermarket setting for the first time; the effects of acute exposure to BE characters on children's food preferences and choice; the influence of portion size depictions on food packaging on children's serving and consumption; and finally, children's ability to accurately use TLL to select the healthier foods from within a matched pair, and the efficacy of a brief online intervention aimed at improving their accuracy when using TLL.

The principal findings indicate that the use of persuasive techniques on food packaging of child-focused products are predominantly used to promote unhealthy foods. The majority of child-focused foods in the UK supermarket setting are classed as unhealthy by the nutrient profiling model used to govern what can and can't be advertised to children on television, with non-alcoholic beverages and confectionery being the dominant food groups. This suggests that much work is needed to redress the balance between healthy and unhealthy foods being promoted to children via food-packaging, which is, for the most part, unrestricted, with regards to the employment of persuasive techniques. The most commonly used promotional characters were BE characters (the focus of Chapter 4), the majority of which were found on unhealthy foods, and TLL were the most commonly found nutritional labelling system on child-focused foods (the focus of Chapter 6).

This thesis also indicates that acute exposure to BE characters on food packaging does in fact have an influence on children's self-reported food preference and their actual food choices, regardless of whether the character-food associations are congruent or incongruent. This thesis also demonstrated that visual cues on food packaging, such as portion size depictions on the front of a cereal pack, have a tangible effect on the amount of food children will serve themselves and then subsequently consume, irrespective of their weight status, hunger and

predicted liking of the cereal. Furthermore, it was shown that children can successfully apply TLL (the UK's recommended nutritional labelling system and most commonly found system on child-focused foods as indicated in Chapter 3) to make accurate, within-category food evaluations and select the healthier item within the pair. Moreover, those children who had lower levels of accuracy at baseline benefitted most from a brief online intervention which increased their accuracy to 100%.

These experimental studies help us to further understand the influence and persuasive power of a variety of different promotional techniques which are commonly used on food-packaging in the UK. Furthermore, it has addressed the influence of these techniques on a variety of different food-related outcomes which may contribute to positive energy balance and a diet of poor nutritional quality. However, there is still scope for much more research to delve further into the mechanisms and individual differences that may mediate the effects of these manipulations. Lab-based and experimental findings may not necessarily translate into everyday eating behaviours, but provide the proof of concept that can then be adapted, and used to form the basis for behavioural interventions that take into account individual differences in responses to external food cues.

Increasing our understanding of environmental determinants of eating behaviours is crucial if we are to encourage healthier food preferences, choices and consumption levels in children. Not only will this benefit children in the immediate term, but will help them develop healthier eating patterns which may last in the longer term also. The current 'obesogenic environment' promotes the intake of highly palatable, energy-dense foods, which are readily available, and relentlessly promoted through complex, integrated marketing strategies. Section 1.4.2.3.1 discussed the WHO recommendations on marketing food to children, which suggested that policy should aim to reduce the impact on children of marketing foods which are HFSS, with an overall objective of reducing both the power of, and exposure to, the marketing of HFSS foods (WHO, 2010). In order to inform the development of new policy, a body of strong empirical evidence is required

demonstrating the extent of children's exposure to these marketing techniques and also the power or the influence of the techniques identified. Attempts have been made to reduce and restrict TV advertising of HFSS foods to children, so when we consider that the majority of child-focused foods in supermarkets are also HFSS, tighter restrictions are needed which would limit the use of such promotional techniques on food packaging when marketing foods to children.

In line with the WHO recommendations (WHO, 2010), the current thesis has quantified, for the first time, the exposure children have to various on-package persuasive techniques in a UK supermarket. As well as establishing the extent of commonly referred to techniques, it also helped to identify additional techniques which are overlooked in the current literature and the types of foods they are used to promote, thus identifying potential avenues for future research. Furthermore, it has established the power, or influence, of various persuasive techniques which are currently employed on food-packaging to promote HFSS foods to children. Specifically, the findings suggest that current policy on licensed characters should be extended to include BE characters, which have been demonstrated to have a similar influence on children's eating behaviours. Furthermore, by identifying additional types of promotional characters in Chapter 3 which may influence children, avenues for more research have become apparent. These additional techniques lend support to the WHO (2010) recommendation to have clear definitions for key policy terms, such as a comprehensive definition for promotional characters as a whole, as opposed to differentiating between the various types.

Efforts should be made by policy makers, food manufacturers and advertisers to reduce overconsumption and poor food choices in order to help curb the current childhood obesity problem, and its associated health risks. This should be done by highlighting current research needs, which will help to identify policy loopholes which may potentially be exploited, and by introducing comprehensive, evidence-based policy, with clearly defined key terms.

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Appendix 2a

Parental Information Sheet

Pilot study of children's awareness of brand equity characters

Your child is being invited to participate in a research study. Before you decide whether or not you are happy for them to take part, it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything you do not understand. Please also feel free to discuss this with your child; it is very important that they are not coerced to take part. You should only accept this invitation if you and your child are both happy to do so.

What is the purpose of the study?

Overall, we are interested in finding out whether or not brand equity characters (such as Tony the Tiger for Kellogg's Frosties) affect children's taste preferences and food choices. First, we need to know what characters UK children have heard of, and like, and what they know about the character (such as what foods they are associated with). This will allow us to choose the best characters to use in future studies.

Why has my child been invited to take part?

We are looking for volunteers who are aged 4-8 years old and have lived in the UK for at least the last 3 years. If your child meets these criteria, then they are eligible to take part.

Does my child have to take part?

Neither you nor your child is under any obligation to take part in this study. It is completely your choice and your child's choice. If you do decide to take part, and your child is also happy to do so (see below), then you are free to withdraw at any time and without giving a reason, without incurring a disadvantage.

What will happen if I agree for my child to take part?

If you agree that your child can take part, we ask that sign the end of this form (where specified) to indicate that you give your consent for your child to participate. We also ask that you ensure that your child is happy to take part by allowing them to read /reading to them (depending on how best you think they would be able to understand the information) the information below and allowing them to sign the form where appropriate.

Then we will ask that you sit with your child and go through the enclosed questionnaire, completing all sections as fully as possible. Finally we ask you to please return the consent form and completed questionnaire to the researcher, Ms Lauren McGale or principal investigator, Dr Emma Boyland, by email (scanned documents/electronic signature applied) or post (pre-paid envelopes can be provided) using the details overleaf.

How do I report a complaint about this study?

Nearly all children enjoy taking part in studies like this one, which has been approved by the University of Liverpool Research Ethics Committee. However, the University have a formal procedure to deal with complaints and for the reporting of adverse effects. If a participant or a participant's representative wishes to raise a concern about the study, and in particular about the conduct of the study or the individuals involved, that would be inappropriate to raise with the principal

investigator (Dr Emma Boyland 0151 794 1137), please use the complaints procedure. Complaints should be addressed to the Research Governance Officer in Research and Business Services (ethics@liv.ac.uk, 0151 794 8727). Please provide the identifying information below:

Principal Investigator: Dr Emma Boyland

Research Project Title: A study to investigate if brand equity characters have an impact on children's taste preferences and food choice, also considering character recognition and liking.
Ethics Reference Number: RETH000617

We do hope that you will be happy for your child to participate.
Yours sincerely,
Ms Lauren McGale and Dr Emma Boyland
University of Liverpool

Contact details:
Email:
Researcher Ms Lauren McGale
Email: lmgale@liverpool.ac.uk

Principal Investigator Dr Emma Boyland
Email: e.boyland@liverpool.ac.uk

Postal address for both (pre-paid envelopes can be provided upon request):
Department of Experimental Psychology
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Eleanor Rathbone Building
Bedford Street South
Liverpool
L69 7ZA

Child Information Sheet

Hello, my name is Lauren and I'm from the University of Liverpool. I am writing to you because I am interested in finding out what cartoon characters you like and what you know about them.

If you are happy to take part, a member of your family will sit with you and show you some pictures of cartoon characters. They will ask you if you have ever seen the characters before and if so, where you have seen them. They will also ask how much you like the characters.

You don't have to take part if you don't want to, and if you start and then decide you don't want to do anymore then that is fine too!

Thank you for reading about my study!

Pilot study of children's awareness of brand equity characters

PARENT/GUARDIAN CONSENT FORM

PLEASE RETURN THIS FORM WITH THE COMPLETED QUESTIONNAIRE TO TAKE PART

I am/am not (delete as applicable) willing for my child to participate in the above study.

I have read and understood all the information provided in the information sheet and above, and have had any outstanding queries answered to my satisfaction.

Signed…….Date……

Name of parent/guardian……..…(BLOCK CAPITALS PLEASE)

Name of child……..(BLOCK CAPITALS PLEASE)

Age of child (years and months): …….

Gender of child: Girl / boy (circle as appropriate)

University of Liverpool

Pilot study of children's awareness of brand equity characters

CHILD CONSENT FORM

I understand what this study is about and I am happy to take part

Signed…….Date……

Appendix 2b

Pilot study of children's awareness of brand equity characters

Please only complete this questionnaire if both you and your child are happy to take part in this study and have both signed the consent forms provided.

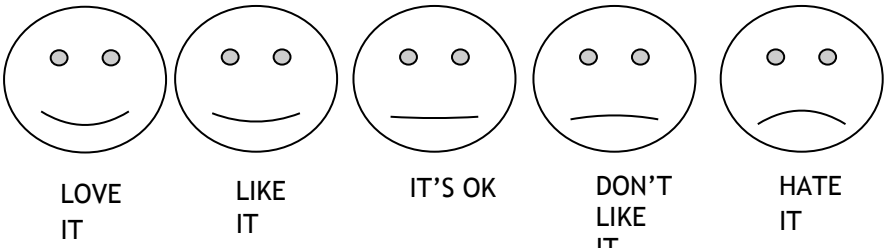
Please show your child the picture below:

1. Does your child recognise this character? YES / NO (circle as appropriate)
2. If yes, where have they seen this character before? (please give as much detail as possible, e.g. if they know the name of the character, if they mention advertising, food, packaging, Kellogg's or Frosties etc. Please only prompt for clarification, not to suggest what the 'right answer' might be).

   _____

   _____

3. How much does your child like the character on the scale below? (mark the appropriate face)



Appendix 2c

Recognition

Combined Scores – potential of two points, 1 if they recognised the character and 1 point if they could name the character/product associated with it.

Top 5:

1. Coco Pops/Coco the Monkey	53
2. Pringles	50
3. Pom Bear	48
4. Rice Krispies	46
5. Cheestrings	46

Liking

Total score out of 4, based on smiley face likert scale.

Love it – 4

Like it - 3

It's Ok – 2

Don't like it – 1

Hate it – 0

Top 5:

1. Coco Pops	97
2. Cheestrings	80
3. Pringles	80
4. Pom Bear	79
5. Frosties	79

(M&M's close behind, with 78)

Total Score

Each product ends up with a total score, by combining recognition and liking scores.

1. Coco Pops	97
2. Pringles	80
3. Pom Bear	80
4. Cheestrings	79
5. Frosties	79

Appendix 4a

Head teacher Information Sheet and Consent Form

University of Liverpool

<u>Study of brand equity character effect on taste and choice.</u>

Dear Sir/Madam,

I am a postgraduate student pursuing a PhD at the University of Liverpool and am currently conducting a research study in the area stated above for my doctoral thesis. I have Criminal Record Bureau (CRB) approval to conduct research with children.

To do this study I need a sample of children (aged between 4-8 years) to take part in the study on a single day. On this occasion, I will sit with each participating child on a one-to-one basis in a designated area of the school. I will show them three pairs of foods in (Coco Pops Snack Bar, Cheestrings, Pom bear Potato Snacks) one of each pair will have a brand equity character on the packaging. I will ask the child to taste each item. I will then record their responses to a few questions about the taste of the food, which food they would choose for a snack and whether or not they recognise and like the character shown on the packaging. I will then allow them to select one of the foods as a snack for them to eat when appropriate.

After all participating children have completed this part of the study I would need to record each of their weight and height measurements in private with a member of school staff present at all times. All data collected would of course be kept strictly confidential, with children being allowed to withdraw from the experiment at any time they wish. After initial explanation of the study procedure to all children, the experiment itself should take no longer than 20 minutes per child.

I have a consent form on which parents will be asked to indicate whether or not their child has any history of food allergies or intolerance and whether they are willing for their child to participate. If so there is also a questionnaire for parents to complete on their child's behalf. This includes questions related to their child's media use and consumer behaviour as well as optional questions asking for identification of their race/ethnicity and the parents' highest education level (factors which have consistently been shown to mediate the effects of marketing on children). Children will then be told what the study involves and asked themselves if they wish to take part in the study prior to data collection.

It would be very much appreciated if you would consider allowing me to conduct this research at your school. We will follow up this letter with a phone call to discuss possible arrangements, but in the meantime if you have any queries or require further information regarding the study, please do not hesitate to contact us (details provided below).

Many thanks,

Ms Lauren McGale

Investigator Contact Details:

School of Psychology
University of Liverpool
Eleanor Rathbone Building
Bedford St South
Liverpool
L69 7ZA

Tel.: (0151) 794 1137
Fax: (0151) 794 1405

INFORMATION SHEET

As you may be aware, the UK now has regulations governing the advertising of high fat, sugar and/or salt (HFSS) foods to children on television. These regulations prohibit the use of licensed characters (i.e. characters which have been created for an animated programme or movie and are then licensed by brands to appear in their promotions, e.g. Shrek) in HFSS food advertisements targeted directly at pre-school or primary school children. This prohibition does not apply to brand equity characters (which are created for the sole purpose of promoting a product or brand and have no separate identity outside of that role e.g. Tony the Tiger for Kellogg's Frosties). Previous studies have shown that licensed characters influence children's taste preferences and food choice decisions; we are interested in finding out if brand equity characters have the same effect.

This study will take place on one occasion during normal school hours. The study has two parts:

In Part 1, children will be asked to taste three pairs of common UK foods *(insert brands and names of foods when identified by pilot study),* and answer questions about the taste of the food, which food they would choose for a snack and whether or not they recognise and like the character shown on the packaging.

In Part 2 children's height and weight measurements will be taken, in private, with a member of staff present at all times. Results will be recorded discreetly so they are not seen by the child, or any subsequent children.

Ethics, confidentiality considerations and parental consent

Parts 1 will be carried out in an area of the child's normal classroom or a designated alternative area of the school (as preferred by school staff) with a member of staff present. Completed sheets will later be securely stored in a locked filing cabinet at the University. These sheets will not include children's names, but will include a numerical "key" for each participant (this is simply to allow us to destroy the child's sheets if their parent/guardian withdraws consent after the data has been collected). After the study has been completed and written up, the key sheet will be destroyed.

Part 2 will be carried out in a private room, with a member of school staff present at all times. Any children who do not wish to be weighed or measured will not be coerced.

In the write-up of the research, the data will be presented completely anonymously, without referring to individual children (e.g. “75% of children preferred the taste of the food with the character on the packaging”). The school will also be sent a summary of the results of the study (again, this will not refer to individual children).

Please note that this research is not aimed at assessing individual children’s diet or health, and indeed does NOT produce any score that can be taken as a measure of this. This research will not “test” individual children.

Contact Details

If you would like further information on this study or have any questions, please do not hesitate to contact me by email (lmcgale@liverpool.ac.uk) or contact my supervisor, Dr Emma Boyland (University of Liverpool) on 0151 794 1137 or by email at e.boyland@liv.ac.uk.

CONSENT FORM

HEADTEACHER: Please read the statements below before signing.

*I have read the information outlined in the information sheet.

*I agree to the children in my school taking part in the study outlined in the information sheet.

*The investigator has answered all my outstanding questions about the study and its purpose.

*I understand that I can withdraw from the study at any time. I understand that if I wish to withdraw from the study after taking part, I can request that any data collected from the children at my school be destroyed. However, I understand that this will not be possible if the study has already been submitted for publication.

*I understand that all data will be anonymous and confidential. The children will not be identifiable in any publications. Only the investigators at the University of Liverpool will have access to the raw data.

*I understand that, in accordance to the Data Protection Act, I can request access to the data collected.

NAME OF HEAD TEACHER: _____

SIGNATURE:_____ DATE: _____

RESEARCHERS: Please read the statements below before signing.

*I agree that the head teacher or parent/guardian can choose to withdraw their child at any time.

*I understand that if the head teacher or parent/guardian wishes to withdraw from the study after taking part, I must destroy all data if they so request it. However, I understand that this will not be possible if the study has already been submitted for publication.

*I agree to keep all data anonymous and confidential and not to allow access to raw data to any investigator outside the University of Liverpool.

NAME OF RESEARCHER:

_____

SIGNATURE:_____ DATE: _____

Appendix 4b

Parental Information Sheet and OPT-IN Consent Form

University of Liverpool

Study of the effect of brand characters on taste and food choice.

Dear Parent/Legal Guardian,

At the Laboratory for the Study of Human Ingestive Behaviour at the University of Liverpool, we investigate how children make food choices. Mrs Rick has kindly agreed that we can conduct one of our food choice studies at Kind David Primary School.

Information about the study

The UK now has rules about how high fat, sugar and/or salt foods can be advertised to children on television. Advertisers are not allowed to use licensed characters (which are characters borrowed from familiar cartoons and tv programmes e.g. Shrek) but they can use brand characters (which are characters developed solely for the promotion of a food product e.g. Tony the Tiger for Kellogg's Frosties). Previous studies have shown that licensed characters influence children's taste preferences and food choice decisions; we are interested in finding out if brand characters have the same effect.

This study will take place on one occasion during normal school hours. The study has two parts:

In Part 1, children with parental consent for participation and who have indicated that they wish to take part in the study will be asked to taste three pairs of common UK foods *(Pom Bear crisps, Cheestrings and Coco Pops Cereal Bars)* and answer questions about the taste of the food, which food they would choose for a snack and whether or not they recognise and like the character shown on the packaging. They will be allowed to select one item to take away as a snack food to be eaten when appropriate.

In Part 2 children's height and weight measurements will be taken, in private, with a member of staff present at all times. Results will be recorded discreetly so they are not seen by the child, or any subsequent children.

Ethics, confidentiality considerations and parental consent

Children tend to enjoy these studies and are usually eager to participate. <u>However, we require consent from you before your child can take part.</u> Participation is entirely voluntary and you may withdraw your child at any time without having to give a reason, and without detriment to you or your child (if you withdraw your child after the study has begun we will destroy any data already collected). If any child does

not want to participate themselves they will not be asked to, even if you have given your consent for your child to participate.

Children will work with me, a PhD student at the University of Liverpool, in their usual classroom/another area in the school with a member of school staff also present at all times. I have full "Enhanced Disclosure" Criminal Records Bureau certificates (the same certificate that teachers are required to obtain) to work with children.

Only the researchers involved (myself and my supervisor) will have access to the data, and the children's names will not be stored with the data. In the write-up of the research, the data will be presented anonymously, without referring to individual children. The school will also be sent a summary of the results of the study (again, this will not refer to individual children).

Reporting complaints and adverse events

Nearly all children enjoy taking part in studies like this one, which has been approved by the University of Liverpool Research Ethics Committee. However, the University have a formal procedure to deal with complaints and for the reporting of adverse effects. If a participant or a participant's representative wishes to raise a concern about the study, and in particular about the conduct of the study or the individuals involved, that would be inappropriate to raise with the principal investigator (Dr Emma Boyland 0151 794 1137), please use the complaints procedure. Complaints should be addressed to the Research Governance Officer in Research and Business Services (ethics@liv.ac.uk, 0151 794 8727). Please provide the identifying information below:

Principal Investigator: Dr Emma Boyland

Research Project Title: A study to investigate if brand equity characters have an impact on children's taste preferences and food choice, also considering character recognition and liking.

Ethics Reference Number: RETH000617

Please aid our screening process by stating clearly if your child has any history of food allergies or intolerance; also please indicate whether or not you are willing for your child to take part in this study by completing the slip below. Please sign, detach, and return the slip at the bottom of this page BY 9TH FEBRUARY when the study will begin. If you are willing for your child to participate, please also complete the enclosed questionnaire and return it with the form below.

We hope that you will be happy for your child to participate.

Yours sincerely,

Ms Lauren McGale

University of Liverpool

Study of brand equity character effect on taste and choice.

PARENT/GUARDIAN CONSENT FORM

PLEASE RETURN BY DATE

Please read carefully and tick the applicable box. If you have read the list of foods included in this study and are in any doubt about the potential health consequences of your child taking part then please tick the second statement.

My child has NO history or any food related illness/allergies/intolerances ☐

My child DOES have a history of food related illness/allergies/intolerances ☐

I am/am not (delete as applicable) willing for my child to participate in the study to be conducted at <insert school>

I have read and understood all the information provided in the information sheet and above, and have had any outstanding queries answered to my satisfaction.

Signed…….Date……
……

Name of parent/guardian……..…(BLOCK CAPITALS PLEASE)

Name of child……..(BLOCK CAPITALS PLEASE)

Child's date of birth…….

Study of brand equity character effect on taste and choice.

Questionnaire for parents

If you are happy for your child to take part in this study, please return the signed consent form and this completed questionnaire to the researcher as indicated on the information sheet provided.

If you would rather not answer any of these questions then please leave them blank.

1. **Please indicate your relationship with the child taking part in this study:**
   Mother / Father / Legal Guardian (*circle as appropriate*)

2. **Please indicate your highest education level (*delete as appropriate*):**

   Completed post-graduate education (Master's degree/PhD or equivalent)

   Completed undergraduate education (degree or equivalent)

   Completed A-levels (or equivalent)

   Completed GCSEs (or equivalent)

   Other (please specify):_____

3. **Please describe your child's ethnic origin using your own words:**

   _____

4. **How many hours of television does your child watch on a typical week (school) day?**

   _____

5. **How many hours of television does your child watch on a typical weekend day?**

   _____

6. **Does your child usually watch commercial channels (with adverts on) or non-commercial channels (no adverts, e.g. the BBC)?**

   _____

7. **Does your child have a TV in their bedroom? Yes / No (*circle as appropriate*)**

8. **How many hours does your child spend on the internet on a typical week (school) day?**

   _____

9. **How many hours does your child spend on the internet on a typical weekend day?**

   _____

10. **How often does your child ask you to buy particular foods/drinks for them?**

Every day / Every week / Sometimes / Not very often / Never (*circle as appropriate*)

11. **If they ask for you to buy things, do they mention the brand name of the food/drink (e.g. Kellogg's or Coca-Cola?)**

    Yes / No (*circle as appropriate*)

12. **How often do you buy your child what they have asked for?**

Every day / Every week / Sometimes / Not very often / Never (*circle as appropriate*)

13. **How much influence does your child have over the foods that are bought for the family?**

A lot / Quite a lot / Some / Not much / None (*circle as appropriate*)

14. **Does your child ever make food/drink purchases when you are not there? (e.g. with pocket money)**

    Yes / No (*circle as appropriate*)

Thank you very much for completing this questionnaire!

Appendix 4c

"Characters on food packets"

Information sheet for you!

Hello, my name is Lauren and I'm from the University of Liverpool. I am visiting your school today because I am interested in finding out what foods you like to eat and what characters you like to be on the food packets. Please have a look at this leaflet which tells you about this study.

What is the study about?

This study is to find out what foods you like to eat and what characters you like to be on the food packets.

Why have I been chosen?

You are very important and with your help I can learn more about this!

What will happen if I take part?

1. **I will ask you to taste some foods and look at some characters and tell me what you think of them. (I will explain what to do as we go along too so don't worry about remembering anything). You will be able to choose one of the foods to take away as a snack to have when the teacher/a member of your family says it's OK.**
2. **Then I will see how tall you are and what you weigh (no-one else will see this).**

Can I stop if I don't want to do the study anymore?

Yes, you can stop at any point if you don't want to take part anymore. You don't have to say why.

Will the things I write be kept secret?

Yes, we will put a number on it but not your name. No-one will know who you are when we write about this study.

If you have any questions, please ask me!

Thank you for reading about my study ☺

A bit for the researcher / your class teacher to fill in:

I have witnessed _____ give both their verbal assent and consent to participating in this study.

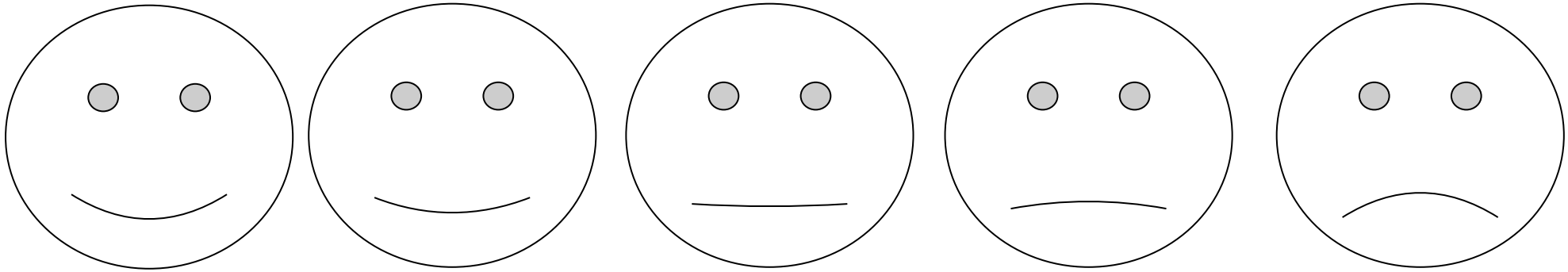
They are a girl/boy (circle as appropriate) and are _____ years and _____ months old.

Name and occupation (researcher/teacher) of witness:

_____

Signature:_____ Date:_____

Appendix 4d



LOVE IT

LIKE IT

IT'S OK

DON'T LIKE IT

HATE IT

Appendix 4e

Study 1 Response Sheets

Study of brand equity character effect on taste and choice.

PHASE 1 CONGRUENT CHARACTERS – RESPONSE RECORD SHEET

Text in italics indicates the script and instructions to be used by the researcher.

1.

Place the first pair of foods in front of the child.

Food: CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

Point at one of the items.

"Please eat a bit of this food"

(When the child has finished eating)

"Now please eat a bit of this food"

(When the child has finished eating)

"Do they taste the same to you? Or point to the food that tastes the best to you."

OVERALL TASTE:

The participant has indicated that they believe the foods taste the SAME / the participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

SPECIFIC TASTE:

Point at each of the items in turn and ask:

"Do you love it, like it, it's OK, don't like it or hate it?"

Character food: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

Food without the character: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

SNACK CHOICE:

"Which one would you choose for a snack?"

The participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

2.

Repeat the above script with the second pair of foods (vary the location of the character food).

Food: CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

OVERALL TASTE:

The participant has indicated that they believe the foods taste the SAME / the participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

SPECIFIC TASTE:

Point at each of the items in turn and ask:

"Do you love it, like it, it's OK, don't like it or hate it?"

Character food: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

Food without the character: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

SNACK CHOICE:

"Which one would you choose for a snack?"

The participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

3.

Repeat the above script with the third pair of foods (vary the location of the character food).

Food: CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

OVERALL TASTE:

The participant has indicated that they believe the foods taste the SAME / the participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

SPECIFIC TASTE:

Point at each of the items in turn and ask:

"Do you love it, like it, it's OK, don't like it or hate it?"

Character food: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

Food without the character: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

SNACK CHOICE:

"Which one would you choose for a snack?"

The participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

Study of brand equity character effect on taste and choice.

PHASE 1 CONGRUENT CHARACTERS – RESPONSE RECORD SHEET 2

Text in italics indicates the script and instructions to be used by the researcher.

1.

Hold up image of first character seen in 1 on previous task.

Character: CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

RECOGNITION:

"Do you recognise this character?"

YES / NO

IDENTIFICATION:

"Where have you seen this character before?"

MENTIONS ADVERTISING / THE BRAND / FOOD / NAMED THE CHARACTER (circle all that apply)

Or OTHER IDENTIFYING INFORMATION GIVEN (specify)

_____

LIKING:

Show child smiley face Likert scale and read out labels while pointing at each face.

"Point at the face that best shows how much you like this character"

The participant has selected the face that says

LIKE A LOT / LIKE / OK / DON'T LIKE / REALLY DON'T LIKE

2.

Hold up image of character seen in 2 on previous task.

Character: CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

"Do you recognise this character?"

YES / NO

"Where have you seen this character before?"

MENTIONS ADVERTISING / THE BRAND / FOOD / NAMED THE CHARACTER (circle all that apply)

Or OTHER IDENTIFYING INFORMATION GIVEN (specify)

_____

LIKING:

Show child smiley face Likert scale (on last page of this booklet) and read out labels while pointing at each face.

"Point at the face that best shows how much you like this character"

The participant has selected the face that says

LIKE A LOT / LIKE / OK / DON'T LIKE / REALLY DON'T LIKE

3.

Hold up image of character seen in 3 on previous task.

Character: CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

"Do you recognise this character?"

YES / NO

"Where have you seen this character before?"

MENTIONS ADVERTISING / THE BRAND / FOOD / NAMED THE CHARACTER (circle all that apply)

Or OTHER IDENTIFYING INFORMATION GIVEN (specify)

_____

LIKING:

Show child smiley face Likert scale (on last page of this booklet) and read out labels while pointing at each face.

"Point at the face that best shows how much you like this character"

The participant has selected the face that says

LIKE A LOT / LIKE / OK / DON'T LIKE / REALLY DON'T LIKE

4.

Place the three foods selected in the ‘snack choice’ sections of the previous task on the table in front of the participant.

“Which of these would you like to take away for a snack? You can eat this when your teacher or a member of your family says it’s OK”

CHEESTRINGS / POM BEAR/ COCO POPS (circle as appropriate)

WITH CHARACTER / WITHOUT CHARACTER (circle as appropriate)

“YOU HAVE FINISHED THIS BIT OF THE STUDY.

THANK YOU VERY MUCH FOR YOUR HELP!”

Study 2 Response Sheets

Study of brand equity character effect on taste and choice.

PHASE 2 INCONGRUENT CHARACTERS – RESPONSE RECORD SHEET

Text in italics indicates the script and instructions to be used by the researcher.

1.

Place the first pair of foods in front of the child.

Food: cereal bar / crisps / cheese *(circle as appropriate)*

Character: Coco monkey / Pom-bear / Cheestring *(circle as appropriate)*

Point at one of the items.

"Please eat a bit of this food"

(When the child has finished eating)

"Now please eat a bit of this food"

(When the child has finished eating)

"Do they taste the same to you? Or point to the food that tastes the best to you."

OVERALL TASTE:

The participant has indicated that they believe the foods taste the SAME / the participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

SPECIFIC TASTE:

Point at each of the items in turn and ask:

"Do you love it, like it, it's OK, don't like it or hate it?"

Character food: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

Food without the character: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

SNACK CHOICE:

"Which one would you choose for a snack?"

The participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

2.

Repeat the above script with the second pair of foods (vary the location of the character food).

Food: cereal bar / crisps / cheese *(circle as appropriate)*

Character: Coco monkey / Pom-bear / Cheestring *(circle as appropriate)*

OVERALL TASTE:

The participant has indicated that they believe the foods taste the SAME / the participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

SPECIFIC TASTE:

Point at each of the items in turn and ask:

"Do you love it, like it, it's OK, don't like it or hate it?"

Character food: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

Food without the character: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

SNACK CHOICE:

"Which one would you choose for a snack?"

The participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

3.

Repeat the above script with the third pair of foods (vary the location of the character food).

Food: cereal bar / crisps / cheese *(circle as appropriate)*

Character: Coco monkey / Pom-bear / Cheestring *(circle as appropriate)*

OVERALL TASTE:

The participant has indicated that they believe the foods taste the SAME / the participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

SPECIFIC TASTE:

Point at each of the items in turn and ask:

"Do you love it, like it, it's OK, don't like it or hate it?"

Character food: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

Food without the character: LOVE IT / LIKE IT / IT'S OK / DON'T LIKE IT / HATE IT (circle answer given).

SNACK CHOICE:

"Which one would you choose for a snack?"

The participant has selected the food WITH / WITHOUT the character *(circle answer given)*.

PHASE 2 INCONGRUENT CHARACTERS – RESPONSE RECORD SHEET 2

Text in italics indicates the script and instructions to be used by the researcher.

1.

Hold up image of first character seen in 1 on previous task.

Character: Coco monkey / Pom-bear / Cheestring *(circle as appropriate).*

RECOGNITION:

"Do you recognise this character?"

YES / NO

IDENTIFICATION:

"Where have you seen this character before?"

MENTIONS ADVERTISING / THE BRAND / FOOD / NAMED THE CHARACTER (circle all that apply)

Or OTHER IDENTIFYING INFORMATION GIVEN (specify)

_____

LIKING:

Show child smiley face Likert scale and read out labels while pointing at each face.

"Point at the face that best shows how much you like this character"

The participant has selected the face that says

LIKE A LOT / LIKE / OK / DON'T LIKE / REALLY DON'T LIKE

2.

Hold up image of character seen in 2 on previous task.

Character: Coco monkey / Pom-bear / Cheestring *(circle as appropriate).*

"Do you recognise this character?"

YES / NO

"Where have you seen this character before?"

MENTIONS ADVERTISING / THE BRAND / FOOD / NAMED THE CHARACTER (circle all that apply)

Or OTHER IDENTIFYING INFORMATION GIVEN (specify)

_____

LIKING:

Show child smiley face Likert scale (on last page of this booklet) and read out labels while pointing at each face.

"Point at the face that best shows how much you like this character"

The participant has selected the face that says

LIKE A LOT / LIKE / OK / DON'T LIKE / REALLY DON'T LIKE

3.

Hold up image of character seen in 3 on previous task.

Character: Coco monkey / Pom-bear / Cheestring *(circle as appropriate).*

"Do you recognise this character?"

YES / NO

"Where have you seen this character before?"

MENTIONS ADVERTISING / THE BRAND / FOOD / NAMED THE CHARACTER (circle all that apply)

Or OTHER IDENTIFYING INFORMATION GIVEN (specify)

_____

LIKING:

Show child smiley face Likert scale (on last page of this booklet) and read out labels while pointing at each face.

"Point at the face that best shows how much you like this character"

The participant has selected the face that says

LIKE A LOT / LIKE / OK / DON'T LIKE / REALLY DON'T LIKE

4.

Place the three foods selected in the 'snack choice' sections of the previous task on the table in front of the participant.

"Which of these would you like to take away for a snack? You can eat this when your teacher or a member of your family says it's OK"

SNACK BAR / CRISPS / CHEESE (circle as appropriate)

WITH CHARACTER / WITHOUT CHARACTER (circle as appropriate)

"YOU HAVE FINISHED THIS BIT OF THE STUDY.

THANK YOU VERY MUCH FOR YOUR HELP!"

Appendix 5a

Head teacher Information Sheet and Consent Form

University of Liverpool

<u>Study of portion-size depictions on cereal boxes</u>

Dear Sir/Madam,

I am a postgraduate student pursuing a PhD at the University of Liverpool and am currently conducting a research study in the area stated above for my doctoral thesis. I have Criminal Record Bureau (CRB) approval to conduct research with children.

To do this study I need a sample of children (aged between 7-11 years, who regularly eat breakfast) to take part in the study on a single occasion. On this occasion, I will sit with each participating child on a one-to-one basis in a designated area of the school. Each child will be given a brief questionnaire to complete regarding their levels of hunger and liking of the cereal box. They will then be asked to pour themselves a bowl of the cereal and eat this, after which they will be asked again about their hunger, enjoyment of the cereal and opinions of the food packaging. The cereal used will be Kellogg's Corn Flakes.

After all participating children have completed this part of the study I would need to record each of their weight and height measurements in private with a member of school staff present at all times. All data collected would of course be kept strictly confidential, with children being allowed to withdraw from the experiment at any time they wish. After initial explanation of the study procedure to all children, the experiment itself should take no longer than 30 minutes per child.

I have a consent form on which parents will be asked to confirm that their child has no history of food allergies or intolerance, and sign if they are willing for their child to participate. If they are happy for their child to take part, there is also a questionnaire for parents to complete on their child's behalf. This includes questions related to their child's general eating and consumer behaviour, as well as optional questions asking for identification of their race/ethnicity and the parents' highest education level. Children will be told what the study involves and asked themselves if they wish to take part in the study prior to data collection.

The focus of this study is looking at whether varying portion-size depictions on the cereal pack will influence how much the children serve themselves and how much they subsequently eat. In order to ensure participants do not guess exactly what we are doing, thus affecting the validity of our findings, parents will be informed that the main aim of the study is to look at the effects of food packaging on the eating experiences of children and children will be told it is a new cereal that we are piloting. Once the data was been collected we will explain everything in full to participants and issue parents with a letter which will explain exactly what we were trying to explore.

It would be very much appreciated if you would consider allowing me to conduct this research at your school. We will follow up this letter with a phone call to discuss possible arrangements, but in the meantime if you have any queries or require further information regarding the study, please do not hesitate to contact us (details provided below).

Many thanks,

Ms Lauren McGale

Investigator Contact Details:

School of Psychology
University of Liverpool
Eleanor Rathbone Building
Bedford St South
Liverpool
L69 7ZA

Tel.: (0151) 794 1137
Fax: (0151) 794 1405

INFORMATION SHEET

Typical portion sizes, as depicted on the front of cereal boxes, often do not accurately represent the recommended serving suggestion, showing bowls filled with several times the recommended amount. This could potentially normalise larger portions and in turn increase over-consumption amongst children when serving themselves. In light of the current problem with childhood obesity here in the UK, this study aims to establish whether the size of the portions that are shown on the front of cereal boxes influences how much children serve themselves and eat.

This study will take place on one occasion at the school's breakfast club. The study has two parts:

In Part 1, children will be asked questions about the cereal packaging and instructed to pour themselves a bowl, which they will have for their breakfast. Once they have finished eating the cereal they will be asked some additional questions regarding their liking of the cereal and its packaging.

In Part 2 children's height and weight measurements will be taken, in private, with a member of staff present at all times. Results will be recorded discreetly so they are not seen by the child, or any subsequent children.

Ethics, confidentiality considerations and parental consent

Parts 1 will be carried out in an area of the child's normal classroom or a designated alternative area of the school (as preferred by school staff) with a member of staff present. Completed sheets will later be securely stored in a locked filing cabinet at the University. These sheets will not include children's names, but will include a numerical "key" for each participant (this is simply to allow us to destroy the child's sheets if their parent/guardian withdraws consent after the data has been collected). After the study has been completed and written up, the key sheet will be destroyed.

Part 2 will be carried out in a private room, with a member of school staff present at all times. Any children who do not wish to be weighed or measured will not be coerced.

In the write-up of the research, the data will be presented completely anonymously, without referring to individual children.

The school will also be sent a summary of the results of the study (again, this will not refer to individual children). In addition, as a token of our appreciation, the school will be gifted with book tokens to the value of £5 per participating child.

Please note that this research is not aimed at assessing individual children's diet or health, and indeed does NOT produce any score that can be taken as a measure of this. This research will not "test" individual children.

Contact Details

If you would like further information on this study or have any questions, please do not hesitate to contact me by email (lmcgale@liverpool.ac.uk) or contact my supervisor, Dr Emma Boyland (University of Liverpool) on 0151 794 1137 or by email at e.boyland@liv.ac.uk

CONSENT FORM

HEADTEACHER: Please read the statements below before signing.

*I have read the information outlined in the information sheet.

*I agree to the children in my school taking part in the study outlined in the information sheet.

*The investigator has answered all my outstanding questions about the study and its purpose.

*I understand that I can withdraw from the study at any time. I understand that if I wish to withdraw from the study after taking part, I can request that any data collected from the children at my school be destroyed. However, I understand that this will not be possible if the study has already been submitted for publication.

*I understand that all data will be anonymous and confidential. The children will not be identifiable in any publications. Only the investigators at the University of Liverpool will have access to the raw data.

*I understand that, in accordance to the Data Protection Act, I can request access to the data collected.

NAME OF HEAD TEACHER: _____

SIGNATURE:_____ DATE: _____

RESEARCHERS: Please read the statements below before signing.

*I agree that the head teacher or parent/guardian can choose to withdraw their child at any time.
*I understand that if the head teacher or parent/guardian wishes to withdraw from the study after taking part, I must destroy all data if they so request it. However, I understand that this will not be possible if the study has already been submitted for publication.
*I agree to keep all data anonymous and confidential and not to allow access to raw data to any investigator outside the University of Liverpool.

NAME OF RESEARCHER:

_____

SIGNATURE:_____ DATE: _____

Appendix 5b

Parental Information Sheet and OPT-IN Consent Form

University of Liverpool

Does food packaging influence children's eating experiences?

Dear Parent/Legal Guardian,

At the Laboratory for the Study of Human Ingestive Behaviour at the University of Liverpool, we investigate how children make food choices. <headteacher> has kindly agreed that we can conduct one of our food choice studies at <school>

Information about the study

It has been repeatedly demonstrated that food packaging influences children's food experiences and consumption and we are interested in further understanding this relationship.

This study will take place on one occasion during normal breakfast club hours. We can only include children that normally eat cereal and attend their breakfast club in school and aged 7-11 years.

There are 2 parts to the study:

In Part 1, children with parental consent for participation and who have indicated that they wish to take part in the study will be asked a few brief questions about their levels of hunger and their opinions of the cereal packaging. We will serve them Kellogg's Corn Flakes, but to conceal the true aims of the study the children will be advised it is a new cereal which we are piloting. They will then be given a cereal box to look at and asked to pour themselves a portion of this cereal for their breakfast. When they have finished eating they will be asked a few short questions about their liking of the cereal and the packaging.

In Part 2 children's height and weight measurements will be taken, in private, with a member of staff present at all times. Results will be recorded discreetly so they are not seen by the child, or any subsequent children. Children will be informed that if they are not happy to complete this part of the study they do not have to.

Ethics, confidentiality considerations and parental consent

Children tend to enjoy these studies and are usually eager to participate. However, we require consent from you before your child can take part. Participation is entirely voluntary and you may withdraw your child at any time without having to give a reason, and without detriment to you or your child (if you withdraw your child after the study has begun we will destroy any data already collected). If any child does not want to participate themselves they will not be asked to, even if you have given your consent for your child to participate.

Children will work with me, a PhD student at the University of Liverpool, in their usual breakfast room/another area in the school with a member of school staff also present at all times. I have full "Enhanced Disclosure" Criminal Records Bureau certificates (the same certificate that teachers are required to obtain) to work with children.

Only the researchers involved (myself and my supervisor) will have access to the data, and the children's names will not be stored with the data. In the write-up of the research, the data will be presented anonymously, without referring to individual children. The school will also be sent a summary of the results of the study (again, this will not refer to individual children).

Reporting complaints and adverse events

Nearly all children enjoy taking part in studies like this one, which has been approved by the University of Liverpool Research Ethics Committee. However, the University have a formal procedure to deal with complaints and for the reporting of adverse effects. If a participant or a participant's representative wishes to raise a concern about the study, and in particular about the conduct of the study or the individuals involved, that would be inappropriate to raise with the principal investigator (Dr Emma Boyland 0151 794 1137), please use the complaints procedure. Complaints should be addressed to the Research Governance Officer in Research and Business Services (ethics@liv.ac.uk, 0151 794 8727). Please provide the identifying information below:

Principal Investigator: Dr Emma Boyland

Research Project Title: Does food packaging influence children's eating experiences?

Ethics Reference Number: RETH000643

If you are willing for your child to take part in this study, please complete the slip below. Please aid our screening process by stating clearly that your child has no history of food allergies or intolerances.

Please sign, detach, and return the slip at the bottom of this page BY (DATE) as this is when the study will begin.

If you are willing for your child to participate, please also complete the enclosed questionnaire and return it with the form below.

We hope that you will be happy for your child to participate.

Yours sincerely,

Ms Lauren McGale

University of Liverpool

Does food packaging influence children's eating experiences?

PARENT/GUARDIAN CONSENT FORM

PLEASE RETURN BY date

Please read the information carefully before completing this form.

My child has NO history or any food related illness/allergies/intolerances ☐

I am willing for my child to participate in the study to be conducted at primary school

I have read and understood all the information provided in the information sheet and above, and have had any outstanding queries answered to my satisfaction.

Signed…….Date……
……

Name of parent/guardian……..…(BLOCK CAPITALS PLEASE)

Name of child……..(BLOCK CAPITALS PLEASE)

Childs Date of Birth ……/…..../…… (DAY/MONTH/YEAR)

Does food packaging influence children's eating experiences?

Questionnaire for parents

If you are happy for your child to take part in this study, please return the signed consent form and this completed questionnaire to the researcher as indicated on the information sheet provided.

If you would rather not answer any of these questions then please leave them blank.

1. **Please indicate your relationship with the child taking part in this study:**
   Mother / Father / Legal Guardian (*circle as appropriate*)

2. **Please indicate your highest education level (*delete as appropriate*):**

   Completed post-graduate education (Master's degree/PhD or equivalent)

   Completed undergraduate education (degree or equivalent)

   Completed A-levels (or equivalent)

   Completed GCSEs (or equivalent)

   Other (please specify):_____

3. **Please tell us your child's gender and date of birth:**
   Girl / Boy
   Date of birth _ _ / _ _ / _ _ (in format DD/MM/YY)

4. **Please provide your home postcode:**

   _____

5. **Please describe your child's ethnic origin using your own words:**

   _____

6. **Does your child typically eat cereal for breakfast? (please circle)**

   YES / NO

7. **Does your child typically serve themselves breakfast? (please circle)**

Child Eating Behaviour Questionnaire (CEBQ)

Please read the following statements and tick the boxes most appropriate to your child's eating behaviour.

	Never	Rarely	Some-times	Often	Always
My child loves food	☐	☐	☐	☐	☐
My child eats more when worried	☐	☐	☐	☐	☐
My child has a big appetite	☐	☐	☐	☐	☐
My child finishes his/her meal quickly	☐	☐	☐	☐	☐
My child is interested in food	☐	☐	☐	☐	☐
My child is always asking for a drink	☐	☐	☐	☐	☐
My child refuses new foods at first	☐	☐	☐	☐	☐
My child eats slowly	☐	☐	☐	☐	☐
My child eats less when angry	☐	☐	☐	☐	☐
My child enjoys tasting new foods	☐	☐	☐	☐	☐
My child eats less when s/he is tired	☐	☐	☐	☐	☐
My child is always asking for food	☐	☐	☐	☐	☐
My child eats more when annoyed	☐	☐	☐	☐	☐
If allowed to, my child would eat too much	☐	☐	☐	☐	☐
My child eats more when anxious	☐	☐	☐	☐	☐
My child enjoys a wide variety of foods	☐	☐	☐	☐	☐
My child leaves food on his/her plate at the end of a meal	☐	☐	☐	☐	☐
My child takes more than 30 minutes to finish a meal	☐	☐	☐	☐	☐

	Never	Rarely	Some-times	Often	Always
Given the choice, my child would eat most of the time	☐	☐	☐	☐	☐
My child looks forward to mealtimes	☐	☐	☐	☐	☐
My child gets full before his/her meal is finished	☐	☐	☐	☐	☐
My child enjoys eating	☐	☐	☐	☐	☐
My child eats more when she is happy	☐	☐	☐	☐	☐
My child is difficult to please with meals	☐	☐	☐	☐	☐
My child eats less when upset	☐	☐	☐	☐	☐
My child gets full up easily	☐	☐	☐	☐	☐
My child eats more when s/he has nothing else to do	☐	☐	☐	☐	☐
Even if my child is full up s/he finds room to eat his/her favourite food	☐	☐	☐	☐	☐
If given the chance, my child would drink continuously throughout the day	☐	☐	☐	☐	☐
My child cannot eat a meal if s/he has had a snack just before	☐	☐	☐	☐	☐
If given the chance, my child would always be having a drink	☐	☐	☐	☐	☐
My child is interested in tasting food s/he hasn't tasted before	☐	☐	☐	☐	☐
My child decides that s/he doesn't like a food, even without tasting it	☐	☐	☐	☐	☐
If given the chance, my child would always have food in his/her mouth	☐	☐	☐	☐	☐
My child eats more and more slowly during the course of a meal	☐	☐	☐	☐	☐

Appendix 5c

"Cereal Study"

Information sheet for you!

Hello, my name is Lauren and I'm from the University of Liverpool. I am visiting your school today because I am interested in finding out what you think about this new breakfast cereal and its packaging. Please have a look at this leaflet which tells you about this study.

What is the study about?

This study is to find out what you think of this new cereal and its packaging.

Why have I been chosen?

You are very important and with your help I can learn more about this!

What will happen if I take part?

3. **I will ask you to look at a cereal box and then I will let you pour yourself some for breakfast. After this I will ask you what you think of the cereal and the box.**
4. **Then I will see how tall you are and what you weigh (no-one else will see this).**

Can I stop if I don't want to do the study anymore?

Yes, you can stop at any point if you don't want to take part anymore. You don't have to say why.

Will the things I write be kept secret?

Yes, we will put a number on it but not your name. No-one will know who you are when we write about this study.

If you have any questions, please ask me!

Thank you for reading about my study ☺

A bit for the researcher / your class teacher to fill in:

I have witnessed _____ give both their verbal assent and consent to participating in this study.

They are a girl/boy (circle as appropriate) and are _____ years and _____ months old.

Name and occupation (researcher/teacher) of witness:

_____

Signature:_____ Date:_____

Appendix 5d

Please read each question and then put a mark through the line to show us how you are feeling in relation to that particular question.

EXAMPLE:

How **TIRED** do you feel **at this moment?**

Not at all tired _____ Extremely tired

PLEASE ANSWER THE FOLLOWING QUESTIONS:

*How **hungry** do you feel **right now**?*

Not at all hungry _____ Extremely hungry

*How much do you think you **will like** the **taste** of this cereal?*

I will hate it _____ I will love it

*How much do you **like** the **colour** of this cereal box?*

I hate it _____ I love it

*How much do you **like** the **character** on the cereal box?*

I hate it _____ I love it

*How much do you **like** this **cereal box**?*

I hate it _____ I love it

*Do you think the **bowl** on the cereal box should be more **colourful**? (please tick)*

Yes ☐

No ☐

*Do you think there is **enough cereal** in the **bowl** on the cereal box? (please tick)*

Not enough ☐

The right amount ☐

Too much ☐

Appendix 5e

Please read each question and then put a mark through the line to show us how you are feeling in relation to that particular question.

EXAMPLE:

How **TIRED** do you feel **at this moment?**

Not at all tired — Extremely tired

PLEASE ANSWER THE FOLLOWING QUESTIONS:

How **HUNGRY** do you feel **at this moment**?

Not at all hungry — Extremely hungry

How **FULL** do you feel **at this moment**?

Not at all full — Extremely full

How much did you **like the TASTE of this cereal?**

I hated it — I loved it

Appendix 5f

Does food packaging influence children's eating experiences?

Dear Parent/Guardian,

You recently gave permission for your child to participate in our research. Firstly, we would like to say thank you for agreeing to let your child participate, it is really appreciated.

We previously stated that the study was looking at the effects of food packaging on children's eating experiences. Whilst this was true, we can now reveal more specifically that we aimed to look at whether changing the portion-size depicted on the front of the cereal box would affect how much cereal your child served themselves and how much they then ate.

Pictures on the front of cereal boxes usually show much larger portions than those which are actually recommended. This can lead people to thinking larger portions are normal and could encourage over-eating.

We hope that you understand that this minor deception was necessary to ensure that any data we collect is valid! Finally, we would like to remind you that you are still free to withdraw your child from this study at any point by getting in touch with myself or my supervisor (contact details below).

Kind regards,

Lauren McGale

Investigator Contact Details:

School of Psychology
University of Liverpool
Eleanor Rathbone Building
Bedford St South
Liverpool
L69 7ZA

Tel.: (0151) 794 3056
Fax: (0151) 794 1405
Email: lmcgale@liverpool.ac.uk

Supervisor Contact Details:

Dr Emma Boyland
Tel.: (0151) 794 1137
Email: eboyland@liverpool.ac.uk

Appendix 6a

PARENT/GUARDIAN INFORMATION SHEET

Study Title: Children's Use of Traffic Light Labelling on Food Packages

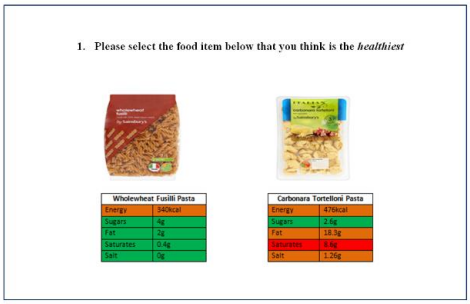
Your child is being invited to participate in a research study. Before you and your child decide whether to participate, it is important that you understand why the research is being done and what it will involve. Please take time to read the following information carefully. We would like to stress that you do not have to accept this invitation and should only agree to take part if you and your child want to.

What is the purpose of the study?
The purpose of the study is to better understand whether or not UK children are able to use traffic light labelling systems (where the levels of fat, salt and sugar in foods are indicated with red (high), amber (medium) and green (low) colours) on food packaging to identify which foods are healthier than others. It will also test whether giving children simple guidance on what the labels mean can help children use them better.

Why has my child been invited to take part?
We are looking for volunteers who are aged between 7 and 11 years and currently live in the UK to take part after their parent/legal guardian has given their consent.

Does my child have to take part?
Your child is under no obligation to take part in this study; it is voluntary and your child should only take part if both you and your child are happy to do so. Please discuss the study (as detailed below) with your child and, if you are happy to do so, ask if they would like to take part. If you or your child has any questions or concerns then please feel free to contact us via the contact details below. If your child does decide to take part, they are free to withdraw at any time and without giving a reason.

What will happen if my child takes part?
You will be taken to a secure website where you will be asked to provide consent for your child to participate by agreeing to 4 statements by clicking a button. If you are happy that your child would like to participate, they will be shown 30 pairs of food items each with traffic light labels and asked to select the item that they think is the healthier choice *(see below for example).*



If you feel your child would need help using the online questionnaire then please feel free to assist them with this part of the study. However it is *very important* that you *do not help them to answer the questions or provide any sort of prompting as* it is a test of their ability to decide on the healthiest choice.

Your child will be asked to complete this task 3 times in total. The first time will be straight after parental consent is given. Immediately following this they will be shown a short video which explains how to use traffic light labels and they will be tested for the second time, thus completing Stage 1 of the study, which should take no longer than 30 minutes to complete. 2 weeks later (Stage 2), we will ask the children to complete the task for the final time, in order to see if any effects of the video training have remained. This stage should take approximately 10 minutes to complete. We will email you to let you know when it is time for your child to do the task the second time. After the task is completed the second time, you will be sent your **£20 online shopping voucher** and your child will receive a full explanation of the study.

Are there any risks in taking part, or benefits from participation?
There are no anticipated risks to you or your child if they take part in the study.

Will my participation be kept confidential, and what will happen to the results?
All the information collected about your child during the course of the research will be anonymous (they will not have a name on them). All of the information provided will be identified only by a unique participant number. We intend to publish the results of the study in a scientific journal, however, only group averages will be given and individual children will not be identifiable from the data.

What if my child is unhappy, or there is a problem?
If your child is unhappy at any point in the study, or if there is a problem, please stop the task immediately and contact the researcher at the email address or telephone number below.

Will taking part be covered by an insurance scheme?

Participants taking part in any study that has been approved by the University of Liverpool are covered by the University's insurance scheme.

Who can I contact if I have further questions?

If you have any questions then please contact the researcher:

Lauren McGale

School of Psychology, University of Liverpool, Liverpool, L69 7ZA, Email: lmcgale@liverpool.ac.uk, Telephone: 0151 794 3056

Appendix 6b

UNIVERSITY OF LIVERPOOL

PARENT/LEGAL GUARDIAN CONSENT FORM

Children's Use of Traffic Light Labelling on Food Packages

I confirm that I have read and understood the parent/guardian information sheet.

I understand that in order to give consent for my child to participate in the study I have to be their parent or legal guardian

I understand my child's participation is voluntary and he/she is free to withdraw at any time without giving any reason.

My child agrees to take part in this study.

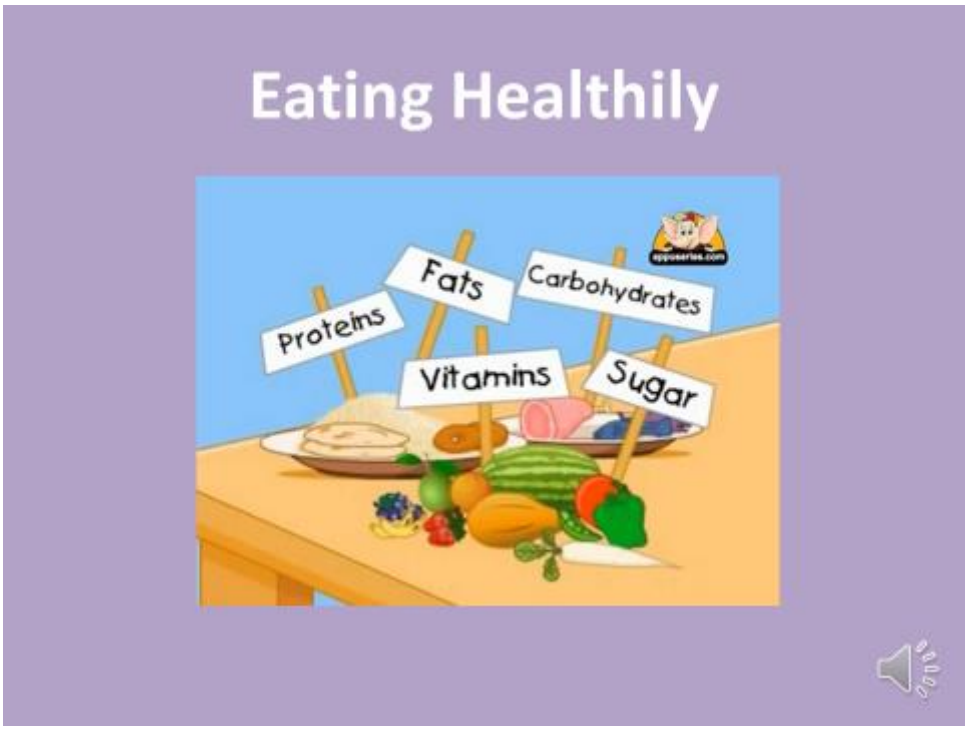
Before your child starts the study, please tick the box below to confirm you agree with all of the above 4 points.

☐

Appendix 6c

Slide 1

Slide 2

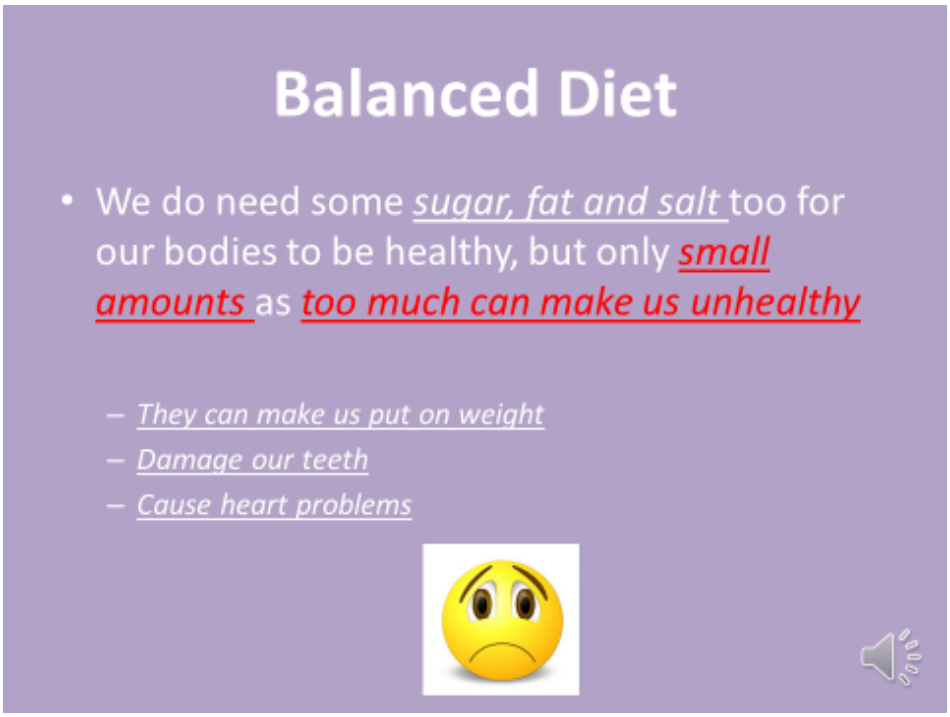


Slide 3

To have a balanced diet which will keep our bodies *healthy* and *working right*, we need a diet which is full of healthy fruit and vegetables. We also need some proteins, which we get from meat, fish and dairy products such as cheese, milk, eggs and yoghurts.

Slide 4

We do need sugar, fat and salt as well for our bodies to be healthy, but we only need *small* amounts of these as too much can make us unhealthy!



Slide 5

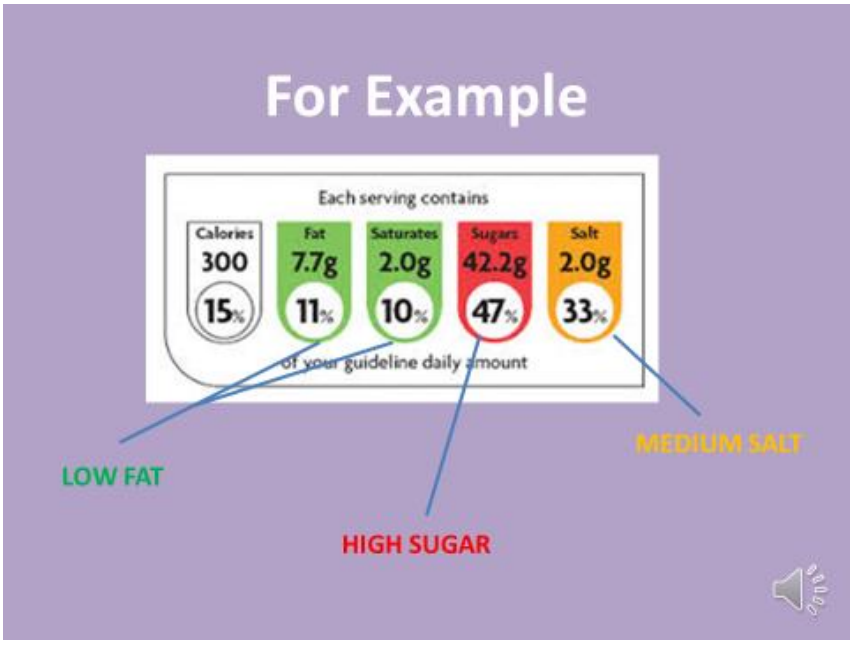
To make this easier for us, supermarkets put labels on food to tell us all the information that we need to understand what we are eating! You have probably seen these on some food packages but here are some examples of these labels

Slide 6

These labels give details about the fat, salt, sugar levels in food – they use a traffic light system to make it easier to understand whether these levels are high, medium or low. If it is red there is a high level, amber means there is a medium level and green means there is a low level

Slide 7

Here we can see that the levels of fat are *green* which means they are *low*, the sugar levels are *red* so they are *high* and the salt levels are *amber* so they are *medium*!

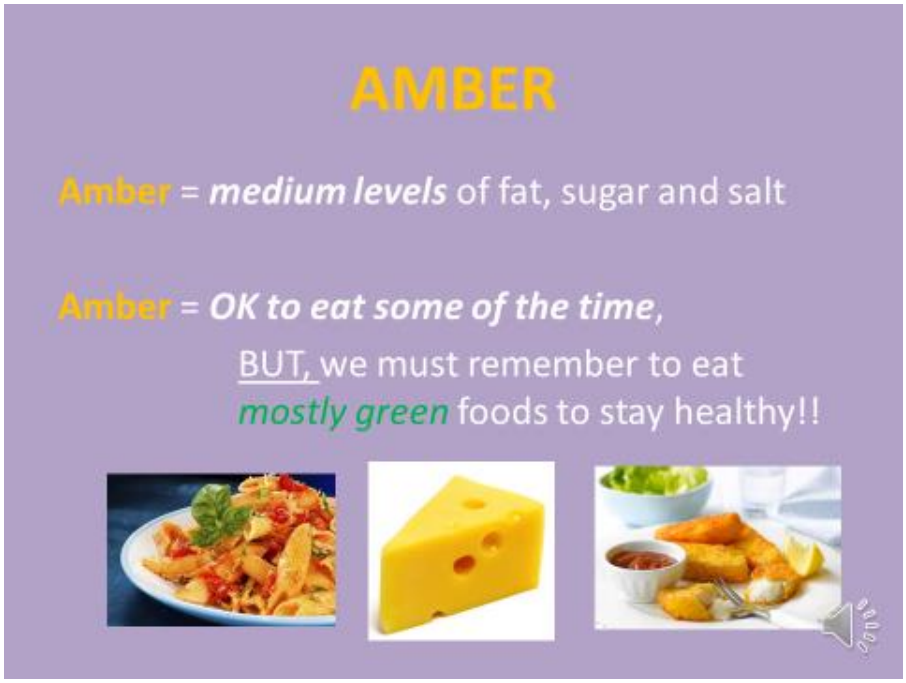


Slide 8

Green means that a food has low levels of fat sugar and salt and is a healthy food choice!
Some healthy foods are shown in these pictures

Slide 9

Amber means there are medium levels of fat sugar and salt in the foods.
They are ok to eat some of the time. There are some pictures of amber foods
But don't forget, it is still better to choose mostly green foods to keep our bodies healthy!



Slide 10
Red foods are high in fat salt and sugar. This doesn't mean we can NEVER eat them, but they should only be eaten occasionally and in small amounts if we want to be healthy!

Slide 11
Now we are going to look at a few examples of how to use the traffic light labels so you will be able to understand how to use them the next time you see one on a food package!

Slide 12
This semi-skimmed milk has mostly greens and only one amber on the label which means it is a healthy choice and it is OK to have this regularly!

Slide 13
These fish fingers are all green and amber. They are not as healthy as something which is all green but they are still OK to eat most of the time!

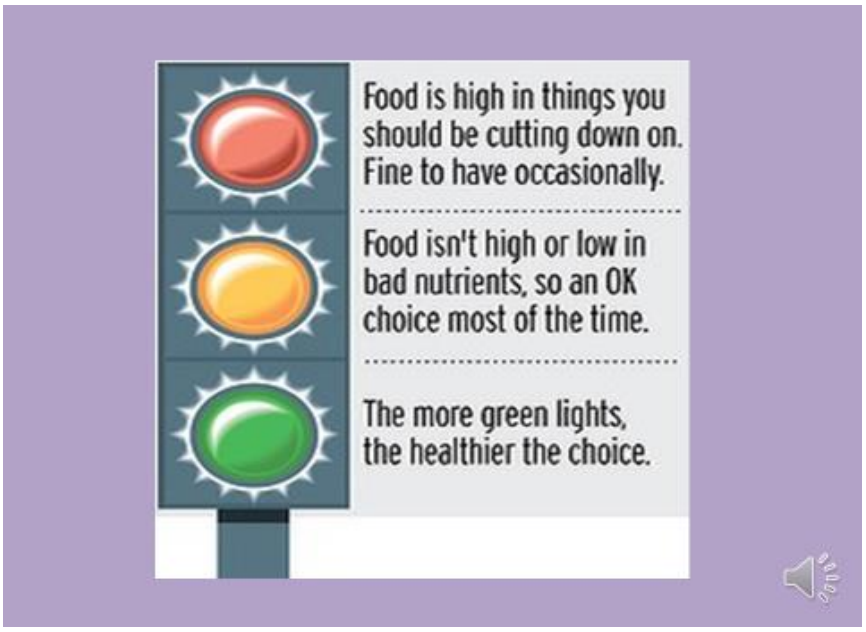
Slide 14
This pizza has only one green, and is mostly amber and red so this means we should only eat this pizza occasionally and we should only eat a small amount of it!

Slide 15
These labels can help us to decide what is healthier to eat, especially when we are choosing between similar foods. We are able to use them to check the levels of fat, sugar and salt in food to

make sure we are not having too much. This means we are able to choose a healthy and balanced diet, by knowing what we are eating!

Slide 16

So to finish up, we will just remind you one last time! Red means that the food is high in things we should be eating less of and it is ok to eat a *little bit* of these foods *occasionally.* Amber means that food is neither high nor low in bad nutrients like fat, sugar and salt, and is OK to choose *most of the time. Finally, green means go!* Food with more green labels are healthiest and should make up most of the food we eat if we want to be healthy!



Slide 17


Traffic lights can help us to eat healthily!
MILK