Television Food Advertising to Children:

Exposure, Power and Potential Consequences

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By

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Abstract

The current thesis aimed to address gaps in the childhood obesity prevention literature. It aimed to investigate i) the drivers of food advertising impact (exposure and power; chapters 3 & 4), ii) the efficacy of a potential intervention to mitigate advertising effects (Chapter 5) iii) the actual impact of eating behaviours including individual differences in susceptibility (EAH; Chapter 6), and iv) it piloted a UK-specific brand awareness instrument (Chapter 7) to aid and inform future research in the field. Chapter 3 (Children's exposure to food advertising on UK television (2008 vs 2010)) found a small decrease in food advertising prevalence in 2010. Non-core foods made up the majority of food adverts broadcast with were few changes in these proportions. There was a marked increase in the proportion of non-core food adverts broadcast during school holidays periods compared to other months of the year. Chapter 4 (Power of food advertising on UK television (2008 vs 2010)) found Implicit (physical activity) and explicit (health claims) health messages increasingly prevalent in UK television food advertising, where health and nutrition appeals were frequently employed. Use of multiple persuasive techniques monitored also displayed seasonal variation in line with school holidays.

Experimental Chapters 5 and 6 were conducted in the Brazil and the UK. Chapter 5 (Do verbal and textual warnings limit the impact of television food adverts on food intake? A study in a sample of Brazilian children) found that warnings displayed around television food advertisements did not reduce children's food consumption (kcal) and may be ineffective at negating the harmful effects on children's food intake. Both warning types investigated (health and persuasiveness warnings) were not widely understood by all children in this sample. For overweight and obese children, intake following food advert exposure was not of a greater magnitude than normal weight children. Children with high levels of television exposure did not display increased intake following food advert exposure. In Chapter 6 (Do television food adverts increase eating in the absence of hunger behaviours in children) Food advert exposure, such that it increased food intake across all participants in hungry and sated groups. Overweight and obese children displayed a greater increase in intake compared to normal weight children following food advert exposure. Overweight and obese children in the sated group showed the largest increase in intake following exposure to food adverts. Older children were more influenced by the food adverts and increased their kcal intake in response In all, this thesis provides the most comprehensive analysis to date of television food advertising monitoring, adds to our knowledge of the impact of television food adverts on children's food intake and pilots a instrument to measure children's food brand awareness.

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Glossary of Acronyms

AMA	American Marketing Association
ANVISA	Agência Nacional de Vigilância Sanitária (The National Health Surveillance Agency)
APA	American Psychological Association
BHF	British Heart Foundation
BMI	Body Mass Index
BPS	British Psychological Society
CARU	Children's Advertising Review Unit (United States)
CFBAI	Children's Food and Beverage Advertising Initiative
CSPI	Center for Science in the Public Interest
EU	European Union
FAO	The Food and Agriculture Organization of the United Nations
FDF	Food and Drink Federation
FTC	Federal Trade Commission (United States)
FSA	Food Standards Agency (United Kingdom)
HFI	Household food insecurity
HSE	Health Survey England
IBGE	Instituto Brasileiro de Geografia e Estatística (The Brazilian Institute of Geography and Statistics)
IFBA	International Food and Beverage Association
IMD	Index of Multiple Deprivation
NCD	Noncommunicable diseases
NCMP	National Children Measurement Programme
NFNP	National Food and Nutrition Policy (Brazil)
NGO	Non-governmental Organisiation

NICE	National Institute for Clinical Excellence
NPS	Nutrient profile system
Ofcom	Office of Communications (United Kingdom)
PAHO	Pan American Health Organization
PBF	Percentage body fat
PHE	Public Health England (United Kingdom)
PNAE	Programa Nacional de Alimentação Escolar (National School Feeding Programme, Brazil)
UEBA	Union of European Beverages Associations
UNCRC	UN Convention on the Rights of the Child
USDA	US Department of Agriculture
WCRF	World Cancer Research Fund
WHA	World Health Assembly
WHO	World Health Organization

Chapter 1: A Review of the literature

Within the present literature review, obesity and weight status will first be defined and obesity prevalence data including childhood obesity trends, presented. This thesis aims to investigate children's exposure and response to food marketing in the UK and Brazil, therefore data pertaining to these two countries specifically will be detailed and compared. In the following section, the aetiology of obesity will be summarised, briefly considering the genetic, psychological and behavioural factors with detailed focus on environmental contributors to childhood obesity levels. Literature into the obesogenic environment and more specifically, the food environment, will then be presented and evaluated with consideration of the role of industry and government. As a key feature of the obesogenic environment, the literature on child-specific food marketing and branding will be discussed.

The latter half of this present literature review will consider research into television specifically; the primary focus of this thesis. The well-documented link between television viewing and childhood obesity will be discussed. The following section will present a summary of research studies investigating television food advertising and its impact on children's choices and preferences. Following this, studies specifically considering children's food intake response to food advertisements exposure will be summarised and critiqued highlighting the distinct weaknesses within the literature. Individual differences (weight status, age and eating behaviour traits) and environmental influences (previous media exposure) relating to this specific literature base will be elaborated on in turn. The review will end with an overview of what is known within this literature and where important weaknesses and research gaps lie.

1.1 Obesity: Definitions and Prevalence

1.1.1 Defining obesity and weight status

The WHO definition of overweight is a body mass index (BMI) greater than or equal to 25kg/m² and the definition of obese is a BMI greater than or equal to 30kg/m² (WHO, 2015c). BMI provides useful population-level classifications of overweight and obesity, and the cut-offs are consistent across both genders and all ages of adults. However, assessing

the weight status of children is more complicated as a child's BMI changes as they mature (National Obesity Observatory, 2011). Growth patterns differ between boys and girls (see 1.1.2.1.for gender differences in childhood obesity), thus both age and sex of a child need to be taken into account when estimating calculating child BMI. Instead of the static thresholds applied to adult BMI categorisation, one way in which children's BMI can be categorised is by using variable thresholds derived from a child growth reference (i.e., weighing and measuring a sample of children to examine how BMI changes by age and sex across a reference population). Individual children can then be compared to the reference population and the degree of variation from an expected value can calculated (National Obesity Observatory, 2011). Once a child's BMI z score has been calculated, this figure can then be checked to see whether it is above or below the defined thresholds for the child growth reference used (National Obesity Observatory, 2011).

1.1.2 Prevalence of childhood obesity

WHO regards childhood obesity as one of the most serious global public health challenges of the 21st century (WHO, 2015). Prevalence of childhood obesity has increased considerably from 1980 in children and adolescents from developed countries, with 23.8% of boys and 22.6% of girls from these territories recorded as overweight or obese in 2013 (Ng et al., 2014). Developing countries have also seen increases in prevalence of overweight and obesity, from 8.1% in 1980 to 12.9% in 2013 for boys and from 8.4% to 13.4% in girls (Ng et al., 2014). In Europe, between 19.3% to 49.0% of boys and between 18.4% to 42.5% of girls were considered overweight or obese in a recent study by the WHO Childhood Obesity Surveillance Initiative 2008 (Wijnhoven et al., 2013). Obesity prevalence alone ranged from 6.0% to 26.6% in boys and from 4.6% to 17.3% in girls (Wijnhoven et al., 2013). The variation demonstrated here implies differing societal and cultural factors impacting on obesity rates. Discussion of research into gender differences in overweight and obesity will now follow.

1.1.2.1 Gender differences in childhood obesity

Few studies have addressed gender differences in childhood obesity, partially due to definitions of overweight and obesity in children, however a review of studies reported that

gender differences in obesity were common both before and during puberty (Wisniewski & Chernausek, 2009a). The authors concluded that boys and girls differ across patterns of weight gain, body composition, hormones and the susceptibility to various other social, ethnic and environmental factors (Wisniewski & Chernausek, 2009b). Data from the NCMP records height and weight measurements of children in state-maintained schools in England for reception (4-5 years) and year 6 (10-11 years) children. With eight years of reliable data, NCMP 2013/2014 (Lifestyle statistics Team, 2014) provides the most up-to-date and reliable UK data on childhood overweight and obesity with 1,101,611 valid measurements recorded across the two age groups. NCPM 2013/2014 reports that in both reception and year 6 a higher percentage of girls were of a healthy weight than boys. To illustrate this further; in reception 77.7% of girls and 75.4% of boys were of a normal weight whereas in year 6 this was 66.7% and 63.6%, respectively. In light of the observed and enduring differences across the gender divide in terms of overweight and obesity, child gender is accounted for in experimental chapters 5 and 6 within the present thesis addressing gaps in this literature.

1.1.2.2 Current trends in childhood obesity in England

The Foresight Report (Department of Health, 2007) cemented obesity as a major public health concern in the UK. This key publication drew on longitudinal data of weight increases (1993-2004) postulating that by 2050, 55% of boys and 70% of girls under 20 years of age may be overweight or obese. More recent projections based on 2000-2007 data points to a healthier future; stipulating that by 2020 13% of boys and 10% of girls aged 2-11 may be obese (National Heart Forum, 2009). Notably, these rates are still high and no significant decrease has been recorded. According to the most recent NCMP data, one in five UK children aged 4-5 years is overweight or obese (boys 23.4%, girls 21.6%) rising to one in three children aged 10-11 (boys 35.2%, girls 31.7%; Lifestyle statistics Team, 2014). When considering levels of obesity alone, approximately one in ten children aged 4-5 (boys 9.9%, girls 9.0%) and one in five children aged 10-11 is currently obese (boys 20.8%, girls 17.3%). In line with these figures, data from the Health Survey for England (HSE) documents a rise in prevalence of childhood obesity in the UK since 1995, when 11% of boys and 12% of girls were obese (Ryley, 2012). This has increased steadily for the majority of years up to 2004 and 2005, peaking at 19% (both boys and girls). However, since 2004, child obesity has

levelled off for children aged 2-10 years (illustrated in Figure 1-1).

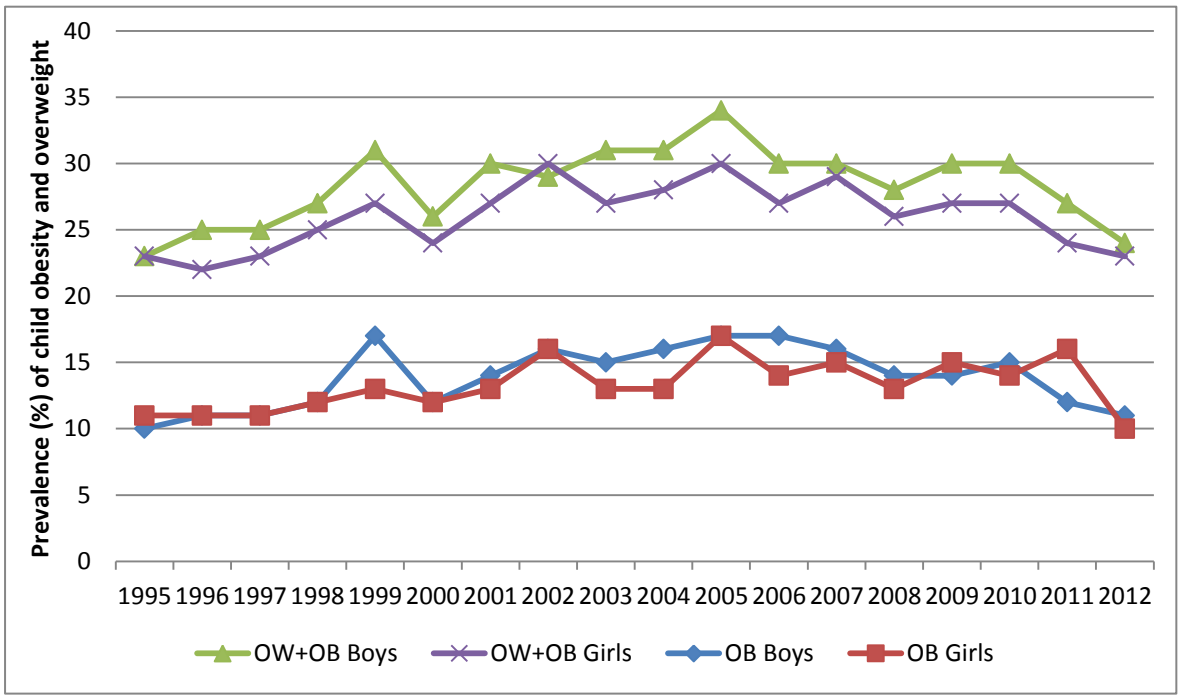

Figure 1-1. Prevalence of child obesity and child overweight (including obesity) in girls and boys aged 2-10 in England.

Figure 1-1 depicts the tapering off of obesity rates demonstrating a plateau at high levels in line with stabilisation seen across other developed countries (Wabitsch, Moss, & Kromeyer-Hauschild, 2014). Child obesity prevalence in the UK and other developed countries is closely associated with socioeconomic status (SES) such that more deprived populations tend to display higher obesity prevalence (Lifestyle statistics Team, 2014a). In general data shows that low SES groups in industrialized countries (like the UK) and high SES groups in developing countries are at higher risk of being overweight than their counterparts (Wang & Lim, 2012; see section 1.1.2.3 for discussion of the relationship between SES and obesity in developing countries).

Further analysis from the NCMP data examines the relationship between BMI and deprivation. As stated in the report, deprivation is based on the 2010 IMD which categorises children into a deprivation decile based on the location of their school (where decile 1 is the least deprived and decile 10 is the most deprived; Lifestyle statistics Team, 2014). The most recent data on BMI and deprivation in UK children is represented in Figure 1-2.

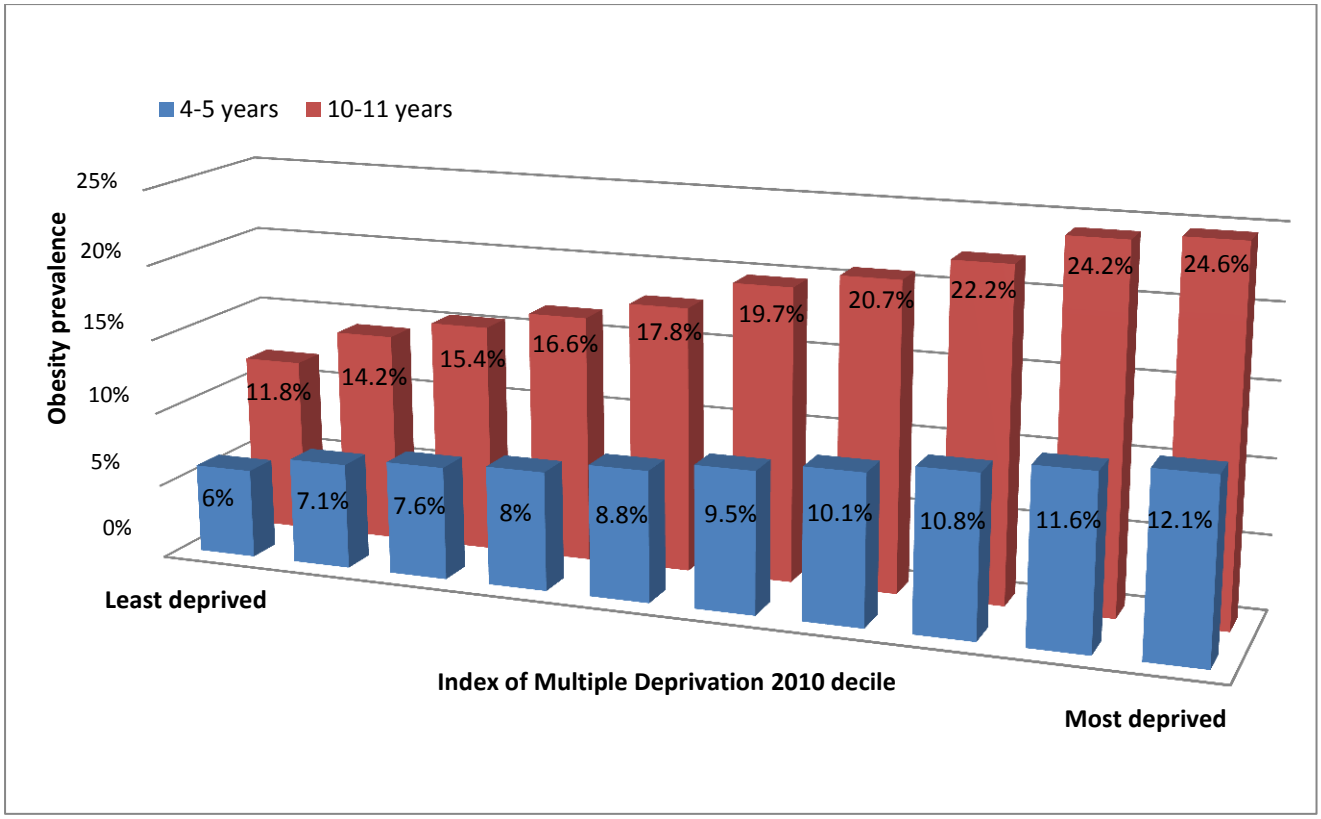

Figure 1-2. UK child obesity prevalence by deprivation decile (NCMP 2012/2013).

As depicted, obesity prevalence in the most deprived 10% of the population is approximately twice that of the least deprived 10%; a gap which appears to be widening. Increases over time are observed in the most deprived Year 6 children (age 10-11 years), whilst least deprived levels remain relatively stable (Lifestyle statistics Team, 2014). Additional household income data from the HSE further supports this social gradient in obesity. HSE annually surveys a representative sample of the English population and recent reports show that child obesity levels rise as household income falls (Ryley, 2012). A US study has sought to explain this disparity in adolescents, purporting that low-income areas have fewer playgrounds and pavements whilst participations in school clubs and sports teams is higher among high SES teen groups (Frederick, Snellmana & Putnam, 2014). Further research elucidates that low SES families are more likely to opt for food products with longer shelve lives which are often high in refined grains and added sugars.

Data from the NCMP also considers obesity and overweight at a regional level exploring child weight status in relation to geography in England. In all, the South East, East of England and East Midlands show the lowest obesity prevalence for children aged 4-5 and the South East, South West and East of England have the lowest obesity prevalence in children aged 10-11. The greatest obesity prevalence for both age groups is seen in London

(10.8% for 4-5 year olds and 22.4% for 10-11 years olds). As would be expected, these data also show a trend for regions with high obesity prevalence in 4-5 year old children to also display high prevalence in 10-11 year olds. Obesity prevalence also varies by Local Authority where the least affluent districts have more than double the obesity rates than wealthy areas. Figures range from 5.5% obesity prevalence in the Royal Borough of Windsor and Maidenhead and 6% in the Royal Borough of Kingston Upon Thames, to 14.4% in the London Borough Of Hackney for children aged 4-5 years. This also parallels the 10-11 age range where local authority figures are at 11.1% for childhood obesity in the London Borough of Richmond upon Thames Council, and more than double in the London Borough of Southwark Council (26.7%). Thus there exists a vast disparity in obesity rates across Local Authority districts further emphasising SES variation in childhood obesity in England.

1.1.2.3 Current trends in childhood obesity in internationally and in Brazil

Data are challenging to gather for international comparisons; some countries publish obesity prevalence data based on height and weight measurements, whilst others opt for self-report measures to produce national obesity data. It is likely that obesity data based on self-reported measures are not accurate and may prove lower than those based on actual measurements, limiting comparison between studies. A recent study addressed this issue by correcting self-reported data with both self-reported and measured weights and heights. The authors conducted sensitivity analysis to demonstrate that the overall global results were robust to the exclusion of these data (Ng et al., 2014). This recent study into prevalence of overweight and obesity found rates rose by 47.1% in children between 1980 and 2013 worldwide (Ng et al., 2014). Overweight and obesity combined have seen substantial increases in children and adolescents in developed countries, 23.8% of boys and 22.6% of girls in 2013 compared with 16.9% of boys and 16.2% of girls in 1980. However obesity now occurs in developing countries too (Popkin, Adair, & Ng, 2012) where prevalence increased in children and adolescents from 8.1% in 1980 to 12.9% in 2013 for boys and from 8.4% to 13.4% in girls (Ng et al., 2014).

Data has shown in recent years that in higher-income countries, greater obesity rates exist in rural areas and among the poor; in contrast to lower-income countries (where

higher levels of obesity were traditionally found amongst wealthier groups; Popkin et al., 2012). New evidence suggests that these patterns are shifting in developing countries like Brazil, with the increasing rate of obesity amongst the poor altering the distribution of health inequalities (Monteiro, Conde, & Popkin, 2007; Popkin et al., 2012). In Brazil (the focus of one chapter within this thesis), the issue of obesity has been a concern since the publication of the NFNP in 1999 which highlighted the double burden of nutritional problems in the Brazilian population: child malnutrition and nutritional deficiencies paired with the emergence of overweight and obesity (updated in 2011; Ministério da Saúde, 2012). The first national anthropometric survey in Brazil conducted in 1975 illustrated higher rates of obesity present in high-income groups. However, from 1989 weight gain patterns in females moved in the direction of an inverse relationship with socioeconomic status, especially in lower income groups (Maria, 2013).Malnutrition can co-exist with obesity in developing countries and this will be discussed further below using Brazil as a specific example. It has been suggested that the Brazilian population is undertaking a 'nutritional transition', defined as recent "major shifts in the nutritional profile of human populations directly related to modifications in dietary intake and nutrient expenditure patterns ..." (Monteiro et al. 2004, p. 433). This recent shift is characterized by diminishing malnutrition and surges in childhood obesity (Kac & Velásquez-Meléndez, 2003; Monteiro et al., 2009). One in three Brazilian children were overweight in 2008 (IGBE, 2009). Levels of overweight and obesity in Brazilian children had remained relatively stable between 1975 and 1989, however a steep incline was seen between 1989 and 2009 in both girls and boys (see Figure 1-3). Obesity in boys has risen 13% in and in girls 10% over the 20 year period, in line with changes in the economy and food system; namely a marked increase in consumption of ultra-processed foods (Monteiro, Levy, Claro, de Castro, & Cannon, 2011).

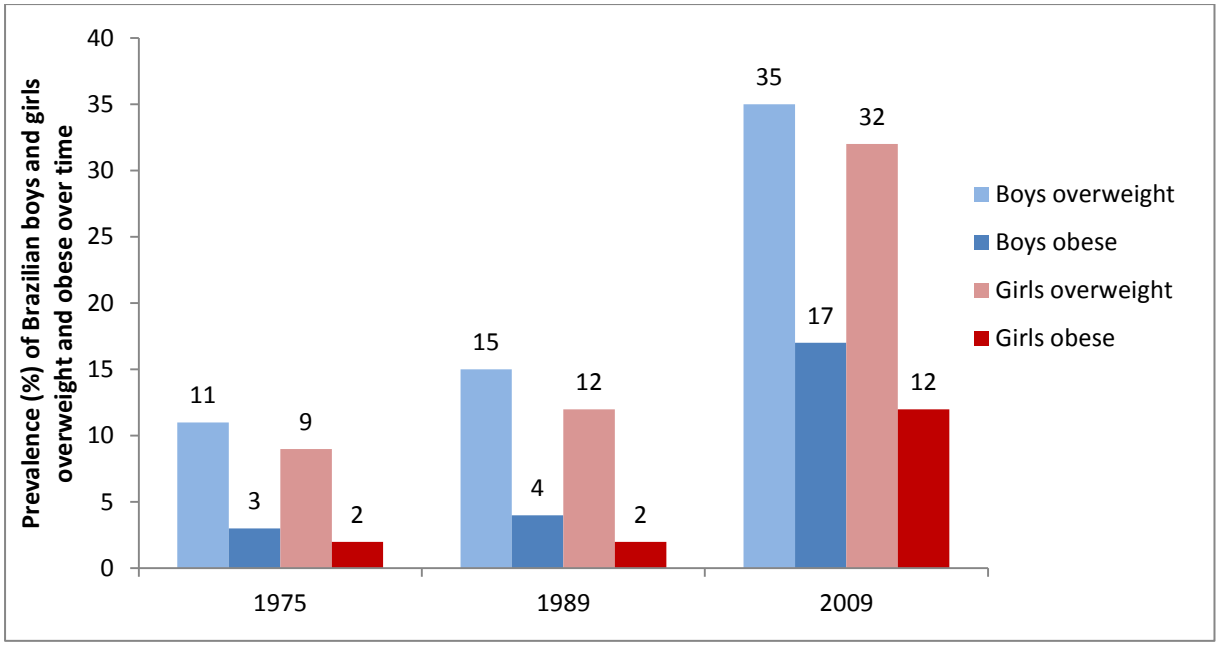

Figure 1-3. Percentage of boys and girls aged 5-19 overweight and obese over time (IBGE, 2009)

More national data from 2013 breaks this down with reports that 15.1% of Brazilian children are overweight, 7.6% obese and 4.5% morbidly obese, totalling 27.2% of children (National Nutrition Surveillance System, 2013). Childhood obesity in Brazil has been examined in a recent review exploring the prevalence of overweight and obesity in children and adolescents between 2 and 19 years old across different regions (Niehues, Gonzales, Lemos, Bezerra, & Haas, 2014). A higher prevalence of overweight was reported in the south (25.7%) and north (28.8%) of Brazil, and higher prevalence of obesity in the southeast (15.4%) and south (10.4%). A notable weakness of this literature as purported by the authors was a lack of consistent national data contrary to national programmes of obesity measurement in England.

Recent data, demonstrates that Brazil's obesity rates are lower than that found in the UK. As displayed in Figure 1-4. Recent data shows that on average there are 4% less overweight or obese boys and 4.9% less girls in Brazil compared with England, signalling that Brazil is still behind the UK with regards to childhood obesity. This may be linked to economic differences between the two countries, as the UK is more economically developed than Brazil. The UK also arguably has a more developed obesogenic food environment and has reached saturation point by multinational food and restaurant companies whereas Brazil has not (Monteiro & Cannon, 2012). These data may imply differing societal and cultural factors impacting on national obesity rates, including HFSS food promotion and

children's intake response after exposure. As the majority of studies into food marketing are conducted within westernised developed countries (e.g., UK & USA), there are a lack of studies that consider responses to food promotion in countries such as Brazil; representing a distinct research gap.

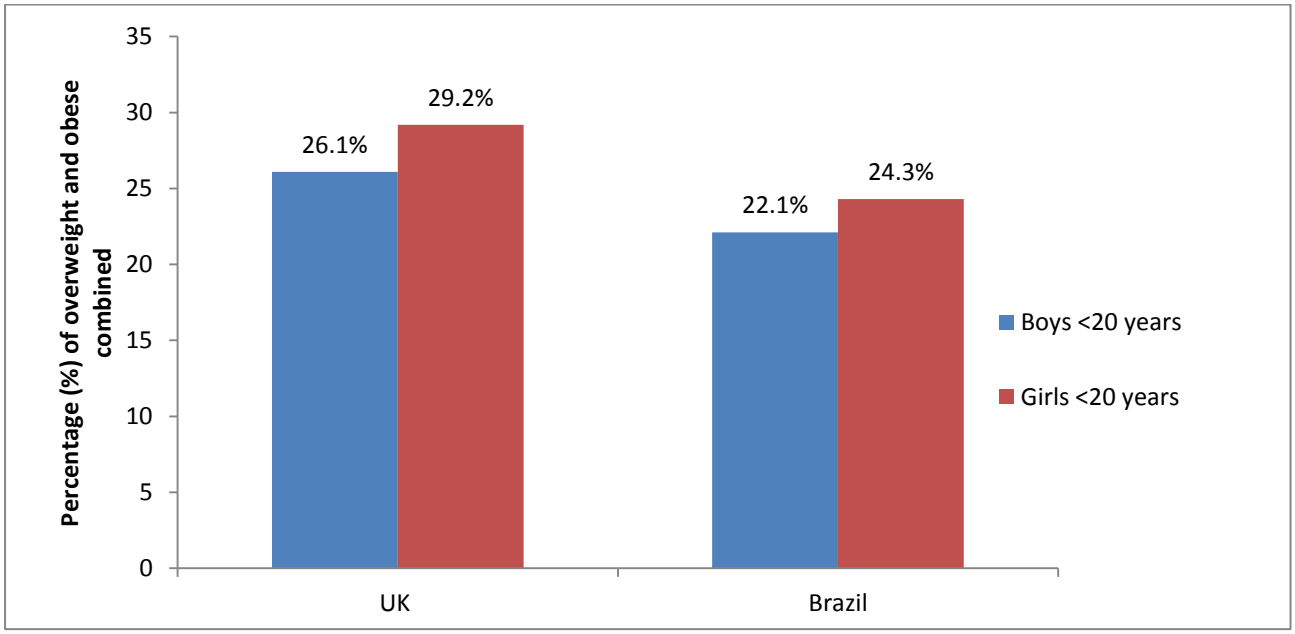

Figure 1-4. Age-standardised national estimates of the percentage of overweight and obese combined for girls and boys in the UK and Brazil (Ng et al., 2014)

1.2 The Aetiology of Obesity

1.2.1 Energy balance and factors contributing to weight gain

To aid understanding of the multifaceted nature of obesity, The Foresight Report was a causal systems map published to visually define the obesity problem (Department of Health, 2007) which has been vital to the progression of the research literature (Finegood, Merth, & Rutter, 2010). The framework illustrates the pure complexity of obesity, detailing 108 variables with more than 300 positive or negative links between variables. Notably, the majority of research underpinning this framework employs adult samples therefore proposed pathways may not apply to children. However it is a useful model to communicate the intricate interdependencies of the research area, with seven stated causes (physiology, food production, food consumption, social psychology, individual psychology, individual

physical activity and physical activity environment) impacting on four key determinants: primary appetite control in the brain, the force of dietary habits, levels of physical activity, the psychology of lifestyle choices; with energy balance as the central crux. Consumption behaviours are a critical modifiable influence via effective statutory policy (as explored in this thesis). Thus, in order to explore this process, it is important to have an appreciation for the foundations of food preferences, (i.e., how they develop and how food choices are made). Detailed commentary of all the many factors is beyond the scope of this thesis, however relevant concepts (the genetic, psychological, behavioural and environmental causes of obesity) as conceptualised in the model, will be briefly discussed below.

1.2.1.1 Genetic factors

The obesogenic environment is a key driver of childhood obesity; however it is accepted that not all children growing up within obesogenic environments are obese. Evidence suggests that genetic susceptibilities may interact with adverse environmental conditions to promote weight gain in weight-promoting environments (where HFSS food marketing is ubiquitous). Twin studies support the genetic basis of obesity where identical twins were reported to have virtually the same weight of whether they had grown up together or separately (Stunkard, Harris, Pedersen, McClearn, 1990). Obesity-related genetic variants and traits have been demonstrated in children and adults. Evidence demonstrates individuals carrying obesity risk alleles, in or near the FTO and MC4R genes, have less healthy eating behaviour patterns, such as higher energy and fat intake and loss of control over eating (Wardle et al., 2009). Such investigation illustrate that the heritability of weight cannot be ignored. However, genetics alone cannot explain the emergence of an obesity epidemic in the last 30 years signifying that the obesogenic environment is a key driver of rising childhood obesity levels.

1.2.1.2 Psychological and Behavioural factors

Longitudinal evidence exists for a psychological basis for obesity where chronic life stress and familial stress (e.g., stress associated with low SES) may have a causal link to weight gain by fostering excessive energy intake in children and adults (Guilfoyle, Zeller, & Modi, 2010; Torres & Nowson, 2007). Psychological research helps tease out motivations and barriers to increasing physical activity and decreasing sedentary time suggesting individual psychology

is vital to weight management (for a detailed explanation of psychological factors from the BPS see Waumsley, 2011). The Foresight Report posits habits, beliefs, translating intention into action, attitudes and moral climate as psychological factors influencing behavior change (Department of Health, 2007), discussion of which are beyond the remit of this thesis.

Eating behaviours have also been of considerable focus within the obesity literature, as eating is a complex and varied behaviour (Harrold, Dovey, Blundell, & Halford, 2012) influencing weight gain. As stated in a recent review, food responsiveness, satiety responsiveness, enjoyment of eating, eating in the absence of hunger (see section 1.5.1.3), reinforcing value of food, disinhibition and impulsivity are all behavioural constructs associated with intake, BMI and weight gain over time (French, Epstein, Jeffery, Blundell, & Wardle, 2012). In one study of 8-12 year old children, compared to those normal weight children, overweight children scored higher on a laboratory measure of reinforcing value of food (Temple et al., 2008). Additionally, research into disinhibition and self-control has demonstrated that obese children were more likely than non-obese children to choose an immediate food reward over a larger, delayed food reward (Bonato & Boland, 1983; Johnson, Parry, & Drabman, 1978; Sobhany & Rogers, 1985). Each construct has developed independently and the majority of studies (e.g., Temple & Epstein, 2012; Viana, Sinde, & Saxton, 2008; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009) show a positive cross-sectional association with BMI. In sum, genetic predispositions, in tandem with individual psychology and eating behaviour constructs all constitute crucial aspects of obesity aetiology. However, research gaps existing in how factors such as eating behaviour traits interact with obesity-promoting environments; specificall television food advertisings. Such population levels factors may present key modifiable risk factors and such weaknesses in the literature limit the development of effective interventions at a policy level.

1.2.1.3 Environmental factors

Discussion of this literature is largely broken down into investigation of the food environment (factors which increase consumption of energy-dense foods) and the built environment (factors which limit our physical activity opportunities), reflecting the idea that diet and physical activity levels are likely to mediate the association between the

environmental and obesity (the food environment will be discussed in detail in section 1.3.1.1). The built environment, offers both opportunities and barriers to physical exercise, related to the availability of parks, sports clubs, transportation amongst other factors. A recent review analysed objective measures of the built environment (spatial analysis approaches) and child weight (Casey et al., 2014) and found that child weight is inversely associated with neighbourhood walkability, however other associations (with food outlets restaurants and parks) were less consistent. In sum, the complex aetiology of obesity requires sustained, multi-levelled solutions beyond the remit of this thesis. However, one of the chief environmental factors thought to influence positive energy intake is the promotion of foods via television. This is the fundamental focus of this thesis and will be explored in more detail in section 1.3.1.3.

1.3.1 The Obesogenic Environment

1.3.1 The concept of the 'food environment'

The obesogenic environment has been defined as "the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations" (p. 564; Swinburn, Egger, & Raza, 1999). Increases in obesity are thought to be the result of normal human response to the obesogenic environments they find themselves in (Swinburn et al., 2011). For example, individuals react to surroundings in multiple settings (homes, neighbourhoods, schools) which in turn are influenced by broader macroenvironments (e.g., education, health systems, food industry) that are less malleable for an individual to shape. Researchers postulate modification to environmental factors (such as reductions in HFSS food advertising) could influence behaviour change at a systemic level with enduring decreases in obesity prevalence (Novak & Brownell, 2012).

Food environments, defined as the physical, economic, and socio-cultural surroundings, opportunities and conditions that influence food choice (Vandevijvere & Swinburn, 2014), form a fundamental portion of the obesogenic environment. The three most prominent drivers of obesity have been posited to be found within our food system. There exists an increased supply of cheap, palatable, and energy-dense nutrient-poor foods with improved distribution where they are readily-available (accessible) and increasingly promoted (Swinburn et al., 2011). As such, the next section of the present literature review

will examine the role of these key factors (food accessibility, industry and government and food promotion) in turn.

1.3.1.1 Accessibility of food

Literature published on the accessibility of foods has predominantly explored exposure to food outlets selling cheap (HFSS) foods of particular appeal to young palates (Prentice & Jebb, 2003). Consumption of food purchased away from the home has increased by 29% in the UK from 1998 to 2008 (The Strategy Unit Cabinet Office, 2008) while the number of fast food outlets has also witnessed considerable growth over twenty years (1980-2000; Burgoine et al., 2009). Studies into food environments (e.g., areas such as cities, schools and communities) promoting the overconsumption of energy dense, nutrient poor foods have considered the unavailability of healthy foods and abundance of unhealthy food outlets have often reported contradictory findings (Burgoine, Forouhi, Griffin, Wareham, & Monsivais, 2014; Héroux, Iannotti, Currie, Pickett, & Janssen, 2012) across and within studies. Little of this research has been conducted in the UK, however one recent study investigating environmental exposure to takeaway food outlets found that exposure in home, work, and commuting environments collectively was significantly associated with marginally higher (in magnitude) consumption of takeaway food, increased BMI and greater odds of obesity (Burgoine et al., 2014). Perhaps the most consistent evidence into food accessibility comes from the US, with studies suggesting that greater availability of healthy foods and healthier food outlets are associated with lower obesity rates (Morland & Evenson, 2009; Morland, Diez Roux, & Wing, 2006) and increased consumption of healthier foods (Auchincloss, Riolo, Brown, Cook, & Diez Roux, 2011).

Researchers posit that methodological issues (e.g., use of brief dietary assessments) may hamper this literature resulting in false findings and reduced power to distinguish associations (Burgoine et al., 2014; Caspi, Sorensen, Subramanian, & Kawachi, 2012). Furthermore, differences in food environments by country (e.g., cultural, environment and socioeconomic factors) may limit generalizability (Duran, Diez Roux, Latorre, & Jaime, 2013). A review of 38 studies by Caspi et al. (2012b) conclude that the field is lacking in standardised measures and a conceptual definition of food access amongst several other

limitations. Thus, the accessibility of foods remains a challenging research area and as it stands the evidence bases is therefore not substantial enough to support government policy intervention into modifying obesogenic neighbourhoods (Burgoine et al., 2014). Distinct from this, literature into food promotion is perhaps more consistent (Boyland & Whalen, 2015) and presents greater potential for improvement via government policy intervention.

1.3.1.2 The Role of industry and Government in shaping the food environment

Certainly, governments and the food and beverage industry are central shapers of the obesogenic environment; both contribute to the problem but can be part of the solution. Protection and promotion of public health are fundamental responsibilities of any government (Gortmaker et al., 2011a) and legislation can shape food industry practises to improve health outcomes. Research posits policy interventions as a potentially swift and cost-effective way of creating change (Gortmaker et al., 2011a). Novak and Brownell (2012) put forward two areas prime for population-level change: taxes on sugary drinks and legislation on marketing to children. Both face resistance from industry (Swinburn et al., 2009). Taxes are a powerful tool for altering the economic landscape of the food environment and drinks with added sugar are key candidates for taxation, constituting more than 10% of caloric intake on average whilst providing little nutritional value (Woodward-Lopez, Kao, & Ritchie, 2011). Modelling studies predict the effect of such a tax would reduce consumption of taxed beverages between 14-20% (Dharmasena & Capps, 2012; Fletcher, Frisvold, & Tefft, 2010; Smith, Lin, & Lee, 2010; Sturm, Powell, Chriqui, & Chaloupka, 2010). Reducing the harmful effects of child-targeted food and drinks marketing is identified as the second policy priority (Harris, Pomeranz, Lobstein, & Brownell, 2009; Novak & Brownell, 2012); this will be discussed in detail below.

1.3.1.3 Food marketing

Marketing can be defined as activity an organization engages in to facilitate an exchange between itself and its customers or consumers (McCall, 2002). Notably, this is distinct from advertising which is defined as one component or a subset of marketing, e.g., television advertising. The food and beverage industry marketing practices shape the current food

environment, where children are preferentially targeted by food marketers (Linn, 2004) as they have both independent spending power (current and future) and a substantial influence over family spending (Boyland & Halford, 2013). Marketers seek to influence children's immediate dietary preferences and build taste preferences whilst securing brand loyalty early-on in life, lasting into adulthood (Lobstein et al., 2015a). Children's taste preferences are more malleable during the early years where evidence suggests that early experience can influence what foods are preferred (Mennella, 2014). This often stays stable to influence lifelong diets making children especially vulnerable to the current food environment of energy-dense processed foods high in refined sugars (Mennella, 2014). Further to this, children's autonomy over their diets changes over time. In children around the age of 10, a 'widening of food repertoire' occurs due to a reduction in neophobia, resulting in more autonomy over food decision making (Cooke & Wardle, 2007).

Food marketing to children has an impact on the purchasing choices made by parents and food kept in homes (Buijzen, Schuurman, & Bomhof, 2008.) The influence children exert on the decision making process of parents has been labelled as 'pester power' (Kelly, Turner, & McKenna, 2006) referring to the influence of children's nagging of parents to purchase specific foods, especially in supermarkets and in response to point-of-sale advertising where it may prove more difficult for parents to resist persistent demands (Buijzen & Valkenburg, 2003; Kelly et al., 2006). When making food decisions, parents routinely consider their children's wants and preferences (Benton, 2004). As such, advertising directed at children may be indirectly influencing parents' consumer behaviour (Buijzen et al., 2008) with implications for children's diets.

Unhealthy food advertising has been the subject of investigation regarding its harmful effects in recent decades. Repeated exposure to food advertising has been shown to impact children's normative beliefs about eating, for example "fast food is as nutritious as home-made meals" (Signorielli & Lears, 1992; Signorielli & Staples, 1997) and expectancies established through advertising exposure affect perceived taste of that food (Lee, Frederick, & Ariely, 2006). In all, marketers target children via traditional advertising forms (e.g., outdoors, cinema, print media and broadcast) and more recently developed avenues (online advertising and point-of-sale) as depicted in Figure 1-5. The following section explores existing literature into forms of online food advertising to children. These represent

marketing avenues which are more challenging in terms of regulation than television food advertising (the fundamental focus of this thesis) but warrant discussion in the wider context of HFSS food marketing.

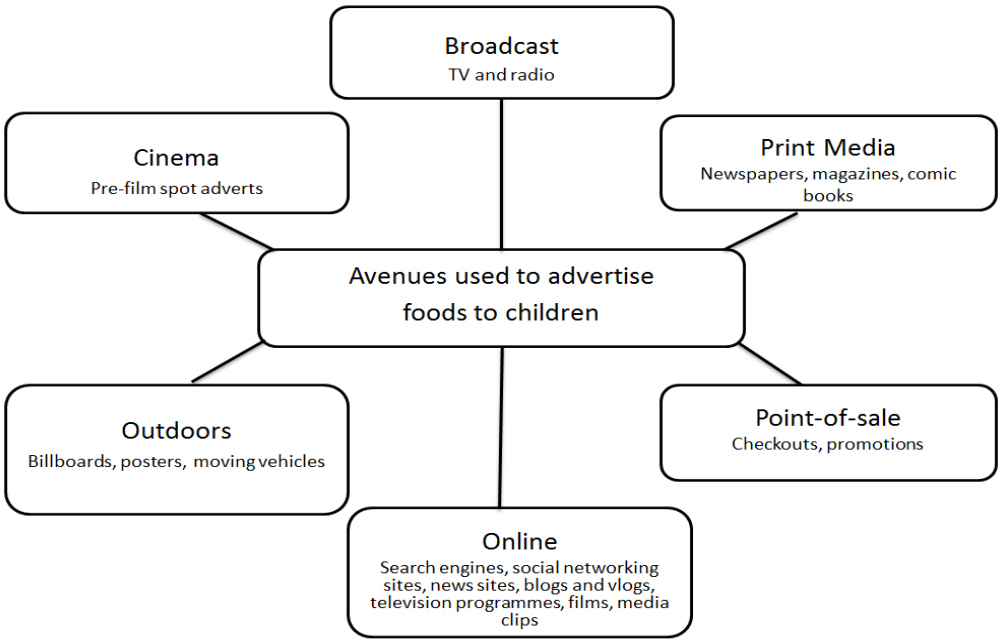

Figure 1-5. A representation of some of the main avenues through which foods are advertised to children

1.3.1.3.1 Online (new media) marketing

New media refers to digital technologies, including the internet and mobile devices, that are ever-changing and expanding (Kelly, Vandevijvere, Freeman, & Jenkin, 2015). Recent years have seen children and young people becoming competent and consistent users of the internet and other digital media (Rideout, Foehr, & Roberts, 2010). A large survey of 9-16 year olds across 25 European countries found that 59 % of Internet users had their own social media profile (Livingstone, Ólafsson, & Staksrud, 2013) and in the UK this is higher at seven in ten 12-15 year olds (Ofcom, 2014). Moreover, eight in ten UK children aged 12-15 own a mobile phone and children are increasingly likely to access the internet via a tablet, with 34% of children aged 5-15 now owning their own tablet computer (Ofcom, 2014). Food and beverage companies have taken advantage of this trend and have expanded child-targeted food marketing into commercial websites, third-party Internet advertising (i.e. placement of banner advertising on other companies websites), online videos, social media, and advergames (Faber, Lee, & Nan, 2004). Vlogging (video logging) is perhaps the most

recent emergent of food marketing proliferation, where vloggers are paid to feature an unhealthy food product (e.g., Oreos or Krave cereal) in a game, task or review within an established bloggers video (Newsround report, 2014).

Industry spend on online advertising is thus increasing. US data illustrates that new media food advertising accounted for approximately 7% ($122.5 million) of all reported youth directed marketing expenditures in 2009, up from 4% in 2006 (FTC, 2012). Interestingly, 2012 saw McDonald's adverts for Happy Meals increase 63% to 31 million ads monthly and three-quarters of these appeared on children's websites, such as Nick.com and CartoonNetwork.com (Yale Rudd Center, 2012). Estimates of the biggest advertising expenditures on Facebook in 2013 included major global food companies (i.e., Nestle, Coca-Cola and Starbucks; Edwards, 2013) illustrating how critical social elements of marketing are for brands to reach young consumers. Multinational food companies are shifting budget spend where online advertising now constitutes around 50% of total marketing spend (Adweek, 2014). Marketers state digital video represents opportunity to "deliver media-rich brand campaigns like the ones seen on TV but with more of an opportunity to fine-tune messaging." (Adweek, 2014). Furthermore, in terms of cost comparison, advert spend does not directly equate to exposure; as forms of internet marketing cost relatively less than television advertisements (Adweek.com, 2012).

New media marketing varies from traditional forms in numerous respects (Kelly et al., 2015), facilitating peer endorsement of, and personal relationships with food and beverage brands (Mangold & Faulds, 2009) to a greater extent. Such qualities are well-established as essential for strengthening brand awareness and encouraging product purchases (Sprott, Czellar, & Spangenberg, 2009). Additionally, children have been found to have far lower recognition of advertisements on webpages than for identifying television adverts at the same age (Ali, Blades, Oates, & Blumberg, 2009), whilst advergames (advertising embedded within online games) further increase difficulty in recognising advertising messages (Moore, 2006). A report into 2014 media use in the UK found only one third of 12-15 year olds and one in eight 8-11 year olds could correctly identify sponsored links or paid-for advertising online (Ofcom, 2014). New media also allows for further integration of commercial messages across numerous media platforms magnifying

responses (Cairns, Angus, & Hastings, 2009). For example food companies may link film, toy and food products and new media; where, for example, a breakfast cereal packaging may promote a brand-promoting game played on a web site, with matching Facebook page and Twitter messaging. Finally, parents are less likely to be exposed to, and thus aware of, new media marketing techniques and less able to implement parental mediation due to a lack of technical expertise (Livingstone & Bober, 2006). In sum, new media provides opportunity for food marketers to offer ubiquitous connectivity, personalisation and immersive environments for children. Measurement of the scope of online food marketing remains a challenge but is vital for policy debate and advocacy (Kelly et al., 2015). While some avenues of food marketing monitoring are in their infancy, only limited empirical research examines the impact of internet food advertising to children. However one area with a considerable evidence base is the influence of advergames.

As defined above, advergames are branded games with advertising messages embedded within; a marketing strategy inherently appealing to children and adolescents Research confirms that most food advergames promote products low in nutrition (Moore & Rideout, 2007), whilst children are unable to identify the marketing intentions of high-sugar promoting advergames in another study (Calvert, 2008). There is inconsistency as to whether exposure to advergames featuring healthy foods promotes healthy food intake specifically (Harris, Speers, Schwartz, & Brownell, 2012) or simply drives greater caloric intake in the same way as unhealthy food advergames (Folkvord, Anschütz, Nederkoorn, Westerik, & Buijzen, 2014). Recent mechanistic research suggests the personality construct 'impulsivity' may play a role in susceptibility to food advergames with those children reporting greater impulsivity finding it more difficult to refrain from eating after playing an advergame promoting energy-dense snacks.

In sum, new media food marketing is emerging in numerous forms and evidence suggests that existing regulation avenues may be inefficient at reducing its levels. Research posits that television adverts and advergames may be equally effective in moulding children's thoughts and preference as advergames offer increased interactivity but are limited by being casual and 2D in nature. Conversely, television advertising lacking in interactivity offers more realistic virtual worlds (Bellman, Kemp, Haddad, & Varan, 2014). Thus despite marketing's expansion into new digital technologies; television remains the

first point of call for many of the food and drinks industry and is the primary channel for food and drink advertising globally (Kelly et al., 2010) with 62% of the advertising media share across Europe and the US (IFBA, 2014b). Moreover, due to the international platforms that new media food marketing currently span, evidence implies that, relative to television food marketing (see section 1.4), online forms of food marketing represent a challenging area of health policy research.

Consistent across online advertising, television advertising and all food advertising forms, thus relevant to the present thesis, is the ubiquitous use of branding used to create a sense of awareness and familiarity between consumers and food and drink products. Research into branding will now be discussed with particular focus on specific techniques employed by food companies (brand characters).

1.3.1.3.2 Food Branding

Branding, defined as "a name, term, design, symbol, or any other feature that identifies one seller's goods or service as distinct from those of other sellers" by the American Marketing Association (AMA, 2016), is a method used by the food and drinks industry to create a recognizable image of a product to attract consumers and boost sales (Keller et al., 2012). Research shows that children reject unfamiliar foods (Fallon, Rozin & Pliner, 1984) therefore branding can be used by marketers as a technique to overcome this by fostering a sense of familiarity with an entire product range from the same manufacturer. Batada and Borzekowski (2008) suggest that children who recognise characters, logos and slogans (branding techniques utilised by marketers) from adverts are more likely to select products and brands. A pivotal study by Robinson, and colleagues (2007) supports this premise but added a novel finding to this literature; children did not just choose branded foods, they thought that it tasted better, therefore demonstrating the value of branding going beyond conscious choice. Children aged 3-5 were asked to taste identical foods and beverages labelled in McDonald's or unbranded packaging. Indeed, although the food and drink samples were identical, children indicated a statistically significant preference for the taste of food and drinks labelled with McDonald's brand logos, typifying how the branding of foods impacts children's preferences. Keller et al., (2012) investigated this further in a

controlled laboratory setting by manipulating brand and packaging cues. Overweight children displayed a cognitive bias toward some food brand images; although authors note a small sample of children were tested.

1.3.1.3.2.1 Brand character/packaging

One established branding technique relied on by food marketers to increase the familiarity of food product are brand characters which have traditionally formed part of general marketing strategies for both children and adults. Indeed, strong emotional ties with brand characters and logos may act as triggers cultivating brand loyalty persisting into adulthood (Connell, Brucks, & Nielsen, 2014) and this element of character branding will now be discussed in reference to food branding studies.

There are two types of brand character, brand-equity characters and licensed characters/spokes-characters. Brand-equity characters are defined as those designed to promote a specific product (e.g., Coco the monkey from Coco-Pops) whereas spokes-characters are the intellectual property of media companies (e.g., Dora the Explorer) and are used in commercial franchising and merchandising activities to build on customer brand loyalty via trust, association and preference (Kraak & Story, 2014). Importantly, brand-equity characters and spokes-characters cross cultural divides (LeBel & Cooke, 2008), therefore are integral to the marketing for multinational food and media companies. Children develop 'parasocial relationships' with often culturally tailored mascots and cartoon media characters which represent friendships based on characters' attractiveness and the persuasive messages they convey (Bond & Calvert, 2014). Characters are often associated with memorable logos, slogans, jingles, taglines, music and stories (Hémar-Nicolas & Gollety, 2012; Kraak & Story, 2014) and nostalgia through parent-child communication may further generate positive feelings towards food brand characters (Phillips, 1996). Academic literature has explored the impact of brand characters on children's diet-related outcomes but ongoing assessment of their use within UK television food advertising is limited which is a weakness observed in the television monitoring literature.

1.4 Television Viewing and Food Advert Exposure

Research from a recent UK survey illustrates that television is the media device that would be most missed by children and adolescents (Ofcom, 2014). Certainly, television is still the media activity 5-15 year olds would prefer to engage in when given the choice and as such more time is spent watching television every week (14.6 hours) than undertaking any other media activity (Ofcom, 2014). An expansive literature now scrutinises the influence of television viewing as a critical sedentary factor affecting childhood obesity prevalence.

1.4.1 Television viewing and childhood obesity

The association between television viewing and childhood obesity is well documented (Burke et al., 2006; Carson & Janssen, 2012). Longitudinal studies tend to show positive associations between excessive television viewing and obesity amongst youth (Marshall, Biddle, Gorely, Cameron, & Murdey, 2004; Rey-López, Vicente-Rodríguez, Biosca, & Moreno, 2008). The latter review of 28 longitudinal studies published into television viewing and obesity found that the majority reported a positive association between television viewing and adiposity, except six studies which reported a null relationship. Cross-sectional research shows that increased television viewing hours are positively associated with BMI in both adolescents and children with an apparent dose response effect (Braithwaite et al., 2013). In a large sample (n=369,881) of participants aged 12-15 across 54 countries, analyses show a 10-27% increased risk of overweight or obesity in adolescents and children watching 1-3 hours of television per day, where the association is strongest in adolescent females. This study, and smaller cross-sectional studies of this nature (Blass et al., 2006; Matheson et al., 2004; Salmon, Campbell, & Crawford, 2006), prevent determination of whether these associations are in some way causal or whether television viewing may be a marker of other lifestyle factors that may influence BMI (e.g., socioeconomic status, physical activity, other sedentary activities). However, the associations are consistent with longitudinal studies (as alluded to above) and also with intervention research. Indeed, as children's television viewing is potentially modifiable (Swinburn & Shelly, 2008), intervention research has explored school based interventions (Gortmaker et al., 1999; Robinson, 1999) to reduce television viewing. Reducing viewing time was found to slow the increase in BMI in adolescence (Robinson, 1999) a further intervention reduced obesity among female subjects

in the intervention schools (from 23.6 to 20.3%), but not in male subjects (Gortmaker et al., 1999). These studies illustrate that interventions seeking to reduce television viewing may be useful at clinical and population levels.

The positive association of television viewing and obesity may not just be due to the sedentary nature of television viewing, but its influence over food intake. Studies demonstrate relationships between television viewing and increased fast-food intake, snacking, and decreased fruit and vegetable intake (Boynton-Jarrett et al., 2003; Taveras et al., 2006; Thomson, Spence, Raine, & Laing, 2010). Thus, television viewing is not simply associated with overweight because it is a sedentary activity; it also has influence over food intake. A key publication aimed to disentangle the impact of commercial television; finding that commercial television (as opposed to non-commercial television) as being specifically related to increased BMI, even when physical activity and eating whilst viewing television were taken into account (Zimmerman & Bell, 2010). Therefore, one purported mechanism that television might influence food intake is via exposure to the food advertising that is broadcast on commercial channels. This has prompted quantification of television (summarised in depth in chapters 3 &4) however in terms of monitoring television food advertising, TV food advertising does indeed affect attitudes, preferences, choices and consumption in children and adolescents, this will be reviewed in the subsequent sections with particular emphasis on identifying the gaps in knowledge that this thesis addresses. What is not known however is how the television food landscape is changing in countries such as the UK as no studies systemtically quantify this in the long term. This distinct gap in the literature is addressed in chapter 3 of this thesis.

1.4.2.1 Effects of television food advertising on food preferences and choices

Food preference is defined as the "selection of one item over others" (p.42; Birch, 1999). It is often understood that liking is the foundation of food preference, which may be the case in the majority of times. However, liking does not wholly determine food preference (Birch, 1999). To illustrate, a more palatable foods (e.g., butter) may not always be selected over less palatable alternatives (e.g., low fat margarine) due to health implications or price

factors (Rogers, 1999). Therefore, it is important to note that liking and preference in the context of food habits are not synonymous. Research elucidates that food preferences are established in childhood and are likely to be maintained into adulthood (Benton, 2004; Mennella, 2014) and environmental factors are very influential in food preferences (Wardle, & Cooke, 2008). Therefore, studies have sought to determine how television food advertising may affect the formation of food preferences at a time when children's eating habits may be less established.

In preference studies, children are typically asked to choose their favourite food from a series of pictures depicting HFSS foods (Chernin, 2008) following advertising exposure. In an early study where children were exposed to either a series of commercials for sugary snacks/breakfast foods or public service announcements (PSA) promoting nutritious eating, it was found that children who saw television adverts for sugary foods selected significantly more sugared foods than children who saw the PSAs or did not watch television (Goldberg, Gorn, Gibson, 1978). Results here are in accordance with studies conducted around a similar time (Resnik & Stern, 1977) after exposure to crisp adverts, children were significantly more likely to select advertised brands of crisps than children in the control group.

A recent systematic review of published literature (2002-2013) identified 18 studies researching effects of food promotion (including television food advertising and other avenues) on children's food preferences (Cairns et al., 2013), although notably two did not report findings relating to food preferences. In randomised and controlled experiments, studies have found evidence for preference changes towards HFSS foods in response to television food advertising (e.g., Halford et al., 2008) and non-product specific brand loyalty (e.g., Robinson et al., 2007), although importantly Robinson and colleagues (2007) exposed children to food branding on packaging. Overall, the review posits that on balance forms of food promotion can influence food preference.

Recent developments outside the timeframe of the Cairns et al. (2013) review conducted in UK samples have using three food preference measures (Food Preference Measure, the Adapted Food Preference Measure and the Leeds Forced- Choice Test) to explore food preferences in children. Participants (n=281) were exposed to toy or food

television adverts on two separate occasions with a 2 weeks in between (Boyland, Harrold, Kirkham, Corker, et al., 2011). Results found that all children selected more branded and non-branded high fat and high carbohydrate food items from food preference lists after exposure to the food advert condition compared with after viewing control (toy) adverts. Food preference studies have also been used to analyse the impact of creative strategies employed by food marketers used in television advertising, where one study (exposing children to food packaging) found nutrient content claims and sports celebrity endorsements to influence children's preferences towards energy-dense, nutrient-poor foods.

Food preferences are the drivers of food choice in children. Therefore research has sought to investigate how children's food choices may be influenced by television food promotion. Food choices are defined as "the process of choosing foods" (p.443; Eertmans, 2001) and is a complex and dynamic process that undoubtedly influenced by a variety of factors (Wardle & Cooke, 2008). A more detailed definition purports food choices as "a complex function of preferences for sensory (taste, odour, texture) characteristics, combined with the influence of non-sensory factors, including food-related expectations and attitudes, health claims, prices, ethical concerns and mood" (p.498; Prescott, Young, O'Neill, Yau, & Stevens, 2002).

Experimental research into the impact of television food marketing on children's food choice has aimed to explore the impact of adverts for 'healthy' meal bundles (now more frequently advertised in reaction to stricter Ofcom advertising regulations for HFSS foods) on children's (n=59, aged 7-10) selection of foods (Boyland, Kavanagh-Safran, & Halford, 2015). Exposure to 'healthy' fast food meal bundles in television advertisements promotes liking for fast food but not healthier choices in children. Children were exposed to control adverts (two breaks of five toy adverts) or experimental adverts (one advert replaced by a McDonalds happy meal advert in each of the breaks) in a within-participant, counterbalanced design. The 'healthy' meal bundle featured fish fingers, a bag of fruit and a bottle of water and all adverts were embedded within a cartoon in both conditions. Following this, children took park in a menu task reporting their liking response for McDonald's food items and fast food more generally. Liking for fast food showed an increased after exposure to the food adverts relative to control (P=0.004). Moreover,

exposure to adverts for 'healthy' meal bundles failed to promote healthier choices in children. Although food preference and choice are explored in studies, there is still argument to suggest that they may not be directly analogous to actual food intake which is a weakness of this literature. Therefore studies measuring food intake directly may represent a research gap warranting addressing. Empirical research into the association between children's exposure to television food advertising and their actual food intake will now be discussed.

1.4.2.2 Effects of television food advertising on food intake

The impact of television food advertising on child food intake is readily demonstrated across studies (Boyland & Halford, 2013) and was first scrutinised in experimental studies during the 1980s (Gorn & Goldberg, 1980; Jeffrey, McLellarn, & Fox, 1982). More recently there has been renewed interest in this area, perhaps due to increasing obesity prevalence and associated concern over potential environmental determinants. Studies in UK samples use energy intake outcomes (i.e., gram/kilocalorie (kcal); where food bowls are weighed before and after *ad libitum* intake session) to measure effect of advert type (food or control). A study by Halford et al. (2004), employed a within-participant, randomized experimental paradigm where children (n=42, aged 9-11) were exposed to food and non-food adverts before a cartoon. Food advertising increased *ad libitum* food intake across all participants. This finding was replicated in a subsequent experiment with children aged 5-6 (n=93; Halford, Boyland, Hughes, Oliveira, & Dovey, 2007). Total kcal intake was significantly higher after exposure to 10 food adverts (compared to 10 toy adverts in the control condition). As the test foods used in both studies differed from brands displayed in the food adverts, these data demonstrate that exposure to food adverts elicits a 'beyond-brand' effect whereby food consumption in general is promoted. A further follow up study found that all children displayed significantly increased consumption of sweet energy-dense snacks in response to the adverts but intake was greatest in obese children. Obese children increased their intake by 155%, overweight by 101% and normal weight by 89% after food ads relative to their intake in the control condition (Halford et al., 2008). The role of weight status is dissected in further detail in section 1.5.1.1. Some authors have also included potential moderators and mediators of effects. For example, a UK-based study categorised children (n=66, aged 5-6)

as either high or low on a food neophobia scale and exposed them to unhealthy food or healthy food advertisements and toy advertisements in the control condition (Dovey, Taylor, Stow, Boyland, & Halford, 2011). Food advert exposure (for unhealthy or healthy items) increased in highly neophobic children's intake of foods during an *ad libitum* snack break by 11% (47 kcal). In a study by Anschutz et al. (2010) a potential gender effect was described where food intake in boys was higher when watching food advertising compared to girls. Maternal pressure to control weight gain was subsequently investigated as a factor in children's eating post-exposure to food advertising (Anschutz et al., 2010). Children with high maternal pressure increased intake in response to food advertising compared to neutral adverts.

Whilst an overall effect has been demonstrated of television food advertising exposure on food intake, the measurement of moderating variables is critical to examine differences in children and a key gap in this research. Limited data suggests that neophbia (Dovey et al., 2011) and maternal pressure may be important, however research has yet to consider the role of eating in the absence of hunger, expecially in relation to other individual differences (age, weight status) and environmental factors (previous media exposure) as discussed below.

1.5 Individual Differences and Environmental Factors in Television Food Advertising responses

Although studies have demonstrated that food advertising affects all children, there are suggestions that there may be individual differences in response that relate to a number of factors. Individual differences in television food advert responses have been demonstrated in experimental food consumption and preference tasks (Boyland & Halford, 2013; Boyland, Harrold, Kirkham, Corker, et al., 2011). Weight status, age (correlated with advertising literacy development) have been discussed in relation to food marketing however eating in the absence of hunger (a behavioural trait which refers to children's susceptibility to eating when sated, first coined by Fisher and Birch (1999) has yet to be explored in the context of food adverts. Levels of habitual television viewing (or previous media exposure) are an environmental facet also present in the field alongside. Below is a brief summary of the research literature into each of the relevant variables and factors.

1.5.1 Individual differences

1.5.1.1 Weight status

Overweight and obese children have been found to be particularly susceptible to food promotion on television (Forman, Halford, Summe, MacDougall, & Keller, 2009; Halford et al., 2008). Explanations have looked to Schachter's externality theory (Schachter, 1971) purporting that "internal state is irrelevant to eating by obese, and that external, food-relevant cues trigger eating for such people" (p.97). This established theory states that obese people are more reactive to external cues to eat and less sensitive to internal hunger and satiety signals than their lean counterparts. As a result of over-responsiveness to external food cues and decreased responsivity to hunger and satiety signals, the theory implies that overeating could occur in overweight and obese individuals when exposed to environmental food cues like television food advertising. The role of weight status in the influence of television food advertising has been established by studies reporting that obese children correctly recognised a larger amount of food adverts than normal weight children, which was positively correlated with the amount of food consumed in a subsequent task (Halford, Gillespie, Brown, Pontin, & Dovey, 2004). Moreover, Halford et al. (2007) reported that recognition of food adverts was associated with BMI in 5-7 year old children (Halford, Boyland, Hughes, Oliveira, & Dovey, 2007). Overweight children were significantly more likely to remember fast food logos than other food logos (Arredondo, Castaneda, Elder, Slymen, & Dozier, 2009). Therefore, child participants in the relevant studies of this thesis (chapters 5 and 6) were weighed and measured to ensure that weight status effects could be explored within these paradigms.

1.5.1.2 Age

Studies into the relationship between age and susceptibility to advertising were first conducted in the 1980s, reporting that children could identify television advertisements by 6 years and comprehend their persuasive intent by 8 years of age (Levin, Petros, & Petrella, 1982). However more recent studies have found no significant differences on the impact of television advertising exposure by children's age (D'Alessio, Laghi, & Baiocco, 2009;

Pettigrew et al., 2013). This challenges the assumption that children's ability to withstand the influence of adverts will grow as their cognitive capacity increases (Brucks, Goldberg, Armstrong, 1986). Indeed, conventional child and advertising theory assumes that a child's capacity to consider advertisements in a critical light may protect against its potential harm and increases with age. This is termed their 'advertising literacy' (grasp of the intent and techniques of adverts; Livingstone & Helsper, 2006). However, evidence does not support its role in limiting advertising influence (Mallincrodt & Mizerski, 2007; Rozendaal et al., 2009).Briefly, Rozendaal et al., (2009) found that only one of three advertising literacy variables investigated (understanding of persuasive intent) reduced children's desire for advertised products. A review by Livingstone and Helsper (2006) communicated that the available evidence does not support the belief that older children are less susceptible to its impacts. Further to this, rapidly growing use of contemporary affect-based advertising is processed by children under conditions of low elaboration, meaning they are less likely to use any knowledge of advertising intent as a critical defence (Buijzen, Van Reijmersdal, & Owen, 2010). Affect-laden advertising attempts to appeal to the emotional tendencies of consumers by strategically incorporating language or imagery in their marketing communications that target affective sensibilities (Putrevu, 2014). Indeed, when this occurs under low elaboration processing, consumers are less likely to focus their attention on central message arguments and be less able to expend cognitive resources needed for detailed processing. Consequently, children may be unlikely to use their knowledge of advertising as a critical defence to counter the persuasive nature of advertising. Insights from developmental psychology suggest that children's inability to use their knowledge of advertising as a defence is further exacerbated by their immature cognitive capabilities (Moses & Baldwin, 2005). Using age as a proxy for advertising literacy may be redundant, however differences in *ad libitum* intake studies and knowledge of food and beverage brands may vary by age therefore child age will be obtained across the relevant experimental studies of this thesis. Alongside age, behavioural traits may offer explanation of variability in food advert response summarised in the paragraph below.

1.5.1.3 Eating in the absence of hunger

Eating in the absence of hunger (EAH) is a behavioural trait referring to children's susceptibility to eating when sated, in response to the presence of palatable snacks (Fisher & Birch, 2002). EAH has been identified as a behavioural pathway linked to childhood obesity. To summarise briefly, paediatric EAH was first investigated in laboratory settings by objectively measuring children's snack intake after a meal that had been given in order to experimentally reduce hunger levels (Birch, Fisher, & Davison, 2003; Fisher & Birch, 2002). Girls (5-7 years) who consumed large quantities of snack foods even after this standardised lunch were reported to have approximately a 5-fold greater likelihood of being overweight compared with children of low levels of snack intake (Fisher & Birch, 2002). Similarly, children aged 5-18 years with high levels of snack food intake following a standardized meal were reported to have a 50% greater odds of being obese (Fisher et al., 2007). Further experimental data implies that overweight and obese adolescents may be especially susceptible to intake in the absence of hunger (Shomaker et al., 2010). However, measurement of EAH has not yet been investigated in related to food advertising intake outcomes. It is feasible that one explanation for the weight status differences in response to food advertising exposure is that overweight/obese children are more likely to consume foods in the absence of hunger. Fundamentally, food adverts may be providing a salient food cue to promote general intake, beyond just the food brands promoted in the adverts. This is explored in further detail throughout Chapter 5 with greater examination of the empirical research base. Summaries above relating to weight status, age and EAH highlight two gaps in the television food advertising literature; 1) such differences have yet to be tested and explored in non-UK/US sample and, 2) EAH has not been addressed in relation to age and gender in any studies limiting this research literature.

1.5.2 Environmental factors

1.5.2.1 Previous media exposure

As frequent media viewing is often associated with a more unhealthy diet and higher BMI in children (McGinnis, Appleton, Gootman & Kraak, 2006), experimental studies have explored previous media exposure in relation to food marketing response in children (Boyland, Harrold, Kirkham, Corker, et al., 2011; Buijzen et al. 2008). Buijzen et al. (2008) found that

exposure to food advertising in children was directly associated with their consumption of advertised brands and generic energy-dense product categories. Boyland et al. (2011) went further to establish a relationship between children's responsiveness to television food advertising and habitual television viewing as a proxy for commercial exposure. All children demonstrated a greater preference for branded foods after food adverts compared to control adverts however high television viewing displayed a greater magnitude of preference shift. Thus, high television viewers may be more prone to food advertising messages, impacting on consumption habits. However, a weakness of this literature discussed is that this has not yet been tested within a Brazilian sample of children.

1.6 Summary

This thesis aims to address weaknesses in the television food advertising literature by conducting long-term, systematic monitoring studies of television food advertising; offering a distinctive contribution to the UK literature base and the field more broadly. Studies offer short-term snapshots in terms of frequencies of food adverts broadcast (summarised in chapter 3) but what is not known currently however, is how the UK television food advertising landscape is changing in fluctuations of the frequencys and types of foods advertised and what techiniques are used to market these. By investigating the drivers of food advertising impact (exposure and power), Chapters 3 & 4 seek to address this with analysis of continued monitoring data.

Moreover, as summarised, there now exists a substantial body of literature to demonstrate the impact of television food advertising exposure on children's food intake. However, the majority of studies into food marketing are conducted within westernised developed countries (e.g., UK & USA), and there exists a lack of studies that consider responses to food promotion in countries such as Brazil. As prevalence data may imply differing societal and cultural factors like levels and response to HFSS food promotion and different approaches to food advertising regulation; this represents a distinct research gap which the present thesis seeks to address in Chapter 5. Within the UK literature, whilst studies have established an effect of television food advertising on intake, how eating behaviours are implicated as individual differences in susceptibility to food promotion is

lacking in this literature. This is addressed in Chapter 6. However, before data pertaining to this thesis is discussed, Chapter 2 will clarify and justify the selected research approaches.

Chapter 2. Methodology

2.1 Introduction

The research detailed within this thesis contributes to the literature exploring television food advertising and its role in eating behaviours through the use of multiple robust observational and experimental paradigms. This chapter describes and justifies the general research approach taken, the measures employed, and explains the specific decisions made regarding the methodology employed in this thesis.

2.2 Participant Recruitment

This thesis focuses on the impact of food advertising on children's dietary choices and eating behaviours. A target aged range of 7-11 years was selected for reasons illustrated below (consistency with existing literature and relevant level of cognitive development) however within that the exact composition of samples varied because of the opportunistic sampling approach taken due to the practicalities of recruiting the numbers of child participants necessary. Participants in Chapter 5 were recruited in Brazil, where the number of participants recruited was subject to time and financial restraints associated with conducting collaborative experimental research abroad. A total of 120 participants aged 7-11 years were recruited from one primary school (Mean=9.3; SD=1.19). In Chapter 6, 150 participants aged 7-11 were recruited from UK schools, reflecting less of a time constraint on recruitment (Mean=9.06; SD=1.20). The age ranges recruited in chapters 5 and 6 are consistent with the target age range for this type of research based on previously published studies (Anschutz, Engels, & Van Strien, 2009; Boyland et al., 2013; Boyland, Kavanagh-Safran, & Halford, 2015; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008). The target age range used in the current thesis (children aged 7-11 years) is particularly relevant in seeking to explore the impact of acute experimental exposure to food advertising on measured intake outcomes as it spans one of Piaget's analytical stages of development (Piaget, 1971) and was adapted by Roedder-John (1999) to create a theory of childhood consumer socialisation (John, 1999). The analytical stage (spanning the age range of children in Chapters 5 and 6) encompasses important developments in children's

consumer socialisation, and is characterised by transformations from perceptual to symbolic thought, concrete to abstract reasoning, and egocentricity to the ability to extend beyond their own perspective (John, 1999). Children's consumer decision-making skills at this stage are described as being more adaptive and responsive than younger children (the perceptual stage, ages 3-7) but not yet fully formed (the reflective stage, ages 11-16; Clarke & Svaneas, 2014). Thus, children aged 7-11 were selected as the target age group to recruit as they represent a key group with some understanding of the function food advertising. However, their knowledge of the persuasive intent of advertising is yet to be fully understood by children in this age range, who also attach more importance to branding when it comes to food selection (Bahn, 1986; Carter, Patterson, Donovan, Ewing, & Roberts, 2011). With regards to ethnicity, the majority of children in Chapter 5 were Black and in Chapter 6 were Caucasian. This reflects the differing ethnic and cultural populations the participants were drawn from (Brazil and UK). Ethnicity was neither recorded nor used as an exclusion criterion in either study.

2.2.1 Potential for bias in sampling method

Opportunistic sampling may have potentially excluded children in appropriate year groups who were otherwise occupied undertaking school examinations or who were on school trips/activities in chapters 5 and 6. In the study conducted in Brazil (Chapter 5), it is probable that the more educated parents with higher literacy skills were more willing for their children to participate in their research due to increased understanding of the study aims and procedure. Moreover, the parents that attended the voluntary meeting where study details were presented were more likely to consent for their children to participate in the study. Recruitment of schools for participation in these studies was also carried out using a convenience sampling technique where local (to the university and research institutions) primary schools were first approached via letter and were then followed up with a phone call to make initial contact with school staff and register their level of interest. For Chapter 6, schools were identified to be approached in accordance with a collaborative database used by researchers who worked with child aged participants. This ensured that there was no overlap in schools having already been contacted by other researchers or that were already participating in different research studies at the University of Liverpool.

Convenience sampling may have potentially resulted in a bias towards the inclusion of schools with higher levels of motivation regarding healthy eating and lifestyle initiatives in Chapter 6. However, as effects of food advertising exposure were found in children from UK schools that are potentially highly motivated to promote health, it is likely that the current research has under rather than over-estimated the magnitude of effect in the UK. The recruited school in Brazil displayed fast food marketing posters around the school and was not considered to be healthier than an average public (state) school in Rio de Janeiro. To clarify, schools healthy lifestyles ethos was not controlled for in the studies.

2.2.2 Body Mass Index and Weight Status

Age-and gender-adjusted Body Mass Index (BMI) was calculated to categorise overweight and obesity in children. Participants' height was measured to the nearest 0.1cm using a stadiometer (SECA Leicester Portable Height Measure) in Chapter 6. For collecting height measurements in Brazil (Chapter 5) a non-branded portable metal height measure was used. To assess child weight, recently calibrated weighing scales were used (SECA 770) and weight was recorded to the nearest 0.1kg. BMI was then calculated as weight (kg)/height (m^2). BMI, weight status and BMI standard deviations were calculated using the WHO AnthroPlus anthropometric calculator (downloaded from www.who.int). This is a reconstruction of the 1977 National Center for Health Statistics (NCHS)/WHO data (Dibley, Goldsby, Staehling, & Trowbridge, 1987) (a non-obese sample with expected heights) which was supplemented with data from WHO Child Growth Standards (de Onis & Lobstein, 2010). Overweight and obesity were defined based on age-and gender-specific BMI cut-off points equivalent to adult BMIs of 25 kg/m^2 and 30 kg/m^2, respectively. Due to the small number of participants in the 'obese' weight category, overweight and obesity were combined for analysis. The statistical package SPSS Statistics 20 (SPSS Inc., Chicago, US) created a dichotomous measure; 1 for normal weight and 2 for overweight/obese, to avoid significant disparity between group sizes in both Chapters 5 and 6.

WHO growth reference charts for children aged 5-19 were used to categorise children into normal weight, overweight and obese categories where Overweight: >+1SD (equivalent to BMI 25 kg/m^2 at 19 years) and Obesity: >+2SD (equivalent to BMI 30 kg/m^2 at

19 years). This standardisation (Cole, 2000) is required as BMI in children is subject to much variation according to age and gender (Cole, Faith, Pietrobelli, & Heo, 2005). This relates to variation in growth patterns, weight gain, and changes in body composition. In addition, BMI was also converted to an age- and gender-appropriate standard deviation score (BMI SDS) which is the most accurate way of comparing BMIs in a group that is heterogeneous with regards to age and gender (discussed in section 2.1). BMI *z*-score is optimal for assessing adiposity on a single occasion (Cole et al., 2005). Use of standardised scores rather than raw BMI values in addition to age-and gender-specific weight status categories ensures that these data are comparable to international research, and that interpretations based on statistical analyses of these data are valid and meaningful.

BMI of 21.2 kg/m^2 would be classified as overweight for a 12 year old boy but normal weight for a girl of the same age. Furthermore, a BMI of 20.0 kg/m^2 would indicate obesity in 6 year old children, whereas a child aged 11 years would be considered normal weight with the same BMI.

2.3 Ethical Considerations

The ethical code of Practice at the University of Liverpool ('Code of Practice for Experiments with Human Volunteers') was adhered to at all times during research conducted within this thesis. This code applies wherever the possibility exists that data collection may present special risks or intensify existing hazards present in “everyday” life. For the studies featuring human participants where studies took place in schools (Chapters 5 and 6), risks were minimal. All experimental procedures took place in particpant’s normal school environment, therefore all written tasks presented no risk in addition to normal everyday school tasks for the child. Only one procedural component had possible physical or psychological risk; this was the taking of height and weight measurements of children. The positioning of these items in the space made available in schools was such that they were away from all other children taking part in the study. A member of school staff was present at all times to weigh and measure each child in turn. In Chapter 5, due to space restricitons in the school in Rio de Janeiro, participants were told to exit the room and line up at the door whilst being supervised by a member ofstaff to ensure they did not enter the room

until it was their turn to be measured. Whilst children were away from the measuring equipment, the second research assistant took height and weight measurements of children one-by-one as the came back into the room to ensure adequate space between children and measurement recordings. Recorded measurements of height or weight of previous participants were not visible to the subsequent participant. Had children communicated any signs of distress throughout any stage of the procedure, including taking height and weight measurements, testing would have ended immediately, however this was not an issue at any point.

2.3.1 Informed Consent Procedures

The Head teacher (Gatekeeper) of all schools both in Brazil and the UK provided informed consent for study procedures before each experiment commenced. As experiments took place within normal school hours and within usual school settings, Head teachers were able to safeguard the interests of all pupils involved. Head teachers consented for research to commence when they felt satisfied that school participation would confer no physical or psychological risks to pupils above and beyond that of a typical school day (Appendix 5c and 6b for Head teacher information and consent forms). In addition to the procedure involving Head teachers, a named contact within each school (identified to supervise the running of the study) was also provided with all study information and contact details for the Principal Investigator (Dr Emma Boyland) and the researcher (Ms Rosa Whalen) including an email address and office telephone number. For Chapter 5 conducted in Brazil, parents were also provided with the local contact details of the principal collaborator (Dr Fabio Gomes) including an address, email address and telephone number. This ensured that all parties could contact the researchers to ask questions at a later date, if they so wished.

Experiments detailed within this thesis and associated consent procedures all fully complied with University of Liverpool's Policy Documents 'Draft Policy on Information Governance in Research Involving Human Participants' and 'Draft Policy on Requesting Consent for Research Involving Human Participants'; prepared by the Department of Medicine and currently being considered by the University Council (www.liv.ac.uk/humantissues/; last accessed 4th April 2016). The 'Requesting Consent'

document states that children are defined in the Human Tissue Act as those less than 18 years of age and they may consent to involvement in a research study if they are competent to do so.

From the standpoint of experimental ethics, children aged approximately 12 years and over are thought to be considered capable of understanding what an experiment involves and as such can provide informed consent for themselves. For children who indicated verbally that they wished to participate, the researchers (acting as witnesses) signed the consent form to formally document the verbal consent process. All potential child participants undertook this process, providing consent actively and individually. However, as 12 years of age was above the upper age limit of the target group for Chapters 5 and 6, it was considered suitable to provide all parents of potential participants with study information to incorporate an additional level of security. This gave parents the opportunity to make their wishes regarding their child's participation known. These requests were abided by, and children whose parents did not did not wish them to participate were not asked to. Further to this, these children were given alternative classroom tasks to complete so as not to feel isolated from the group of children granted permission to participate in the study.

2.3.2 Obtaining Informed Consent from the Children

All potential participants were given study information to read on the study day and had the opportunity to discuss the study with teachers, parents or the researchers, if they so wished. On study days, the study information was verbally communicated to children accompanied by a paper child information sheet (see Appendix 5e and 6d) in low pressure circumstances (small groups of children with researchers present). They were also provided with multiple opportunities to ask the researchers questions (Chapter 5 and Chapter 6). After the final experimental session of each study, participants were thanked and the study's aims and objectives were explained.

2.2.3 Data Confidentiality

Children were allocated a participant number on recruitment to each study and were not identified by name, initials or date of birth. Screening details and all study data in manual

form were stored in a locked filing cabinet in a locked office. Electronic study data were stored on a PC with password protection and up-to-date anti-virus software. For Chapter 5, Head teachers were not granted access to the data as specified within the ethical approval and this was made clear within the Head teacher letter which was translated into Portuguese. For Chapter 6 data were made available to Head teachers on request, and if required this was provided in an anonymised way with no reference to individual participants.

2.4 Materials

For an experiment to be ecologically valid, exposure to "everyday" stimuli in typical surroundings is preferable when designing research studies. However, measuring children's food preferences and intake in response to television food advertising with such external validity comes with intrinsic difficulties. Namely, issues surrounding lack of control over the experimental manipulation (e.g., confounding variables not accounted for) and measurement (data collection errors, underreporting; Stubbs, Johnstone, O'Reilly, & Poppitt, 2007) are likely to manifest in more naturalistic experiments. The experimental studies within this thesis (Chapters 5 and 6) took place either in school settings or in the home environment. Both surroundings may represent a good compromise between the artificiality of laboratory-based studies and the loss of methodological control inherent in epidemiological studies (Stubbs et al., 2007). These settings could be said to provide more ecological validity than laboratory studies, even those which attempt to increase the ecological validity of lab settings via typical home furniture and furnishings (Anschutz, Engels, Becker, & van Strien, 2008; Anschutz, Engels, van der Zwaluw, & Van Strien, 2011). Moreover, the television advertising stimuli (described in section 2.3.1 below) and the food brand logos and foods (described in section 2.5.4) both used genuine advertisements (from Brazil and the UK, where appropriate) and logos and products shown on television and both commonly available and familiar to UK consumers to ensure naturalistic food stimuli (e.g., branding) with context where possible.

2.4.1 Television Advertising Stimuli

To assess the acute experimental effects of television food advertising exposure in Brazil and the UK, appropriate television food advertising stimuli were selected and developed in line with those used in previous studies in this research group (Boyland, Harrold, Kirkham, Corker, et al., 2011; Halford, Boyland, Hughes, Oliveira, & Dovey, 2007; Halford, Gillespie, Brown, Pontin, & Dovey, 2004b; Halford et al., 2008). As food brands associate themselves with fundamental human motivations (e.g., attractiveness, accomplishment) to encourage product sales (Wansink, 2003) and food advertising to children typically uses such appeals (Schor & Ford, 2007), real-life food adverts, previously broadcast on television, warranted inclusion within experimental studies. Using mock food adverts or imagery would have lost the positive associations built by existing food brands reinforced over time in consumers (Heath, 2001) and thus would have had less validity. Furthermore, today's young children are deemed 'digital natives', whereby they have grown up with technology and feel comfortable using it (Prensky, 2001). Thus adverts created especially for studies by the researchers or university would have not had the credibility of real-world adverts where digitally competent children may not have reacted in the same way as to established brand adverts.

2.5 Methods

Three experimental designs were used in this thesis to examine the effects of television food advertising on children's food choices, intake and brand awareness as well as further content analysis designed to analyse the landscape of television food advertising on UK TV. This variety in use of approaches is a considered strength of this thesis. Incorporating several different designs helps to increase the likelihood of capturing effects where they exist. Chapters 5 and 6 follow a series of published studies using similar paradigms (Halford et al., 2008a; Halford et al., 2007; Halford et al., 2008b; Halford et al., 2004) but investigate either an approach to regulation (Chapter 5) or a novel individual difference (Chapter 6) thus contributing to the established literature in this area.

2.5.1 Content Analysis

Chapters 3 and 4 analysed a substantial sample of 2010 UK commercial television and compared these data to equivalent data from 2008 to explore differences over time and evaluate the efficacy of food and beverage advertising regulations. Chapter 3

comprehensively measured children's potential exposure to food advertising on television in 2010 (i.e., the extent of television food advertising on the UK television most popular with children) whilst Chapter 4 monitored the power of those food advertisements (i.e., the nature or creative content of UK television food advertising). Due to the comparative nature of chapters 3 and 4 measuring change over time in UK food advertising from 2008 to 2010, the protocol for this research needed to mirror existing published research (Boyland, Harrold, Kirkham, & Halford, 2011; Boyland, Harrold, Kirkham, & Halford, 2012) to be comparable. The 2008 methodology which was paralleled was robust and merged the best qualities of previous research in this field, namely research conducted by (Kelly et al., 2010a; based on (Chapman, Nicolas, Supramaniam, 2006) and the Kaiser Family Foundation (Gantz, Schwartz, Angelini, & Rideout, 2007).

2.5.1.1 Television Sampling

Specific channels were selected prior to 2008 data collection on the basis of their popularity with UK children and young people aged 4-15 years (Ofcom, 2007) and 5-16 years (Childwise, 2007). Based on data that a reasonable proportion of children's viewing (18%) was devoted to terrestrial public service broadcasters (ITV1, Channel 4 and Channel Five; Ofcom, 2007), these channels were selected for recording in 2008. Data from Childwise ascertained that 95% of 5-16 year olds watched cable or digital television in the preceding week (Childwise, 2007). Therefore, as in 2008, 6 channels were chosen for inclusion; the most popular channels with 5-10 and 11-16 year old boys and girls available through these platforms. These were Smash Hits, MTV, Sky One, Sky Sports One, E4 and 4Music (Childwise, 2007). It was initially determined that, of the dedicated children's channels, the following channels were most popular with children 4-15 years in multichannel homes (over 90% of homes in the UK): the Disney Channel, CBeebies, CBBC, Nickelodeon, Boomerang, CiTV, Cartoon Network and Jetix. Of these, four channels were excluded from sampling: CBeebies and CBBC (non-commercial channels) and the Disney channel (does not broadcast traditional food advertising, only television programme sponsorship; Gantz et al., 2007). The children's channel Jetix was sampled in the 2008 data analysis (Boyland, Harrold, Kirkham, & Halford, 2011; Boyland et al., 2012) but went off air between 2008 and 2010 so was not available for inclusion here.

Recordings for each channel were made on one weekday (a Tuesday or Thursday) and one weekend day (Saturday or Sunday) per month, to minimise the effects of advertising variation across days of the week. Television sampling was conducted during February, April, June, August, October and December 2010 and was recorded from 06:00 to 22:00 hours on test days. Therefore, for each of the 13 channels, 12 samples were obtained (6 weekdays and 6 weekend days) of 16 hours each. One channel (CiTV) only broadcasts from 6am-6pm therefore samples for this channel only cover 12 hours. Recording errors were observed during the 2010 television sampling due to machine and human error. One channel (Channel 4) was complete with all 12 samples across the 6 months. Two channels were missing one day of recording (Nickelodeon and Cartoon Network). Six channels were missing two days of recordings (Boomerang, Sky One, Sky Sports One, Smash Hits, MTV and E4). One channel (Channel Five) was missing three days of recording. Two channels were missing four recording days (ITV and CiTV). Finally, one channel (4Music) was missing five recording days. Recording errors amounted to 480 hours of missing television recordings.

2.5.1.2 Coding procedure

Prior to coding data for the studies described Chapters 3 and 4, the coding scheme was studied intensively and the present researcher was trained by Dr Emma Boyland (Boyland, Harrold, Kirkham, & Halford, 2011; Boyland et al., 2012). This involved coding a two hour sample of television with guidance through the coding manual and discussion of any issues that arose from the experienced researcher. An independent sample of coding was then completed by the present researcher and this was reviewed by the experienced researcher a week later and as no discrepancies were found, coding was considered to be accurate. Assessment of study coding then commenced. Television was recorded using Toshiba LCD colour televisions (model 15VL63B) and Samsung DVD-HR753 DVD recorders. Recordings were made initially onto the hard disk drive of the DVD recorder, and then copied onto DVD discs for coding and storage. Coding was initially recorded on Excel (Microsoft Corporation, US) spreadsheets with clearly labelled variables.

2.5.2 Experimental Designs with Human Participants

Chapter 5 used a within-subjects design featuring two conditions: a control condition (toy advert exposure) and an experimental condition (food advert exposure featuring one of

three warning types). All participants took part in both conditions therefore acted as their own control. This allowed for a robust assessment of the effects of television advertisement exposure on children's kcal intake. However, between-subject comparisons were carried out for warning type, weight status and TV viewing level. Similarly in Chapter 6, which used a mixed design to assess the impact of hunger state on children's kcal intake following food advertising exposure, children acted as their own control by completed by the food advertisement and control advertisement conditions. Thus both Chapter 5 and 6 necessitated between-subject comparisons to explore habitual television viewing exposure.

2.6 Measures

For the research questions addressed by this thesis, assessments of television viewing habits and brand awareness were required. This section describes the relevant measures used in this thesis, including considerations of the strengths and weaknesses of the included tasks. As these measures were all self-report by the child participants, it is important to state that children were guided through questionnaires item by item to increase the completion rate and ensure accuracy. The researchers ensured, where possible, that children were not colluding or influencing each other's responses.

2.6.1 Television Viewing Questionnaires

When measuring children's television exposure in naturalistic environments, a level of compromise must be reached between the level of precision and detail, and the feasibility of methods (e.g., time and financial limitations). Although previous research has suggested that measures to assess television exposure have not kept pace with the burgeoning research interest in the topic (Bryant, Lucove, Evenson, & Marshall, 2007), the research area has since progressed towards more sophisticated measurement of child television exposure. Researchers have recently utilised behavioural engineering technology to provide objective measurement of television exposure (Robinson, Winiewicz, Fuerch, Roemmich, & Epstein, 2006). For example, equipment such as 'TV Allowance' (Mindmaster Inc, Miami, Florida) monitors each time a television set within a home is powered on and off and has been used in multiple studies (Epstein et al., 2008; Mendoza, McLeod, Chen, Nicklas, & Baranowski, 2013). With this approach, children are assigned a unique pin number (entered by a parent

or adult) to track their television viewing over days/weeks providing a proxy estimate of a child's television viewing. Separate unique 'family' pin numbers can also be provided when others were watching television without the child present. TV Allowance then sums the minutes of use for each code to objectively determine use of that device. However, due to the expense of this equipment (each electronic device costs approximately $100; Gorin, Raynor, Chula-Maguire, & Wing, 2006), this is often not financially feasible, especially when testing large samples as in this thesis (Chapters 5 & 6).

As such, within this thesis, self-report measures were designated the most appropriate tool for measuring television watching in this population. Self-report instruments (tools exclusively designed to assess TV viewing) have been shown to have test-retest reliability of r = 0.58 (Armstrong et al., 1998), r = 0.94 (Robinson & Killen, 2013) and r = 0.82 (Mendoza et al., 2013) in previous research. The latter study, comparing the validity three separate methods of television viewing measurement exposure in preschool children, found that self-report television diaries had the highest test-retest reliability, followed by the TV Allowance measure. Ecological Momentary Assessment (EMA; Dunton, Liao, Intille, Spruijt-Metz, & Pentz, 2011; Dunton, Liao, Intille, Wolch, & Pentz, 2011) demonstrated the least test-retest reliability, a method where participants answer brief surveys throughout their day related to a behaviour (e.g., television viewing) of interest. Therefore, research seems to suggest that objective measurement of television viewing correlates highly and significantly with television diaries (i.e., a type of self-report measures), suggesting convergent validity (Mendoza et al., 2013). Therefore, a self-report questionnaire was employed to measure children's habitual television watching in Chapters 5 and 6.

2.6.1. Revised Habitual Television Viewing Questionnaire (HTVQ-R)

The Revised Habitual Television Viewing Questionnaire (HTVQ-R) was developed by Dr Boyland as reported in her thesis (Boyland, 2011) and summarised in brief below. As parents tend to underreport their children's viewing (Bryant et al., 2006), it was developed for children to complete themselves and then subsequently revised to reduce demand on child participants. The initial Habitual Television Viewing Questionnaire (HTVQ; Boyland, 2011) was a 24-item measure designed to ascertain participants' habitual television advertising exposure using television viewing habits as a proxy. The HTVQ was self-administered by the participants (when instructed by the researcher) and featured the recall

period of a 'typical' day, most often used in tools of this nature (Bryant et al., 2006). It was confirmed both verbally and within the questionnaire that television viewing did not incorporate DVD watching or engaging with computer games screened on television. This was to ensure the most accurate self-report data from children. The HTVQ asked the children to report the number of hours of television they view per day, what time of day this viewing takes place and the type of channels viewed (i.e. to give an indication of their relative exposure to commercial or non-commercial broadcasting). The measure also asked children to report on their access to television sets (i.e., the number of televisions in the house, whether or not they have a set in their bedroom, the existence of any parental viewing restrictions) and whether they have access to cable or satellite television in their home. Children were also asked to report on any other activities they take part in during the week that would restrict their television viewing time (e.g. homework or sports).

Although levels of comprehension and completion of the HTVQ from children of this age group appeared high in studies (Boyland, 2011), a revised version (HTVQ-R) was developed for later studies with aim to improve ease of completion while maintaining accuracy (Appendix 5h). The length of the original questionnaire appeared to be fairly demanding for some children (Boyland, 2011). Therefore the HTVQ was shortened to just 16 items (HTVQ-R). Items removed included questions concerning the existence of any parental restrictions regarding television viewing, as children had difficulty in reporting these where they existed. The HTVQ-R also considered weekday and weekend day viewing separately as this is more accurate and more typical of the literature (Bryant et al., 2006). Average weekly time spent viewing television was calculated by weighting the sum of the weekend and week days.

For analysis, participants were further categorised into high and low TV viewers using a median split of the full data set. Although this measure did not distinguish between commercial and non-commercial television viewing (as data retrieved regarding time spent viewing each type were often poor or inconsistent), data from Ofcom indicates that commercial television viewing is the predominant form of media consumed by this age group (Ofcom, 2004) and therefore it can be assumed that a majority of the viewing time was spent during commercial programming. A version of this questionnaire has been

published as part of a peer reviewed paper (Boyland, Harrold, Kirkham, Corker, et al., 2011) and is similar to those used by other investigators in the field, but is of unknown validity.

2.7 Statistical Analysis

A range of statistical tests are utilised in this thesis, reflecting the range of outcome variables measured by this research. The most appropriate analyses were adopted for each variable and all are described below and in the relevant chapters. For chapters 3 and 4, data from recorded television were originally entered into an Excel 2010 spreadsheet (Microsoft Corporation, US). Data for each recording sample (i.e. each 16 hour recording, a single day for a single channel) was then summarised into a masterfile using SPSS Statistics 21 (SPSS Inc., Chicago, US). These variables included the total number of adverts in that recording, the total number of food adverts, the percentage of food adverts that were for core foods, non-core foods and miscellaneous foods, the percentage of food adverts that were broadcast during peak and non-peak children's viewing times etc. Data analysis was performed using SPSS Statistics 21.

Prior to all analysis, data were tested for the assumptions for parametric data analysis. Normality of distribution was statistically assessed by the examination of skewness and kurtosis. Z-score analysis (determining how far each individual score is from the entire distribution's mean) was used to identify outliers; a score outside the range of -3 to +3 would have been considered an outlier and removed from the data set, however this did not occur. For normally distributed data (Chapters 5 and 6), homogeneity of variance (using Levene's F-test) and covariance (Mauchly's test of sphericity) were assessed, and if violations were found, multivariate tests (MANOVA) were adopted for those variables. If all assumptions for parametric analysis were met, within-subjects and mixed-measure analyses of variance (ANOVA) and bivariate correlations (Pearson's *r*) were used. Post-hoc planned t-tests were carried out (where appropriate) to identify the location of significant differences (with Bonferroni adjustments for multiple comparisons). Two-tailed comparisons were used and statistical significance was taken at the 0.05 level unless otherwise stated.

Chapter 3: Children's exposure to food advertising on UK television (2008 vs 2010)

3.1 Introduction

Food companies spend hundreds of mill

ions of pounds every year promoting their brands and products in the UK, vastly outweighing government funds dedicated to healthy lifestyle initiatives. The seven biggest food companies in the UK (McDonalds, Nestle, Mars, Kellogg's, KFC, Muller Dairy and Kraft Foods) spend over £300 million a year on marketing; totalling more than ten times that spent on the Government's public health campaign Change 4 Life (£25,000,000; Fabian Commission on Food and Poverty, 2015). This illustrates the huge financial resources multinational food companies have to spend on promotion of their food and drink products (Fabian Commission on Food and Poverty, 2015), the majority of which are energy-dense and nutrient-poor. Such level of spend allows food brands to "associate themselves at a fundamental human level with human needs with human needs and desires" and specifically target adverts at "certain groups that are most likely to buy" their products (p17; Fabian Commission on Food and Poverty, 2015). This is achieved via powerful and relentless food and beverage branding campaigns; indeed research posits food as one of the most highly branded product types, with over 80% of US grocery items being branded (Story & French, 2004).

Television is thought to be very effective at building strong brands (Heath, 2009) and despite recent proliferation of marketing techniques and approaches (Powell, Harris, et al., 2013), television remains the dominant medium of food and beverage promotion to youth (Fleming-Milici, Harris, Sarda, & Schwartz, 2013; Landon, 2013). Crucially, television is still popular with children, where a recent report investigating child media use and attitudes in the UK (Ofcom, 2014) found that more time is spent by children watching television across the week (an average of 14.6 hours) than engagement in all other alternate media. When questioned, children aged 5-15 said that they would miss television most out of all media (Ofcom, 2014) and in terms of food marketing, television advertising may act as a launchpad

to other food marketing avenues (e.g., online advertising), facilitating wider and enduring brand immersion in children of all ages.

Experimental studies and reviews demonstrate the impact of pervasive and engaging television food advertising on children's food preferences and consumption (Boyland et al., 2013; Boyland, Kavanagh-Safran, & Halford, 2015; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Kelly et al., 2010), as explored in detail in Chapter 1. In light of this, international bodies and organisations have put forward increasingly comprehensive guidance on policy development and implementation, with the aim of encouraging governments to take statutory action to limit the effects of food promotion on children's diets (WHO, 2010, 2012, 2013; see section 3.1.4). Despite this momentum, few nations have implemented statutory restrictions (see section 3.1.6). Such research would assist in determining best practise in food and beverage advertising restriction and aid and inform the efficacy of food advertising policy globally. The UK's broadcasting regulator Ofcom's implemented regulations on food and drink in full in 2009 (see Box 1), with the aim of reducing "the exposure of children to HFSS (foods high in fat/sugar and/or salt) advertising, as a means of reducing opportunities to persuade children to demand and consume HFSS products"(p1; Ofcom, 2010). However, there is a paucity of studies investigating the impact in terms of UK children's real-world exposure to HFSS adverts.

Box 1. UK Ofcom regulations

It was confirmed that: 1) advertisements for HFSS products should not be shown in or around programmes specifically made for children (which includes pre-school children); 2) HFSS advertising will be removed from dedicated children's channels; 3) all of the measures will apply equally to programme sponsorship; 4) HFSS advertising would continue to be allowed at other times. Ofcom's principal aim was 'to reduce the exposure of children to HFSS advertising, as a means of reducing opportunities to persuade children to demand and consume HFSS products'.

The present chapter aims to capture the UK television food advertising landscape during 2010 to examine the impact of the Ofcom regulations on UK children's exposure to HFSS food advertising, by comparing this with a previously published data set of UK food advertising during 2008 (Boyland, Harrold, Kirkham, & Halford, 2011a). As 2008 was the

year in which the regulations were gradually being phased in, comparing this with similar data from 2010 (when the regulations were in full effect), allows for a robust assessment of where the restrictions have had impact over time and is vital to highlight the positive changes which have occurred over time and potential areas of for improvement. This type of research can inform policy action in this area of substantial public health importance.

As this research may be of value to other countries looking to implement statutory regulation to restrict food advertising, it is useful to place this piece of research within the wider context of food advertising internationally (in terms of the quantities of television food advertising found and impact of other existing food advertising legislation). Thus, this chapter introduction will summarise content analyses of television food advertising both internationally and within the UK. Following this will be consideration of recent calls for food marketing regulation from international public health agencies, after which the chapter will review existing research which has sought to monitor its impact in terms of change in food advertising exposure internationally and, most relevant to the present research, within the UK. The final section of this introduction will outline study aims and state hypotheses.

3.1.1 Content analyses of food and beverage television advertising

Food and beverage advertising on television has been quantified across an expansive literature spanning psychology, nutrition and health policy, and is at present an active research area. Content analyses are used as a method of changing television advertisements (qualitative data) into quantitative data which can be explored descriptively or statistically analysed. Research studies typically either directly record and analyse advertising content broadcast on television or purchase this information from research companies such as Nielsen Media. Studies vary in their specific sampling of television in terms of channels used (e.g., Effertz & Wilcke, 2012 examined 10 channels whereas another examined 139 channels; Emond, Sargent, & Gilbert-Diamond, 2015), times of the day (e.g., Scully et al. (2014) analysed from 7:00-17:00 of children's broadcasting whereas Effertz and Wilcke analysed between 6:00 and 22:00) and for how many days/months (e.g., Romero-Fernández, Royo-Bordonada, & Rodríguez-Artalejo (2013) analysed broadcasts across 2 months whereas Emond et al. (2015) conducted their analyse over the course of an entire year). The classification of food advert items also differ amongst studies, where food

adverts are categorised either via, 1) core (healthy), non-core (unhealthy) and miscellaneous foods categories, 2) nutrient profiling systems (UK system and others), 3) food pyramids and, 4) national government food rating systems, amongst others. Given the vast literature on this topic, it is beyond the scope of the current chapter to review all studies. However, key recent (within the last five years) studies and reviews will be critiqued in order that the current study can be placed in context of the wider literature.

Smithers, Lynch & Merlin (2014) conducted a review of studies conducted into food advertising on Australian television. Across the 25 studies reviewed (dating from 2009), non-core foods were advertised for between 1.5 and 6.5 hours during children's peak viewing times, indicating widespread variation. A weakness of this study is that children's peak viewing times were defined differently across publications. From their review it appears that between 2006 and 2011, non-core food advertising decreased by 0.18 advertisements per hour every year, however increases were observed in specific food groups (for example, fast food advertising increased by 0.09 adverts per hour over this time). The study purports that Australian children are exposed to advertising for non-core foods when they watch programmes that are not targeted to children and non-core foods are advertised on Australian television in higher proportions than healthy foods. A cross-cultural study spanning six sites (within China, Indonesia, Malaysia and South Korea) aimed to determine the prevalence of television food advertising to children across the Asia-Pacific (Kelly et al., 2014). Broadcast data were obtained for 192 hours of television from each site (16 hours a day for four days on three channels) from May to October in 2012. Across the sample as a whole, 27% of all adverts were for food or beverages, and the most frequently advertised food product was sugar-sweetened drinks (19%). Non-core food adverts were most frequent during viewing times popular with children, where between three (South Korea) and 15 (Indonesia) non-core food advertisements were broadcast on television each hour. The study concluded that children in the Asia-Pacific are exposed to high amounts of unhealthy food advertising on television. Whereas Smithers and colleagues (2014) did not provide a non-peak comparison for children's peak viewing times; Kelly et al (2014) found that non-core food advertising ranged from 11%-310% higher during peak times compared with non-peak times.

A novel US study aimed to systematically examine Spanish-language children's television to identify disparities that may exist in comparison to food advertising found on English-language channels (Kunkel, Mastro, Ortiz, & McKinley, 2013). Television was recorded across 158 Spanish-language children's television programs and compared with an equivalent sample of English-language advertising, and food adverts were categorised according to the US Department of Health and Human Services food rating system (U.S. Department of Health & Human Services, 2005). This is a measurement framework based on consumer food ratings devised as part of a public information initiative. The authors posit that this simplifies the evaluation of nutritional quality whilst maintaining strong rigour. Kunkel et al. (2013) found that 16% of adverts were for food products. Fast foods were the most heavily advertised food item, constituting 46.2% of all food adverts on Spanish channels, and 35.5% on English-speaking channels. Importantly, the nutritional quality of food items was substantially poorer on Spanish channels than on English channels (although the amount of overall food advertising was lower on Spanish channels). This study is unique in providing clear evidence of disparities in US food advertising targeted at Spanish-speaking children. The targeting of particular population subgroups has been found before in the US, with research into the targeting of black children and adolescents (Powell, Wada, & Kumanyika, 2014). Powell and colleagues (2014) confirmed the presence of targeted advertising such that there was significantly higher exposure to food and beverage product adverts in designated market area (DMA; i.e., local media markets) spot television ratings with higher proportions of black populations, and statistically significant greater relative exposure to unhealthy food and beverage products in DMAs with higher proportions of black children and adolescents.

Within Europe, studies have monitored food advertising prevalence across numerous countries, including Germany, Spain and Ireland. Effertz and Wilcke (2012) recorded television broadcasting for two weekdays and two weekend days between 6:00 and 22:00 for six months (October 2007 to March 2008) for the ten most popular children's television channels. On average across the broadcast sample, 19.9% of adverts were for food products. Of these, 73% were for non-core foods, 21% were for core foods and 6% were not classified. Across three channels commonly viewed by children, 14.5% of adverts were for food products, of which 88.2% were for non-core foods. Additionally, adverts for

HFSS foods were broadcast significantly more often during peak children's viewing times and during and around children's programmes. A study evaluating the nutritional quality of products advertised on television during children's viewing time in Spain (Romero-Fernández, Royo-Bordonada, & Rodríguez-Artalejo, 2013) analysed 80 hours across four television station broadcasts during children's viewing time in May and June 2008. The UK nutrient profile model was utilised to categorise food items advertised and 21.6 % of total advertisements were for food, of which 59.7% were for less healthy products, increasing to 71.2% during children's 'reinforced protection viewing time'. This is a self-regulatory code protecting children from food marketing from 8:00-9:00 and 17:00-20:00 from Monday to Friday and 9:00-12:00 on Saturday and Sunday (Romero-Fernández, Royo-Bordonada, & Rodríguez-Artalejo, 2010). Notably, all breakfast cereals and 80% of the non-alcoholic/soft drinks were categorised as less healthy. Scully et al. (2014) analysed 5 weekdays of children-specific television broadcasting (07:00-17:00) on Irish television and classified foods according to the food pyramid (where unhealthy foods are recommended in moderation). 31 % of advertisements were for food or beverage items with 66.3 % of thesis constituting foods that should be eaten in moderation. The most frequently advertised food was fast food products (27.3%), followed by sweets (21.6%) and dairy products (17.0%). Although studies reviewed so far are methodologically dissimilar, with direct comparisons being challenging, they demonstrate broadly consistent findings in that 1) food advertising constituted 16%-31% of all advertising, 2) the majority of foods promoted were HFSS, and 3) notable differences were observed according to viewing time or audience demographics.

Content analyses have also been conducted which hone in on specific food items thought to be associated with particular disease risk, such as sugar-sweetened drinks, which have been linked to the rising prevalence of diabetes (Imamura et al., 2015). Noting high television advertising spend by energy drink manufacturers (Yale Rudd Center for Food Policy & Obesity, 2013), a recent US study sought to quantify energy drink advertisements on television (Emond et al., 2015). Comprehensive data detailing all adverts broadcast over one year (2012-2013) across US network and cable television channels (n=139) was collected from an advertising monitoring company. These data illustrated that there were 83,071 adverts broadcast for energy drinks during this time, and six of the top ten channels devoting the most television broadcasting time to energy drinks had 12-17 year olds as their

primary target audience. This study provides robust quantitative evidence to illustrate that energy drink manufacturers advertise heavily on adolescent targeted television channels.

Fast food advertising has also been the specific source of both research and media attention in the past decade, as fast food consumption has been linked with increased body fat, BMI and rates of obesity in youth (Andreyeva, Kelly, & Harris, 2011; S. Chou, Rashad, & Grossman, 2008; Grossman, Tekin, & Wada, 2012). A content analysis of television advertising was conducted to examine the advertising of twelve major US fast food restaurants between July 2008 and December 2009 using data obtained from a media company (Yale Rudd Center for Food Policy & Obesity, 2010). It was calculated that for each day during this time, US pre-schoolers and children viewed fast food adverts depicting foods containing 1,100-1,400 calories (2,100 calories for adolescents). Furthermore, one-third of these calories were from sugar and saturated fat. A further study has examined all cereal advertisements that were broadcast on US television between January 2008 and March 2009 reporting that children viewed 1.7 ads per day for cereals, 87% of which promoted high-sugar cereal products (LoDolce, Harris, & Schwartz, 2013). Thus, alongside published snapshots of general food and beverage television advertising, it is clear that monitoring specific unhealthy food items is valuable and informative for policymakers. However, it could be argued that there exists a paucity of this level of in-depth product specific research conducted outside of the US. The current study seeks to address this.

This brief summary of studies across Europe and continents economically and culturally similar to the UK (Australia, US), demonstrates that food and beverages depicted in advertisements on television and during child targeted programming are largely found to be predominantly for non-core foods, and typically constitute between 16%-33% of all advertised products. Specific food groups have also warranted investigation, namely fast food, sugary drinks and high sugar/low fibre cereals, all of which are frequently advertised to children and adolescents on television. Having elaborated on the importance of both fast food and sugary drink food categories, high sugar/low fibre breakfast cereals are also important to consider, as they represent the largest category of packaged food marketed directly to children, and contain 85% more sugar and 65% less than adult cereals (Harris, Schwartz & Brownell, 2009). Crucially, as previously mentioned, methodological differences with respect to broadcasting samples and food categorisations can make direct comparisons

between studies problematic. The next section discusses this issue, within the context of reviewing the available evidence of levels of food advertising on TV in the UK, and I will use this critiquing to justify my chosen approach.

3.1.1.1 Content analyses of UK food and beverage television advertising

There are a limited number of content analyses into food advertising on UK television (see Table 3-1), with the first known study of this type published in 1998. Lewis & Hill (1998) analysed 91 hours of British children's television, findings that food adverts accounted for 50% of total advertisements. A series of subsequent studies conducted by researchers in dentistry, as opposed to appetite and obesity, sought to establish the proportion of adverts depicting foods detrimental to children's oral health. Chestnutt and Ashraf (2002) compared food advertising shown during children's and during primetime (non-child targeted) programming. They found that, during children's television, 73.4% of advertising time was devoted to foods potentially harmful to teeth, when compared with only 18.6% of advertising time during primetime television. Rodd and Patel (2005) found that within 41 hours of children's programming on ITV, 34.8% of all adverts analysed were promoting food and drink products. Out of 1,000 adverts, the most frequently advertised food products included breakfast cereals with added sugar (26.3%), confectionery (23.7%) and noncarbonated soft drinks (18.1%). In another study, 503 hours of UK television were recorded, where 16.4% of advertising was for food and beverages and 38.4% of this was for high sugar items (Morgan, Fairchild, Phillips, Stewart, & Hunter, 2009). Sixsmith and Furnham (2010) analysed 45 hrs of television programming on one channel (ITV), with a focus on persuasive techniques used within television food adverts. Therefore, this particularly paper will be considered in more detail in Chapter 4, which will explore the power (i.e., creative content) of food adverts.

Study	Study design	Sample	Key results
Boyland et al. 2011	Content analysis	5,233.5 hours of broadcasting across 14 commercial television channels, (147,672 adverts)	Food and drinks were the third most heavily advertised product category (12.8%). The top three most commonly broadcasted food adverts were generic supermarket adverts (12.3%) fast foods adverts (11.9%) and high sugar/low fibre breakfast cereals (9.4%). There were a significantly greater proportion of advertisements for food/drinks during peak compared to non-peak children's viewing times. Children's channels broadcast a significantly greater proportion of non-core food advertisements than the family channels. There were significant differences between recording months for the proportion of core/non-core/miscellaneous food advertisements.
Chestnutt & Ashraf (2002)	Content analysis	237 hours of children's television and 42 hours of primetime television (2345 and 891 adverts for analysis respectively).	Significantly more food advertising during children programmes (62.5%) than on prime-time television (18.4%). Of food adverts during children's programming, 73.4% were for products deemed detrimental to oral health, compared with only 18.6% during primetime. The top food categories were; confectionary (46.6%), sugared cereals (24.1%), sugared-dairy products (16.0%), sugared soft-drinks (10.9%), diet (1.3%) and low-sugar (1.2%).
Lewis & Hill (1998)	Content analysis of children's television advertising.	91.3 hours of children's broadcasting (828 adverts for analysis).	Breakdown of food advertising by food product categories: cereal (30.1%); confectionary/savoury snacks, (29.8%); other food (34.3%); and fast-food (5.8%). Top food categories (60%) were confectionary, cereals and savoury snacks. The study compares satellite and terrestrial television, reported more breakfast cereal adverts on satellite television.
Morgan et al. (2008)	Cross-sectional content analysis	503 hours of television from 4 channels (ITV, CiTV, Nick Junior and Nickelodeon)	16.4% of advertising time was devoted to food products and 6.3% of all advertising time was devoted to high-sugar products. Sugared cereals were the most commonly advertised high-sugar product followed by sweetened dairy products and confectionery. The advertising of confectionery and high-sugar foods was influenced by school Christmas holidays.
Rodd & Patel (2005)	Content analysis	Television adverts	On average, 24 adverts were shown per broadcast hour and 34.8% of adverts related to food and drinks products, 95.3% of which were for products that were deemed to be potentially "erosive". The most frequently promoted food and drink products were breakfast cereals with added sugar (26.3%), confectionary (23.7%), and non-carbonated soft drinks (18.1%).
Sixsmith & Furnham (2010)	Content analysis	45 hrs of television programming (ITV) from 2008 (87 different types of food adverts)	Child-directed adverts contained claims of health benefits; scientific information; were shot in 'Leisure' settings; with male characters; had cartoons; and were often fantasy-based. Conversely, significantly more adult-focused advertisements contained price/value information; were shot in 'Shop' settings; with female characters; and starred celebrities.

Table 3-1. Content analyses of UK television food advertising.

As with international studies, content analyses of UK food advertising show a high prevalence of non-core food advertising. Consistently reported across studies are the heavy promotion of high sugar cereal and confectionery. Focus on high sugar foods due to the oral health perspectives of the researchers, whilst useful, may neglect focus on other food categories and trends (e.g., fast food, high fat spreads etc.). Crucially, these studies within the dental health literature do not necessarily offer in-depth analysis of the advertising of foods critical to child weight gain. Moreover, all studies offer short-term snapshots which are limited in investigating change in food advertising prevalence over time and seasonal variation trends. Capturing variation ensures evaluation of times when children have more opportunity to engage with television (e.g., during school holidays). Such narrow ranges of dates limit the generalizability of the data, with further limitations surrounding the analysis of a small number of channels or confined to children's television broadcasting only (Lewis & Hill, 1998; Rodd & Patel, 2005). This is a major shortcoming of the outlined studies, as research from Ofcom shows that over half of children's viewing occurs during adult airtime on commercial channels (Ofcom, 2008). Therefore, these studies may not be adequately capturing UK children's actual exposure. Finally, and crucially, these studies were not conducted during or after the phasing in of the Ofcom regulations, so tell us little about its impact over time or at all. Studies capturing the impact of regulations by sampling before, during and after regulation implementation measure change in food advert frequencies to help inform best routes to policy restriction. The current study addresses all of these weaknesses and thus is a novel, important and timely contribution to the literature.

Monitoring of the seasonality of television food advertising is absent from most published work (see Table 3-1.). Content analyses with short time frames miss capturing definitive evidence of trends. Only one UK study (Boyland et al., 2011) included data across 12 months to capture periods when children have more time to engage with television. Core, non-core and miscellaneous food items advertising were found to change significantly over the year and during school holiday times. The balance of foods advertised was slightly better than during school term-time than holiday periods. Studies which capture seasonal variation may demonstrate fluctuations in food advertising exposure (e.g., marketers may target children with higher frequencies of HFSS adverts during the Easter and summer

school holidays) which can help to inform policy internationally and is a crucial facet of monitoring research.

Similarly, studies which analyse peak children's viewing times (i.e., times at which children constitute greater than 25% of audience share; Ofcom, 2004) on UK television are limited, with only one study measuring differences between peak and non-peak children's viewing times differences (Boyland et al., 2011). These crucial time periods warrant investigation to allow researchers to measure precisely what food adverts are being broadcast at times when high numbers of children are watching. The present study seeks to address the lack of UK studies monitoring this.

3.1.2 Recent calls for food marketing regulation (2012-2015)

Due to empirical evidence consistently demonstrating that the food advertising children are exposed to on television is both prevalent and depicting largely unhealthy items, and that this has a detrimental effect on children's eating behaviour (Boyland & Whalen, 2015), recommendations and guidance on food and beverage marketing restriction have been proposed by international health organisations and lobbyist groups. A fuller description of these proposals is provided in section 1.4.5 of the introductory chapter, but for the sake of brevity, only documents released since 2012 will be reviewed here. After the publication of two key documents discussed in the introduction (WHO, 2010, 2012a), the WHO further posited HFSS food and beverage marketing reduction as one of 25 core indicators in the 2013 'Action Plan and Global Monitoring Framework to Prevent and Control Non-Communicable Diseases' (WHO, 2013a), emphasising this again as a policy priority. Importantly, this confirms the acknowledgement the role food promotion plays in encouraging poor dietary choices in children by WHO. Notably, The World Cancer Research Fund (WCRF) also produced the "NOURISHING framework of food policies" in 2013 to summarize worldwide policy action on the prevention of obesity. Consistent with WHO's 2013 Action (WHO, 2013a) this paper presents global level recommendations aimed at policymakers, providing a framework for monitoring policy action (C Hawkes, Jewell, & Allen, 2013). Within the 'NOURIS' part of the framework (policies relating to the food

environment), the 'R' represents the regulation of food marketing promoting unhealthy foods across all media. A subsequent 2014 document made recommendations to "regulate the marketing of food and non-alcoholic beverages to children in accordance with WHO recommendations" (p19) as an action to reduce childhood obesity (WHO, 2014). Further to this, recent guidelines on sugar reduction (recommendation that adults and children should aim to reduce their daily intake of free sugars to less than 10% of their total energy intake) states that to help adults and children achieve this, interventions such as the "regulation of marketing of food and non-alcoholic beverages that are high in free sugars…" (p18) should be implemented (WHO, 2015). Most recently, the 'Interim Report of the Commission on Ending Childhood Obesity' (WHO, 2015b) states that any attempt to tackle childhood obesity should include a reduction in exposure and power of marketing reaching children as endorsed by the World Health Assembly. Thus, international health organisations remain unanimous on the issue of HFSS food marketing reduction.

Within the UK, PHE released a 2014 report outlining current and future actions to help reduce sugar intake (Public Health England, 2014). This publication states that "It has long been recognised that promotions of foods to children affect food choice and can drive unhealthy food choices" (p21) and recommends the investigation of online forms of marketing restrictions. The UK Heart Forum asserts 'Market Less' as a key potential area for action in terms of sugar reduction and that these could impact on social norms related to consumption of sugary foods and stimulate reformulation or diversification of food products (Mwatsama & Landon, 2014). Although the literature discussed refers to wider food marketing encompassing the majority of its forms, the primary media being regulated in practise thus far is television due to its wide influence and appeal to children, but also national boundaries, making it more feasible than online advertising restrictions. To summarise, there is a clear consensus that food advertising is a growing problem. Momentum towards greater and stricter regulation of advertising is necessary. Whilst the UK has implemented regulations, there has not been adequate evaluation of these, despite this being a key component of the WHO recommendations. These specifically state that not only should countries look to enact regulations but they should be put in place from the commencement of restrictions to provide objective, systematic monitoring to ensure the regulations are achieving their stated aims.

3.1.3 Monitoring studies into statutory television food advertising regulations

Existing research studies have sought to evaluate statutory restriction currently in place. A recent systematic review collated all published papers assessing the impact of enforced measures aiming to reduce the volume, exposure and other negative impacts of advertising for foods to children in traditional media and new media (Chambers, Freeman, Anderson, & MacGillivray, 2015). Studies met the inclusion criteria if they were reporting the effectiveness of policy actions (statutory or self-regulatory), featured relevant outcome measures (e.g. advert exposure), included a comparator (comparisons of different time periods) and were peer-reviewed or grey literature. Seven out of a total nine studies into real-world statutory regulation of television food adverts support its utility (Cecchini et al., 2010; Dhar & Baylis, 2011; Goldberg, 1990a; Kent, Dubois, & Wanless, 2011a; Ofcom, 2008, 2010; Potvin Kent, Dubois, & Wanless, 2012). Further to this, two did not (Adams et al., 2012; Taras & Gage, 1995). Notably, studies considered different regulatory regimes across Canada, Quebec, South Korea, UK and the US, and two of the nine studies reviewed are two decades old and may not reflect current levels of broadcast food promotion.

Two quasi experimental papers included in the above review, Dhar and Baylis (2011) and Goldberg (1990), provide evidence of substantial reductions in advertising and a positive impact on eating behaviour in Quebec after all advertising (not just food) was banned to children aged under 13 years (Office de la Protection du Consummator, 2012). The former used household-level data to examine whether the Quebec advertising ban had an effect on consumption. Methods used were distinct from the majority of studies in the literature, as authors combined data sets from a food expenditure survey and a household expenditure survey from 1984, 1986, 1990, and 1992 to assess whether consumption of fast food altered as a result of the ban (imposed in 1990). Data illustrated that French-speaking households with children were 13% less likely to purchase fast food if they live in Quebec, compared with the rest of Canada. However, a clear limitation of this research is that no other food products were analysed. More evidence from Povtin Kent et al. (2011a; 2012) supports this, where French-speaking children in Quebec experienced more of a reduction in advertising exposure than English-speaking children (where the legislation was not enforced). However, studies did demonstrate that children were still exposed to non-core food advertisements via broadcasts from outside of Quebec. Cecchini et al. (2010) report

that although advertising regulations had the most positive impact on health compared with a number of other initiatives (such as school-based interventions, mass media campaigns and fiscal measures), results were only seen after 40 or 50 years. Studies specific to the UK Ofcom regulations (Adams et al., 2012; Ofcom, 2008, 2010) were contradictory in their assessment of the impact of the restrictions and will now be discussed in further detail.

In the UK, food advertising regulation falls within the remit of the broadcasting regulator Ofcom, with adherence and compliance to the Advertising Standards Authority (ASA). The first UK systematic review of the research literature into food and beverage advertising on children's eating behaviour was published in 2003. (Hastings et al, 2003). Further research was commissioned in 2004 intended to provide an important input to Ofcom and review the provisions of the Advertising Standards Code relating to the promotion of food and drink to children (Ofcom, 2004), prompting Ofcom to take action in 2006. Regulation was preceded by a public consultation to gain feedback on a range of different options for restrictions on television advertising to children. Following this in 2006, Ofcom announced that regulations were going to be confined to HFSS food and drink products as defined by the FSA's nutrient profiling scheme (see Box 1. for a brief summary of the Ofcom regulations).

Scheduling restrictions were phased in during 2007 to 2009 where from December 2007 no more than 75% of the average minutage devoted by that channel to HFSS advertising in 2005 was allowed. Between 1st January 2008 and 31st December 2008, this decreased to 50% of the average and from 1st January 2009 onwards, the scheduling restrictions applied in full to dedicated children's channels. These scheduling restrictions differed from programming 'of particular appeal to children' where from 1st April 2007, advertisements for HFSS products were not to be shown in or around programmes aimed at children (including pre-school children), or in or around programmes that were likely to be of particular appeal to children aged 4-9 years. From 1st January 2008, HFSS advertisements were not be shown in or around programmes that are likely to be of particular appeal to children aged 4- 15.

Restrictions refering to changes to the content of adverts for food and drinks products where enforced, where some Ofcom rulings were specific to HFSS products. Firstly,

the regulations prohibited advertisements encouraging excessive consumption of any food and drink product, and required that portion sizes shown are relevant, (particularly if children are involved). Secondly, rulings prohibited advertisements that seek to sell by appealing to emotions such as pity, fear, loyalty or self-confidence or suggest that having the advertised product somehow confers superiority, for example making a child more confident, clever, popular, or successful. Most relevant to the present research, the implemented regulations prohibited the use in HFSS product advertisements targeted directly at pre-school or primary school children of: i) promotional offers; ii) nutritional and health claims; iii) licensed characters; and iv) celebrities.

Together, these restrictions are held up as "one of the strictest advertising regulatory regimes in the world concerning the foods that can be advertised to children on TV" as quoted by the FDF (Cooper, 2015), and an example for countries currently relying on self-regulatory pledges from industry as their primary strategy to limit food marketing influence on children (C Hawkes & Lobstein, 2011). However, there has been limited examination of the impact of these regulations on television food advertising children in the UK are exposed to. The current study will address this by monitoring, over time, television food advertising on channels popular with children to assess change in food advertising levels over time; a proxy for UK children's exposure.

3.1.4 Monitoring studies into the UK Ofcom regulations

Ofcom conducted its own evaluation of the regulations soon after full implementation in 2010, stating that children saw 37% less HFSS advertising on commercial channels after the regulations. However, this review comparing 3 months of television in 2005 and 2009 tells us little about the ongoing effects of the regulations and it is methodologically flawed due to its short time frame overlooking seasonality of food and drink advertising and failing to monitor trends over time. Adams et al's (2012) study contradicted these data reported by Ofcom using more robust product specific analysis to assess nutritional quality of foods advertised. Adams et al. (2012), compared 7 days of television recorded 6 months before the regulations to 7 days of television after the full regulations had taken effect and, conversely, found that children were still being exposed to the same amount of unhealthy

food advertising as they were pre-regulations. It was found that post-regulation, 14.6% of adverts were for foods, with 55.7% promoting unhealthy foods (increased from 43.2% before regulation) despite widespread adherence to the regulations (ASA, 2009). They found that after the introduction of actions limiting advertising for foods HFSS during children's programming, the proportion of these advertisements had increased. The study authors indicated that their results implied that greater regulation was necessary outside of children's programming. This is a view supported by leading UK public health bodies (Academy of Medical Royal Colleges, 2013 and National Institute for Health and Clinical Excellence, 2010).

The most comprehensive study published in 2011 (Boyland et al., 2011) monitored a large sample of UK television during 2008 (over 5,000 hours examining 147,672 adverts) when the regulations were in the middle phase of implementation (with full implementation of all rules established from January 2009). Food advertising was found to comprise 12.8% of advertised content and proportionally, non-core (unhealthy) foods constituted 56% of all food adverts, core (healthy foods) 18.1% and miscellaneous foods 25.9%. There were a significantly larger proportion of commercials for food during peak children's viewing hours compared to non-peak (15% vs. 12.7%). This study by Boyland and colleagues (2011) will provide the baseline data for the current study.

Inconsistencies in levels of reported advertising exposure between these studies may be explained by the range outcome variables used. Ofcom used their own variable (impact) as measurement of exposure change whereas Adams et al. (2012) focussed on advertising person-minute-views (PMVs = 1,672,417). The present study quantifies core (healthy) and non-core (unhealthy) food commercials, based on criteria outlined by Kelly et al., (2010). This categorisation system differs from nutrient profiling (Department of Health, 2011) as it relies on assigning foods as core and non-core based on categorical judgements rather than an in depth nutritional analysis. However, when studying large scale data, this simpler methodology is more time effective and unlikely to lead to substantial differences in categorisation relative to the more complex nutrient profiling (unpublished data suggest that those foods designated as HFSS using nutrient profiling would also be identified as non-core using our chosen approach). An example of where they might differ is categorising fast food restaurants advertising healthier foods as the food product would be defined as

healthy by nutrient profiling but coded as non-core in the present study. It is arguable whether we should consider this as 'healthy advertising' given that experimental research demonstrates that advertising works at a category level (Halford et al., 2007) eliciting a 'beyond brand effect'. Indeed, we would expect this type of advertising to simply promote fast food as a category, as confirmed in recent research (Boyland, Kavanagh-Safran, & Halford, 2015), and therefore it is perhaps more appropriately included in the unhealthy category.

3.1.5 Aims

The present study aims to address limitations of existing research by: 1) comparing long-term data over the course of a year to monitor seasonal trends; 2) monitoring a range of channels popular with children for 32 hours per month for 6 months of the year, not just examining specific channels at specific times; 3) categorising food items into one of 29 categorised to allow for item level analysis; and, 4) coding for peak children's viewing hours. This study will compare a substantial sample of 2010 UK commercial television with equivalent data from 2008 (Boyland et al., 2011) to evaluate the efficacy of food and beverage (from hereon in referred to as food) advertising regulations, addressing a distinct gap in the literature to undertake the long-term, comprehensive monitoring of television food advertising advocated by WHO (2010, 2012) and Consumers International (Shelton, 2011).

3.1.6 Hypotheses

Based on data from 2008 (Boyland et al., 2011) and the wider research literature as discussed in the introduction, it was hypothesised that:

H1: Food would be less heavily advertised in 2010 than in 2008, where we will see a reduction from the third most heavily advertised product category (as in 2008).

H2: Core foods will make up the majority of food adverts broadcast in the 2010 sample, a shift from 2008 where non-core foods constituted the majority.

H3: Less food adverts will be broadcast during peak child viewing times compared with non-peak child viewing times as in 2008.

H4: Amounts of fast-foods, sugary drinks and high sugar low fibre breakfast cereal adverts would have reduced since 2008.

H5: Proportion of non-core food advertising would decrease marginally in months where children are off school, and core food advertising would increase, as in 2008.

3.2 Method

3.2.1 Television sampling

As no human participants were involved in this study no ethical approval was sought. Television transmissions on 13 commercial channels popular with children (ITV, Channel 4, Channel 5, Nickelodeon, Cartoon Network, Boomerang, Sky, Sky Sports 1, 4Music, Smash Hits, MTV, E4, CiTV) were recorded on one weekday (Tuesday or Thursday) and one weekend day (Saturday or Sunday) during February, April, June, August, October and December 2010 (see Figure 3-7). These were grouped into children's (Nickelodeon, Cartoon Network, Boomerang, CiTV), sport (Sky Sports 1), family (ITV, Channel 4, Channel 5, Sky, E4) and music (4Music, Smash Hits, MTV) channel types, as per Boyland et al. (2011). The criteria for channel selection, as stated in Boyland et al., (2011) was the inclusion of those channels with the greatest viewing share for children aged 4-15 years and those which appeared in the top five channels watched in the previous week by 5-16 year olds (Childwise, 2007; Thickett, 2007). Television was recorded from 6am until 10pm (16 hours), with the exception of CiTV which only broadcasts for 12 hours (6am-6pm). This resulted in a total sample of 1931.5 hours for the study (missing data due to recording errors).

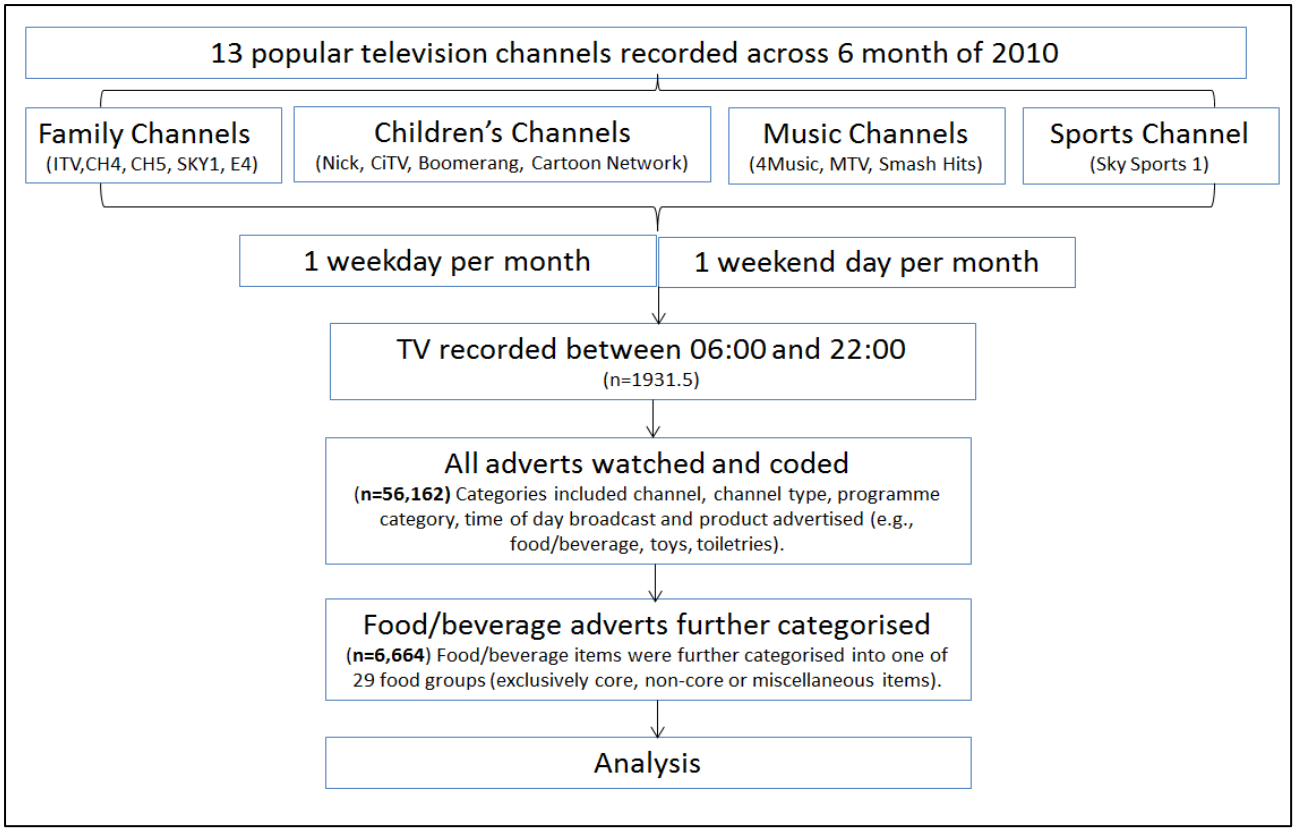

Figure 3-1. Pictorial representation of the television sampling and coding method.

3.2.2 Coding

Coding was conducted in accordance with published papers (Boyland, Harrold, Kirkham, & Halford, 2011; Boyland et al., 2012) and the full coding scheme is provided in explained below. For every item of non-programming content (advertisement), the following information was recorded: the channel it was broadcast on, the day of the week, the starting time of the programme and the time of day. Time of day was coded by half hour time segments (e.g., 06:00-06:29 was coded as time slot 1, 06:30-06:59 was coded as time slot 2 etc.). Every advertisement was also coded for both the name and type of programme it was embedded in or adjacent to. The type of programme was coded as one of 15 categories: comedy, drama, movie, soap opera, music/music video, news/commentary, talk shows, reality, sports, entertainment/variety, documentary, game, children's, infomercial or other (Gantz, Schwartz, Angelini, Rideout, 2007; Kelly et al., 2010). Children's television shows were defined as any program designed to appeal primarily to children under the age of 12 years (Gantz et al., 2007).

Children's television viewing periods were classified as peak children's viewing times and non-peak children's viewing times. Peak children's viewing times were defined as

viewing periods where the number of children watching television (on all analysed channels combined) is greater than a quartile of the maximum child audience rating for the entire day (Kelly et al., 2010). These viewing periods were ascertained, using data on the TV viewing trends of 4-15 year old children published in Appendix 3 of an Ofcom report (Ofcom, 2004), as 17:30-22:00 hours on weekdays and 19:00-21:00 hours on weekend days. All other viewing times were designated 'non-peak'. Advertisements were further coded as either within (0) or between (1) television programming, with the content aired between programmes coding as being associated with the preceding programme.

Every advertisement was coded for the type of product or service represented. The categories used were: food/drink; clothes/shoes; education; entertainment (e.g., music); financial (e.g., building societies); household cleaners/detergents (e.g., washing up liquid); household equipment (e.g., electrical appliances); motoring (e.g., cars and petrol); pet products (e.g., pet food), pharmaceutical (e.g., medications, breath fresheners); public service announcements/community service announcements (general); public service announcements (sponsored by food companies); publishing (e.g., magazines, books, newspapers); retailing/mail order (e.g., catalogues); toiletries (e.g., soap); toys; travel/transport/holidays; utilities (e.g., telephone); channel promotions (promotions for other programmes on that channel or associated channels); and other (Kelly et al., 2010; Gantz et al., 2007).

For all food advertisements, a brand name (e.g., Walkers) was recorded and a thorough description of the product was entered (e.g., ready salted flavoured potato crisps, multi-pack). As food advertising was the central focus of this research, each food product was categorised as one of 3 major food groups (core/healthy, non-core/unhealthy and miscellaneous foods) and then more specifically as one of 28 food categories (detailed below). Core foods, defined as those foods that are required daily to meet nutrient requirements, included: breads (including high fibre, low fat crackers, rice, pasta and noodles); low sugar/high fibre breakfast cereals (<20g sugar/100g and >5g dietary fibre/100g); fruits and fruit products (without added sugar); vegetables and vegetable products without added sugar; low fat/reduced fat milk, yoghurt, custard (<3g/100g fat) and cheese (<15g fat/100g); meat and meat alternatives (not crumbed or battered, including fish, legumes, eggs, nuts, nut products excluding those sugar coated or salted); core foods combined (including frozen meals with <10g fat/serving, soups with <2g/100g fat,

sandwiches, mixed salads; low fat savoury sauces with <10g fat/100g), baby foods (excluding milk formulae); and bottled water (including mineral and soda water).

Non-core items, defined as those that provide nutrients and/or energy in excess of requirements, included: high sugar/low fibre breakfast cereals (>20g/100g sugar or <5g/100g dietary fibre); crumbed/battered meat and meat alternatives (e.g. fish fingers, frozen meals with >10g fat/serving); cakes (including muffins, sweet biscuits, high fat savoury biscuits, pies and pastries); snack foods (including chips, savoury crisps, extruded snacks, popcorn, snack bars, muesli bars, sugar sweetened fruit and vegetable products, and sugar coated nuts); fruit juice and fruit drinks; frozen/fried potato products (excluding packet crisps); full cream milk (including yoghurt, custard, dairy desserts with >3g fat/100g, full fat/25% reduced fat cheese and their alternatives); ice cream and iced confection; chocolate and confectionery (including regular and sugar-free chewing gum and sugar); fast food restaurants/meals (including pizzas, burgers, 'healthy' alternatives from fast food restaurants); high fat/sugar/salt spreads (including yeast extracts, oils, high fat savoury sauces with >10g fat/100g, meal helpers such as stocks and tomato paste, soups with >2g fat/100g); sugar sweetened drinks (including soft drinks, cordials, electrolyte drinks and flavour additions e.g., Milo); and alcohol.

Miscellaneous foods included: vitamin and mineral supplements; tea and coffee; supermarkets advertising mostly non-core foods; supermarkets advertising mostly core foods; generic supermarket ads (or those not clearly advertising core or non-core items); and baby/toddler milk formulae. If more than one food product was shown in the advertisement, the most dominant one was coded. If equal attention was given to a number of products, the product that was shown first was assessed for that commercial (Kelly et al., 2010). When necessary, information required to correctly classify advertised products was obtained by referring the brand websites or the nutritional labelling on product packaging.

Data from this 2010 analysis were then compared to pre-existing data from 2008 to explore changes in advertising prevalence on TV channels popular with children in the UK (a proxy for UK children's exposure to this advertising) between the two time periods when regulatory change occurred. In line with existing monitoring frameworks (Kelly et al., 2013), this study communicates change in television food advertising over time using descriptives (e.g., rate of food versus non-food adverts; rate of unhealthy versus healthy food adverts

across the sample/specific programming). This allows assessment of change in the post-regulatory environment to be efficiently demonstrated; contributing to a "consistent system for monitoring food promotions nationally, regionally and globally" (p.67, Kelly et al., 2013). To assess reliability of coding between researchers, a random two hour sample of television recording was coded by both researchers and compared for consistency. Initial agreement between coders on product category was 93% and food product type classification was 92.9% in agreement, differences were discussed and final classifications decided by mutual agreement.

3.2.3 Pilot coding analysis

Due to differences in sample size (12 months of data for 2008 and 6 months for 2010) comparisons are made on the basis of proportional data (percentages and rates per hour) rather than number of occurrences. To check whether or not 6 months of television advertising recorded in 2010 was likely to be representative of 12 months, the data from 2008 were analysed further. When comparing 6 months of data from 2008 (February, April, June, August, October, December) to the full 12 month dataset from that year, we found less than a 1% change in each proportion of food advertised (core foods (+0.4%) non-core foods (-0.8%) and miscellaneous items (+0.5%)). Therefore the collection and analysis of 6 months of data, which is far more time and cost-effective (both due to required staffing levels and channel subscription charges incurred with this work), does not adversely affect the ability to generalise these findings as being representative of the full year of broadcasting.

3.3 Results

Given the breadth and depth of data presented, the following results section is colour coded where core foods are represented in green, non-core foods in red and miscellaneous foods in blue throughout. The recorded study time for 2010 was 1931.5 hours and the recorded study time in 2008 was 5223.5 hours. The results will now be presented by hypotheses.

H1: Food would be less heavily advertised in 2010 than in 2008, where we will see a reduction from the third most heavily advertised product category (as in 2008).

Food and drinks were the third most frequently advertised product type (11.9% of all advertised products), showing an overall decrease in food advertising prevalence from 2008 of just 7% (*d*=0.0[1]), see Figure 3-2. Table 3-2 shows a comprehensive list of the food types advertised in 2010 compared to 2008. There were a total of 6,664 food and beverage commercials throughout the study period, broadcast at an average rate of 3.5 per hour. Therefore H1 was unsupported as food adverts were still the third most heavily advertised, as in 2008, behind channel promotions (19.5%) and toys (13.2%), a finding consistent with that reported for 2008 (Boyland et al., 2011). Figure 3-3 illustrates a comparison of food adverts as a proportion of all advertised products across the two study samples. This analysis illustrates that the proportion of food adverts (as a percentage of all adverts) was lowest on children's channels (down 95.6% from 2008; where Cohen's effect size value suggests *d*=1.2 large differences) but higher across sports (+5.8%; *d*=0.1), family (+1.7%; *d*=0.1) and music channels (22.6%; where Cohen's effect size value suggests moderate differences (*d*=0.5)) across years.

[1] Where *d*=0.2 is considered a 'small' effect size, *d*=0.5 represents a 'medium' effect size and *d*=0.8 a 'large' effect size.

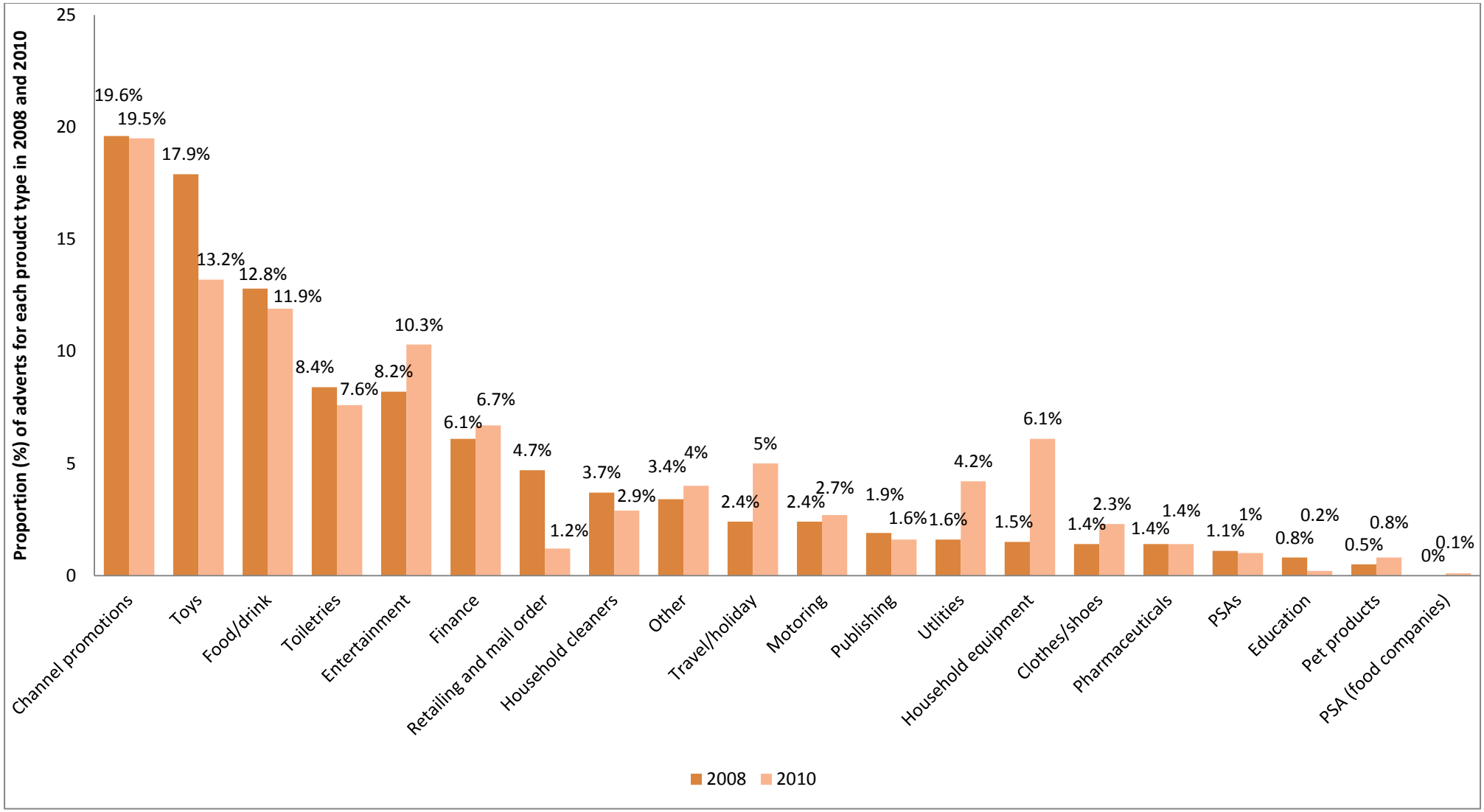

Figure 3-2. Total proportion of advertisements for each product type across 2008 and 2010 study periods

Most frequently advertised foods in 2010	Food type	Position in 2008	2008 %	2010 %	% change
1	Fast food	*2*	*11.9*	*15.2*	**+27.7**
2	Supermarkets - generic	*1*	12.3	*10.6*	**-13.8**
3	Sugar sweetened drinks	13	2.8	7.4	**+164.3**
4	Full fat dairy	12	3.3	7	**+112.2**
5	Low fat dairy	4	8.4	6.1	**-27.4**
6	Chocolate and confectionary	5	8.3	6.1	**-26.5**
7	High fat/sugar/salt spreads	6	6.6	5	**-24.2**
8	Alcohol advertising	8	4.3	4.7	**+9.3**
9	Fruit and fruit products	21	0.9	3.5	**+288.9**
10	Supermarkets – non core	9	4	3.5	**-12.5**
11	High sugar/low fibre breakfast cereals	3	9.4	3.3	**-64.9**
12	Tea and coffee	14	2.7	3	**+11.1**
13	Vegetables	24	0.5	2.9	**+480**
14	Baby and toddler milk formulae	25	0.4	2.8	**+600**
15	Low sugar/high fibre breakfast cereals	11	3.5	2.5	**-28.6**
16	Supermarkets - core	7	6	2.4	**-60**
17	Snack foods	10	3.8	2.3	**-39.5**
18	Core foods combined	17	1.5	2	**+33.3**
19	Crumbed/battered meat	18	0.4	1.9	**+375**
20	Cakes/pies/pastries	16	1.5	1.7	**+13.3**
21	Bread/rice/pasta/noodles	15	2	1.5	**-25**
22	Fruit juice	19	1.1	1.2	**-9.1**
23	Meat and meat alternatives	27	0.4	1	**-150**
24	Ice cream	22	0.7	0.7	**-**
25	Vitamins and mineral supplements	28	0.2	0.7	**+250**
26	Bottled water	23	0.7	0.6	**-14.3**
27	Frozen/fried potato products	26	0.4	0.4	**-**
28	Home delivery food	29	0.1	0.3	**+200**
29	Baby foods	20	0.9	0.2	**-22.2**

Table 3-2. Food products broadcast during the 2010 recording period and % change from 2008

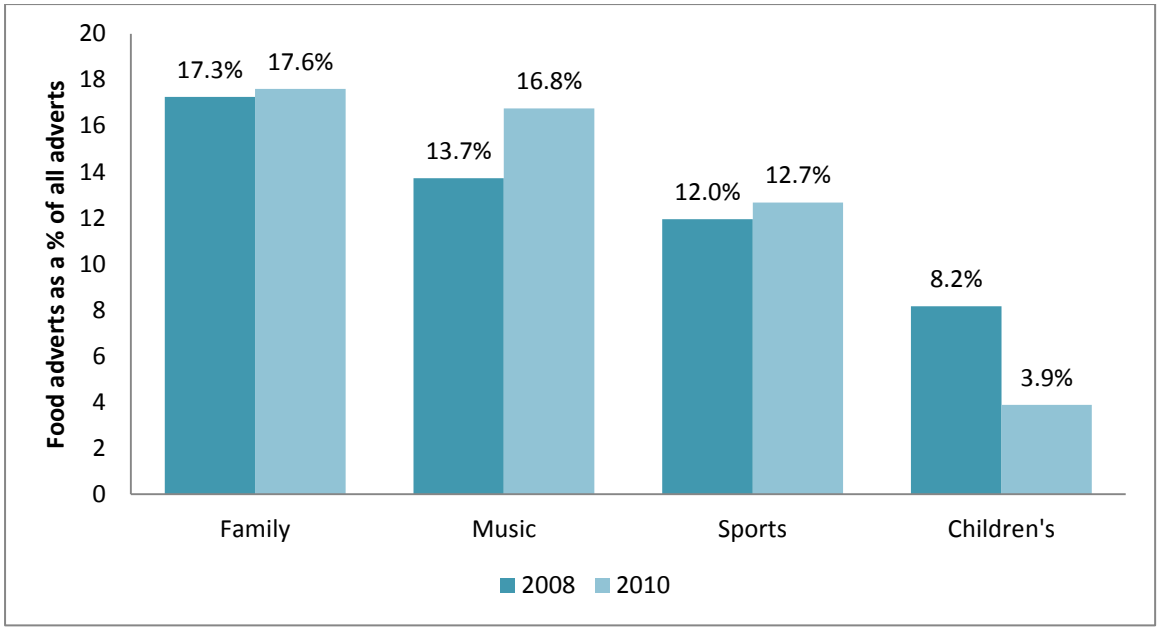

Figure 3-3. Food advertisements as a proportion of all adverts shown across channel types during 2008.

H2: Core foods will make up the majority of food adverts broadcast in the 2010 sample, a shift from 2008 where non-core foods constituted the majority.

Non-core foods made up 53.8% of food adverts broadcast in the 2010 sample, core foods 18.6%, and miscellaneous foods 27.5% (see Figure 3-4). Compared to 2008, there were few changes in these proportions; with a small reduction in non-core food adverts (-3.9%; *d*=0.1) and an even smaller increase in core food adverts (+2.8%; *d*=1.0).

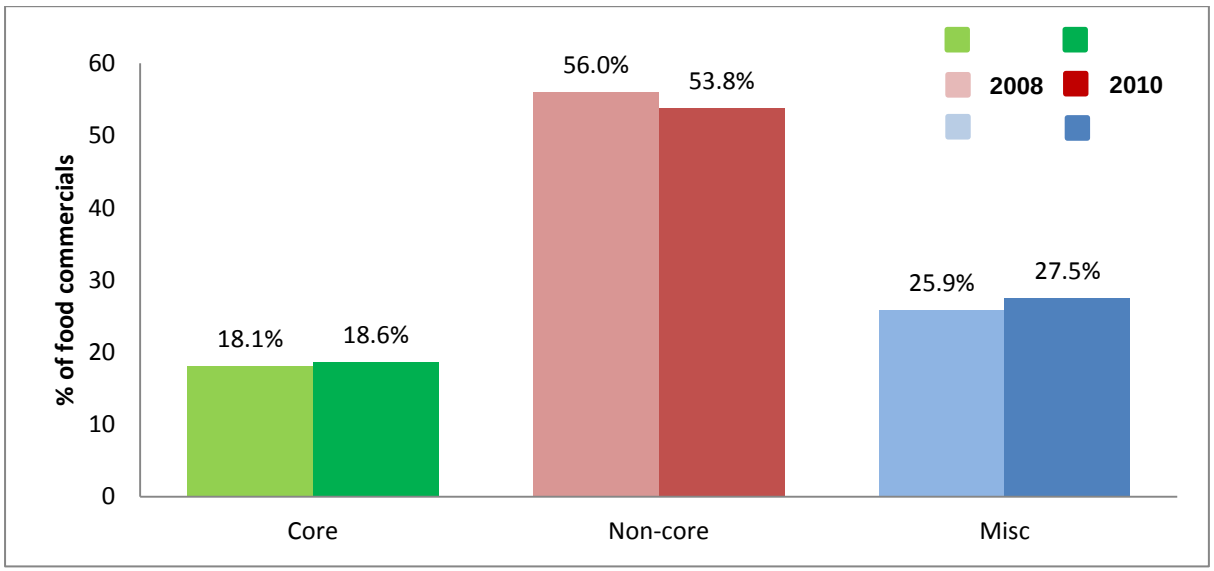

Figure 3-4. Average proportion of food adverts for core, non-core and miscellaneous items across baseline (2008) and current (2010) study periods.

Music channels (4Music, Smash Hits and MTV) broadcast the greatest proportion of non-core food advertisements (59.7%, an increase of 15.3% (*d*= 0.5) from 2008) followed by the family channels (ITV, Channel Four, Channel Five, Sky 1 and E4; 53.6% (*d*=0.0)). For family channels this represented a 6.3% (*d*=0.0) increase from 2008. On children's channels an average of 51.2% of commercials showed non-core foods, a reduction of 14.4% (d=-0.3) from 2008 levels (59.8%). The children's channel CiTV broadcast the largest proportion of non-core food commercials of all 13 channels studied. Further analysis demonstrates that the majority of non-core foods products advertised on this channel were for fast food restaurants (58.4%) and sugar sweetened beverages (25.9%). Children's channel Cartoon Network also broadcast high amounts of non-core foods across the 2010 study period (58.2%) alongside family channels ITV (51.9%) and Channel 4 (51.7%). Finally, the sports channel (Sky Sports 1) broadcast the lowest proportion of non-core food ads in 2010 (48.2%) in contrast to 2008 findings where this channel had the greatest proportion of non-core food ads of all the channel types (78.3%). Children's channels broadcast the highest proportion of core food advertising (27.4%); however the majority of food advertisements on these channels were still for non-core products (see Figures 3-5). Therefore, H2 is supported as non-core food adverts constituted the majority of food adverts broadcast in 2010, with little change from 2008.

2010 saw a 52.4% decrease in food advertising (as a percentage of all adverts broadcast) on dedicated children's channels (Nickelodeon, CiTV, Cartoon Network, Boomerang), from 8.2% in 2008 to 3.9% in 2010. However, increases in food advertising prevalence were seen across all other channel types monitored: family channels (+1.7%), music channels (+22.6%) and the sports channel (+7.8%).

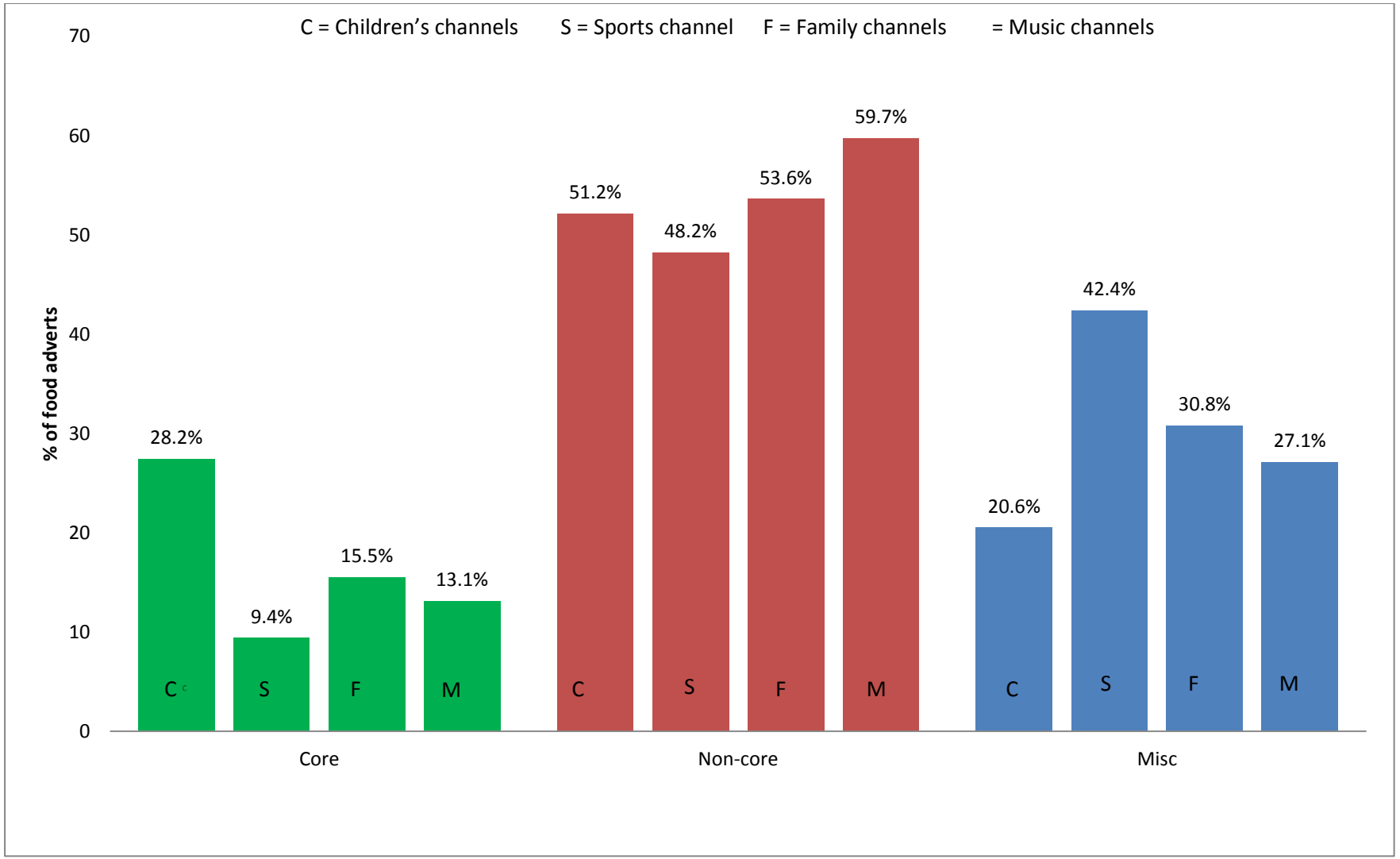

Figure 3-5. Proportion of core, non-core and miscellaneous food adverts across channel types during 2010.

H3: Less food adverts will be broadcast during peak child viewing times compared with non-peak child viewing times as in 2008.

During peak children's viewing times, 17.0% of all commercials in 2010 were for foods, an increase of 38.2% from non-peak children's viewing times (12.3%; *d*=0.4) and an increase of 11.1% from the equivalent times in 2008 (*d*=0.2). Therefore this hypothesis is unsupported. Compared to non-peak viewing times, a higher proportion of food adverts were shown during peak child viewing times on sports channels (+22.5%; *d*=0.5), family channels (+7.9%; *d*=0.1) and music channels (+49.6%; *d*=1.3), with little difference found for children's channels (7.9%; *d*=0.0) in 2010 (see Figure 3.6).

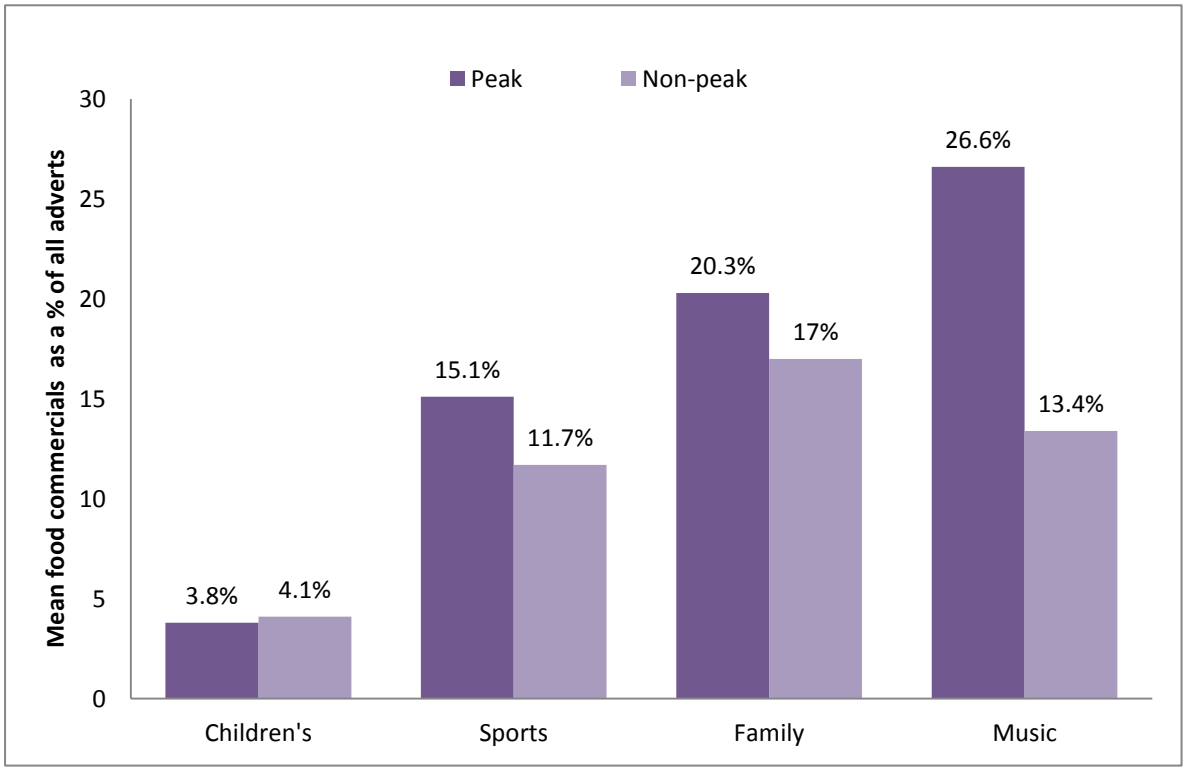

Figure 3-6. The percentage of food adverts as a percentage of all adverts during peak and non-peak children's viewing times across channel types in 2010.

H4: Amounts of fast-foods, sugary drinks and high sugar low fibre breakfast cereal adverts would have reduced since 2008.

Fast food items were the most heavily advertised foods (15.2%) 2010, a 27.7% (*d*=0.2) increase from 2008 (Boyland et al., 2011; see Figure 3-8). The second most frequently advertised food type was generic supermarket adverts (10.6%) which decreased 13.8%

(*d*=0.1) from 2008. Sugar sweetened drinks were the third most frequently advertised food product (7.4%) showing the biggest increase from the 2008 data (+164.3%; *d*=-0.6). Full fat dairy and low fat dairy items were 4th and 5th respectively (see Table 3-2). The largest percentage decreases were seen for high sugar/low fibre breakfast cereals (-64.9%; *d*=0.1), supermarkets advertising mostly core foods (-60%; *d*=0.6), and low fat dairy products (-27.4%; *d*=0.2). H4 is not supported, as although the frequency of high sugar, low fibre breakfast cereals decreased from 2008 to 2010, proportions of fast food adverts increased and sugar sweetened drinks also displayed an increase as detailed above. Further to this, full fat dairy products also showed an increase of 164.3% (*d*=-0.5) between 2008 and 2010. Notably however, advertising for both fruits and vegetables increased, (288.9% (*d*=-0.4) and 480% (*d*=-0.3), respectively). Figure 3-8 illustrates the ten most advertised food products in 2010 and percentage change from 2008. This emphasizes the dominance of non-core food groups within the most frequently advertised items (six of the ten) and low levels of core food groups represented here (two out of ten).

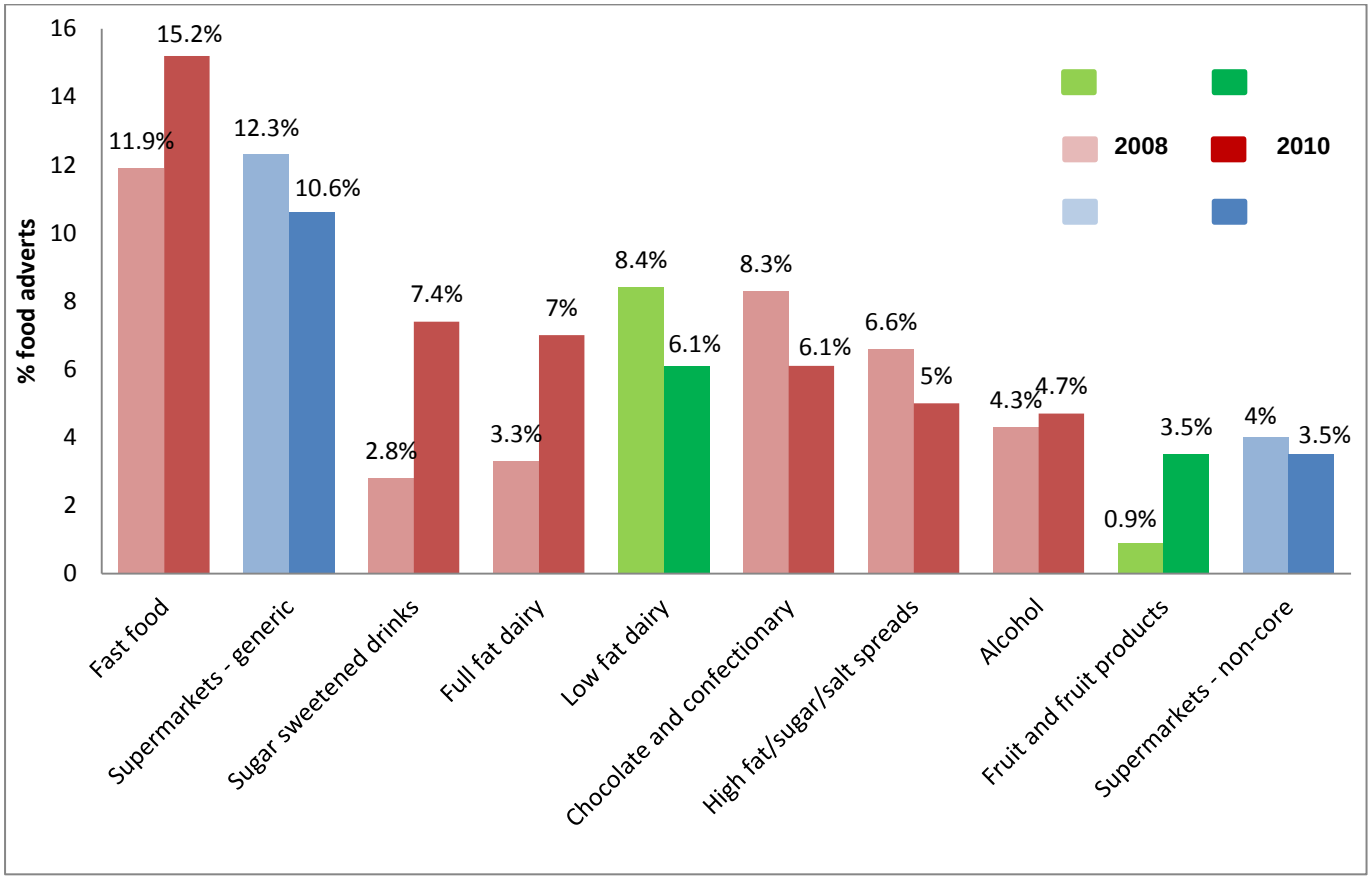

Figure 3-8. The ten most frequently advertised food groups in 2010 compared to 2008 levels.

Looking at dedicated children's channels in isolation (Figure 3-9), the increase in fast food advertising is even more pronounced (+101.5%; *d*=0.8). Sugar sweetened drinks adverts also increased more here than across all channel types (+260.1%; *d*=1.7) as well as full fat dairy items (+4145.5%; *d*=0.4).

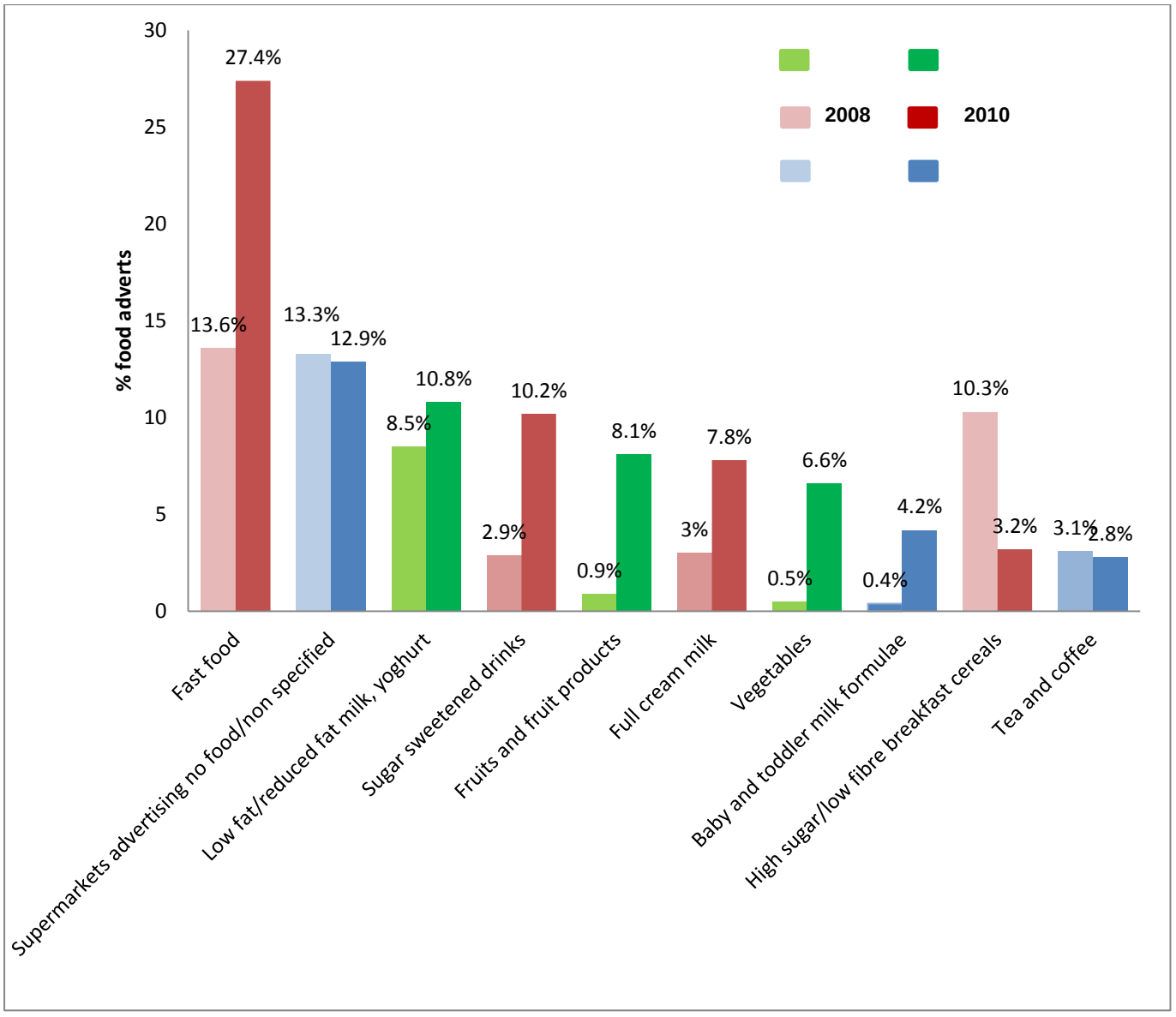

Figure 3-6. The ten most frequently advertised food groups in 2010 on children's channels compared to 2008 levels.

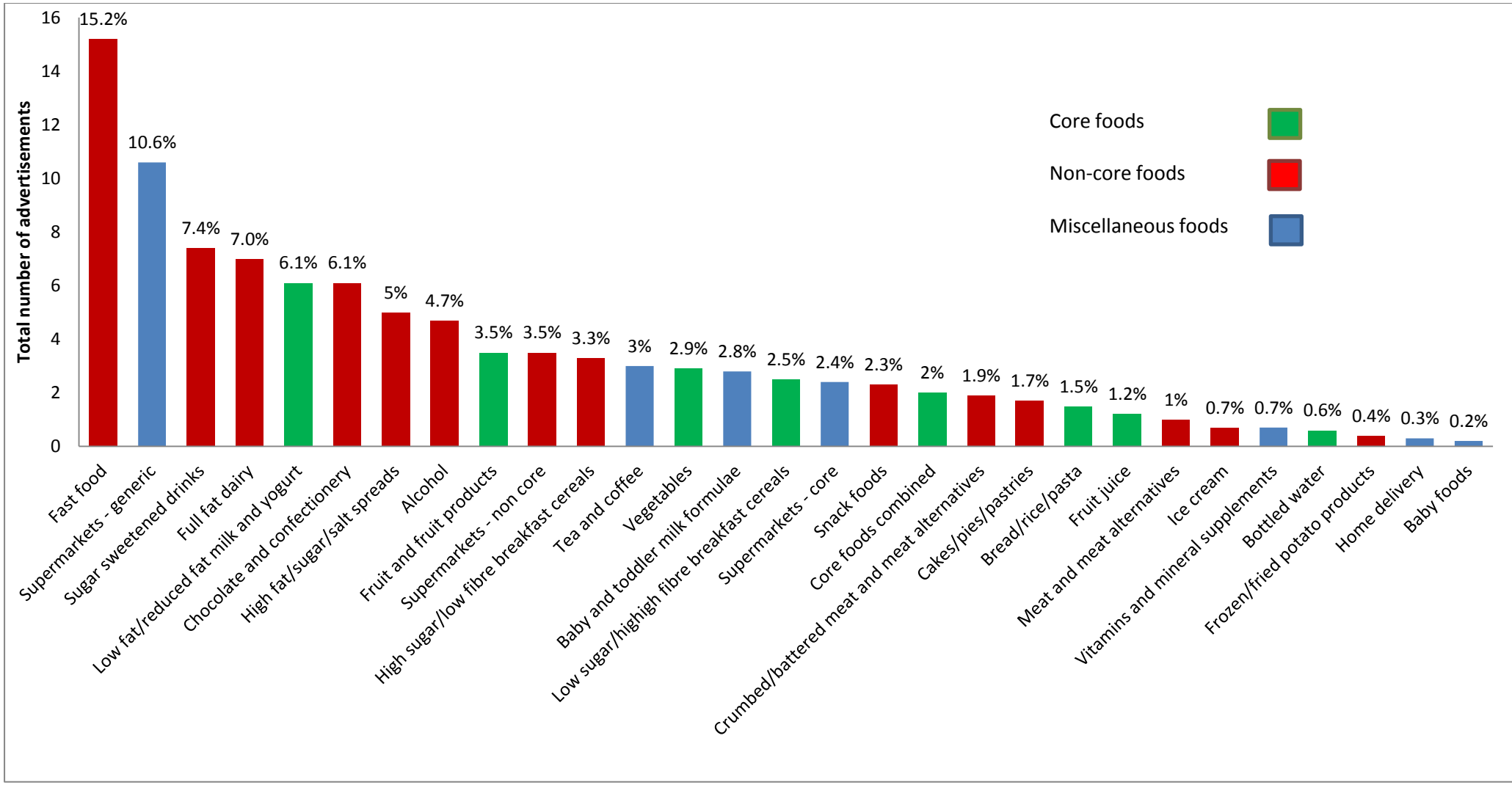

Figure 3-10. The proportion of food adverts for all food categories during the 2010 broadcast period.

H5: Seasonality of food advertising would be observed, where proportion of non-core food advertising would decrease marginally in summer months where children are off school, and core food advertising would increase, as found in 2008.

Analysis of advertising patterns by month across all channels showed a marked increase in the proportion of non-core food commercials broadcast during August (when UK schools are closed for summer vacation for the entirety of the month) compared to other months of the year. During August, 64.3% of foods advertised were for non-core items, with just 10.9% of commercials representing core foods. This is notably different from June (outside of school holidays) where non-core and core products constituted 46.9% and 26.1% of food commercials respectively (see Figure 3-11). Therefore H5 is unsupported as the trends observed in 2010 contrasted markedly with those seen in the 2008 sample. The seasonal variation found in August 2010 differs in direction from the pattern seen in August 2008. Non-core food adverts were 40.4% (*d*=1.1) higher in August 2010 than in 2008 and core food adverts were 19.7% lower (30.5%; *d*=-1.5), implying a decline in the nutritional quality of television food adverts within the school holidays between the two years sampled.

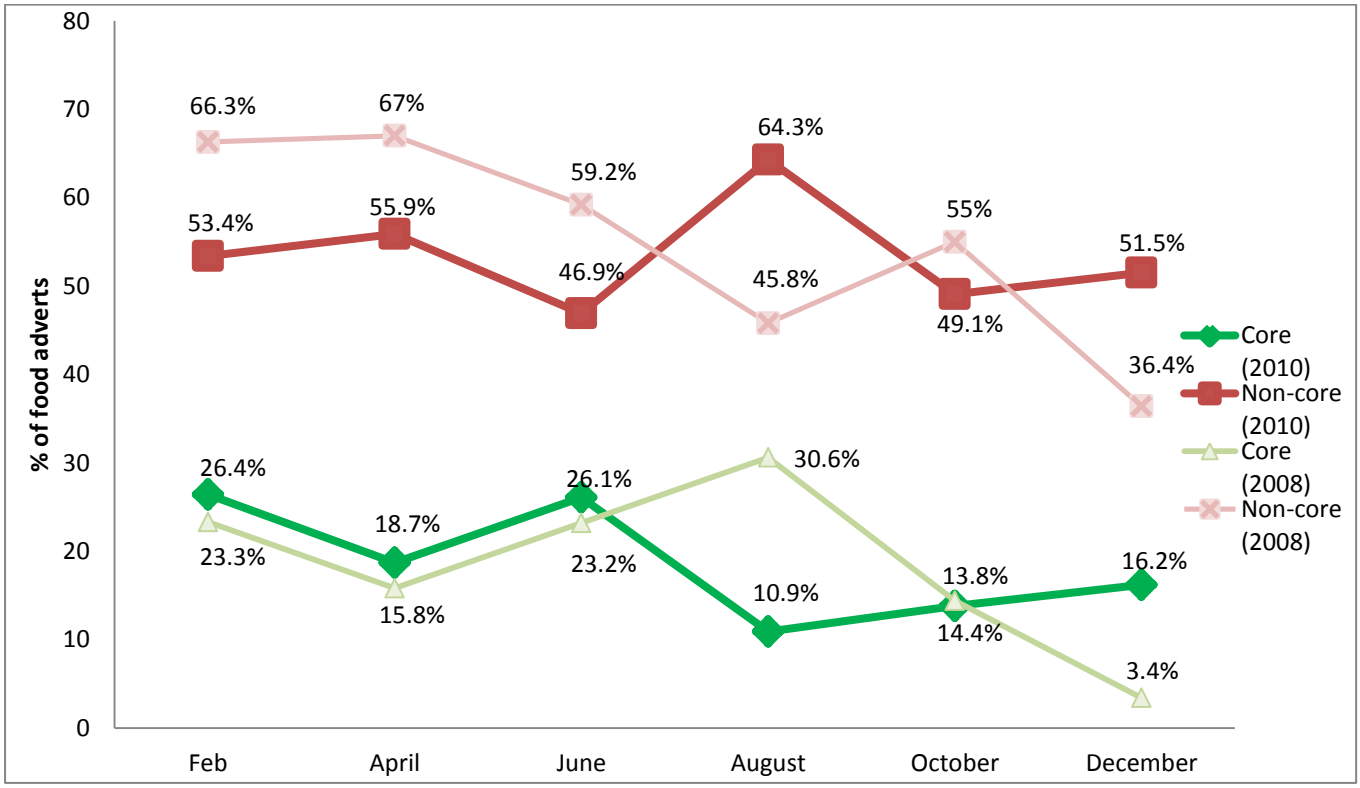

Figure 3-71. Seasonal variation in core and non-core food advertising in 2010 compared to 2008.

Considering dedicated children's channels alone, a 100% increase in food advertising promoting non-core products was seen during August (64%) relative to June (32%), with core food commercials representing 54.8% of advertising during term time and just 18.1% during the school holiday. Considering children's channels alone (see Figure 3-12), coding analysis illustrates that again, the most non-core food adverts were broadcast in August (64%). In contrast to patterns found across all channels, during the month of June, core foods (54.8%), where non-core food advertising was at its lowest across the year (32%).

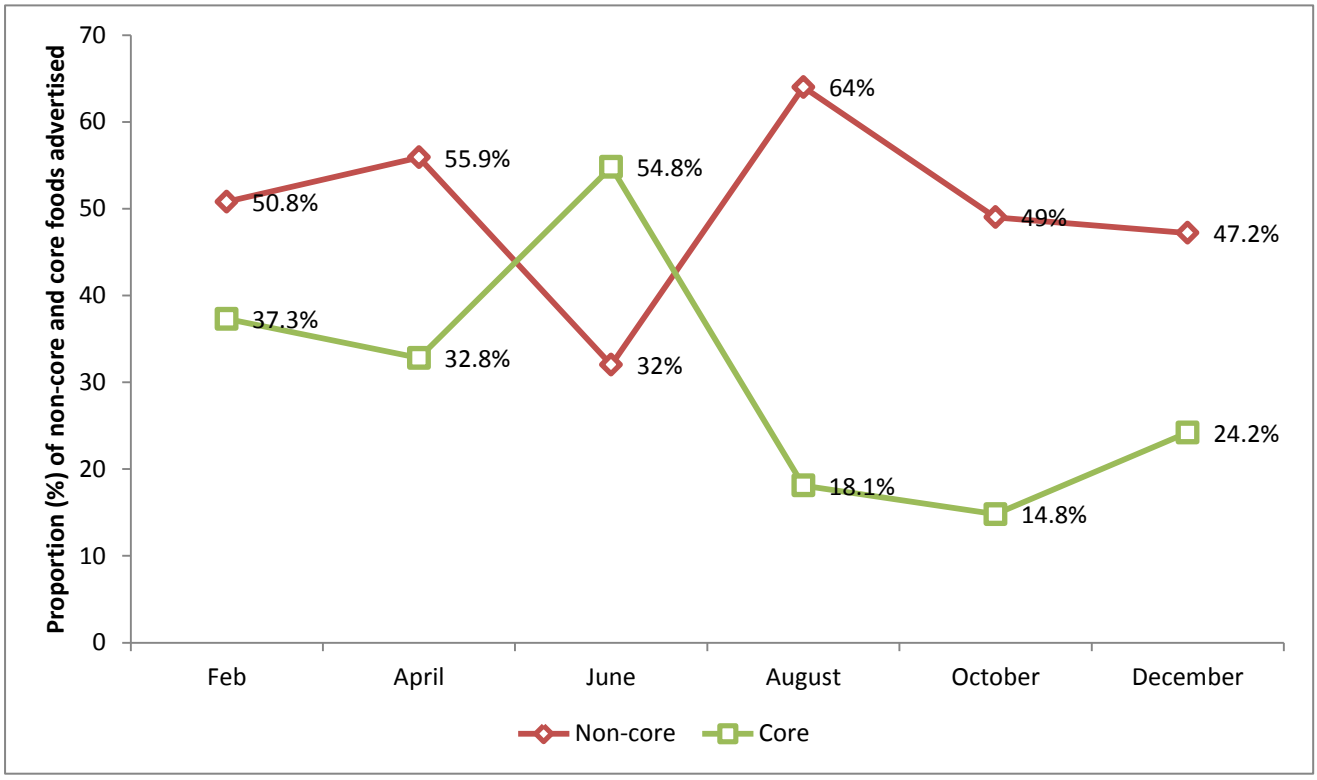

Figure 3-82. Proportion of non-core and core foods advertised on children's channels across 6 months of 2010.

3.4 Discussion

The WHO advocates systematic monitoring and evaluation of national policies restricting food advertising, to determine the most effective means of protecting children from HFSS food promotion (WHO, 2012a). To our knowledge, this study was the most comprehensive comparison ever conducted of television advertising at two different time points (2008 and 2010), representing a comparison of broadcasting during and after full implementation of statutory food advertising regulations using the UK as an example. As in 2008 (Boyland et al. 2011), food was the third most frequently advertised product category in 2010. Comparisons reveal that overall food advertising decreased 7% from 2008, to account for 11.9% of all adverts shown in 2010. This suggests that the current regulatory approach to television food commercial restriction had very little impact on overall levels of food advertising between 2008 and 2010 in the UK. WHO (WHO, 2012a) state that effective policies should reduce both exposure and power of food advertising, however these results highlight that exposure is still an issue despite the introduction of statutory regulations.

The balance of foods advertised (core, non-core and miscellaneous) remained relatively static between the two time points, with non-core food advertising exposure reducing just 3.9% to 53.8%. Although there has been a decrease of food advertising prevalence on children's channels, a 3.9% decrease in unhealthy food advertising across the board does not represent a successful regulatory approach that would be likely to positively impact children's food preferences, choices and intake in any meaningful way. These figures parallel countries where the food industry self-regulates its marketing activity or where no regulation is in place at all, as data from a global study demonstrates that non-core foods featured in 53%-87% of adverts (Kelly et al., 2010). Core foods gained 2.8% more exposure after the regulations with some increases observed in fruit and vegetable advertising. However only one core food item featured in the top 10 most advertised food products (low fat dairy items). Mirroring 2008 analysis (Boyland et al. 2011), six non-core food items made the top 10 (fast food, sugar sweetened drinks, full fat dairy, chocolate and confectionary, high fat/sugar/salt spreads and alcohol) with sugar sweetened cereals and snack foods being replaced by sugar sweetened drinks and full fat dairy in 2010. Adams et al. (2012) found that the proportion of unhealthy food advertisements increased after

implementation of the regulations, with no change in overall advertising prevalence. Indeed the current study saw proportions of specific non-core food types increase but an overall small reduction in non-core food advertising. Since the restrictions were designed to aim to lessen the "opportunities to persuade children to demand and consume HFSS products" (p8; Ofcom, 2008) this lack of change in both prevalence and types of foods advertised goes against Ofcom's stated aims.

Monitoring adverts broadcast during peak children's viewing times demonstrated an increase in amounts of foods advertised (as a percentage of all adverts during peak times) of 2.4% from 2008. Fewer healthy and more unhealthy foods were advertised during peak child viewing times in 2010, thus illustrating a shift in scheduling of adverts rather than a tangible reduction in unhealthy food advertising. This is a concern as 67% of children's total television viewing takes place outside children's viewing time; something that has remained steady since 2005 (Ofcom, 2008). Indeed, basing restrictions on the proportions of child viewers rather than actual numbers of viewing figures means these regulations fail to protect children during peak children's viewing hours where we have found non-core food advertising to increase; something highlighted by a leading UK consumer group, Which?, in consultations ahead of regulations being implemented (Ofcom, 2006). This represents one of the leading weaknesses of the Ofcom regulations as they stand, as this research shows that restrictions have little effect outside of dedicated children's programming, which, as already stated, constitutes a minority of children's viewing time.

An increase in the prevalence of fast food advertising between 2008 and 2010 meant that fast food became the most frequently advertised food item in the 2010 sample, replacing generic supermarket commercials (advertising neither core nor non-core products). Fast foods were most heavily advertised during August, suggesting that marketers are particularly aiming their products at children and adolescents by advertising most when this demographic has more free time to engage with television media. A recent content analyses of Irish television also found fast food to be the most heavily advertised food product, constituting 27.3 % of food adverts during children's television programming (P Scully et al., 2014). This is in line with reports that the UK fast food market has been growing steadily in recent years (Roach & Burnett, 2012), mirroring the US where between 2006 and 2009, fast food expenditure on television increased by 59.5% (Powell et al., 2013).

As research demonstrates that fast food branding alters children's preferences (Robinson et al., 2007) and causes significant increases in adolescent's percentage body fat (Grossman et al., 2012), this is a concerning trend. Grossman and colleagues elucidate on the potential of a complete advertising ban on fast-food restaurants on television, purporting that this would reduce mean BMI by 2 percent and percentage body fat by 3 percent in youths. This indicates the potential for real positive health-impact as a result of reducing young people's exposure to fast food adverts.

A rise in adverts for 'healthier' fast food options may in part explain this growth in prevalence, as companies sidestep the restrictions on HFSS food commercials by advertising healthier products to ensure air-time for their brands. This approach is being adopted by numerous fast food brands who aim to use television to gain 'trust and affinity' in consumers building brand loyalty (Roach & Burnett, 2012). A recent study found that children exposed to commercials for 'healthy' McDonalds meal bundles (consisting of fish fingers, a fruit bag and a bottle of mineral water) increased their liking of fast food relative to a control condition in which non-food adverts were seen, but did not make healthier choices (Boyland et al., 2015) and children are also misled by the appearance of healthy food items in advertising of fast food brands (Bernhardt, Wilking, Gottlieb, Emond, & Sargent, 2014). Therefore, an increase in healthier fast food advertising may not be accompanied by an increase in healthy eating options for children in UK fast food restaurants; with little beneficial impact on children's diets. Therefore, policymakers should consider whether or not it is appropriate to continue to allow fast food companies to advertise products to children, even if those products are deemed healthy when subject to nutrient profiling.

Increases in the advertising of sugary drinks also warrants further discussion, especially as this was found to be even more pronounced on children's channels. The findings of the present study are consistent with US research that shows that channels devoting the most broadcasting time to energy drinks had 12 to 17 year olds as their primary target audience (Emond et al., 2015). Figures from the present analysis support the fact that marketers are still aiming their products at children with their exposure to sugary drink promotion remaining high. In the UK, soft drinks constitute 30% of teenager's sugar intake and 17% of children's (aged four to ten years) sugar intake (Public Health England,

2015). Sugary drinks are thus the leading contributor of sugar intake in UK children. As advertising has been found to increase consumption of sugary drinks (Andreyeva et al., 2011), and sugar reduction is being pushed as a public health priority both globally and in the UK (Public Health England, 2014; WHO, 2015); attempts to further reduce children's exposure to the promotion of sugary drinks appears warranted. Monitoring of sugary drinks should continue in the UK on television to quantify trends as evidence for policy action.

Healthy foods like fruits and vegetables saw small increases in advertising after the Ofcom regulations were implemented, however the majority of foods advertised still promote unhealthy products on dedicated children's channels and across all channel types. Small increases in fruit and vegetable advertising, vastly outweighed by concurrent increases in fast food and sugary beverage advertising, implies that the Ofcom regulations have fallen short of sufficiently re-balancing the food advertising landscape in the UK. As stated by the WHO (2015), reductions in the exposure of children to marketing of unhealthy foods should be accompanied by increased marketing of healthy foods in order to achieve the goals of driving healthier eating behaviours. The utility of healthy food adverts is debated in the literature. A study examining primes of health foods only increased fruit selection in 'educated' individuals who already displayed higher than average rates of fruit selection (Forwood, Ahern, Hollands, Ng, & Marteau, 2015). Other research has shown that after exposure to a 'healthy' advert, low food neophobic children did not increase their consumption of fruit and vegetables, however did consume less chocolate (Dovey et al., 2011). Increasing the depiction of healthier foods therefore remains a positive shift to normalise the consumption of such foods and support parental efforts to encourage fruit and vegetable consumption. However, this may not work in all groups and contribute to health inequalities.

Observed reductions in sugary-cereal advertising reported in the present study is a an additional promising development. High-sugar cereals prevalent on television are likely convey misleading information about the nutritional attributes of the products and of healthy eating *per se*. For example, a study found that 91% of high-sugar cereal adverts viewed by children ascribed extraordinary powers to their products, and 67% portrayed both healthy and unhealthy eating behaviours (LoDolce et al., 2013). A reduction in television adverts may also lead to decreased engagement in online forms of advertising, as

the majority of breakfast cereal brands maintain child-oriented websites and social media to capture and maintain children's attention (Cheyne et al., 2013). Given children's vulnerability to advertising influence, a reduction in exposure may have an impact on children's belief about cereals and consumption of high-sugar low fibre cereals.

Monitoring of seasonal variation in the balance of foods advertised (core, non-core and miscellaneous items) in the present study produced some notable findings. Crucially, the data contrasts with the seasonal variations found during 2008; where the balance was in fact marginally healthier during months in which school holidays fall. Data across the whole 2010 sample illustrates unequivocally that the balance of food and beverage advertising is particularly poor during April and December (when children have part of the month of school) and at its worst during August (when children are off school for the whole month). Importantly, it is during these months that children have more free time and are likely to spend more time watching television. This is supportive of previous research which reported that high sugar cereals and confectionary were advertised the most frequently during the half term holiday (Morgan et al., 2009). In the current study an 'unhealthy' balance of food advertising specific to holiday times was found across children's channels and music channels especially, where high proportions of non-core food adverts impact on levels of core foods advertised. Results here imply that after full implementation of the regulations, channels may have shifted the timing of their advertising in an attempt to reach children when they are likely to be watching television. Thus, although the overall balance of foods advertised has changed little since 2008, it could be argued that non-core food adverts are even more targeted at children and adolescents now than before the full regulations were enforced.

Without dismissing the small number of positive changes (increases in fruit and vegetable advertising and decreases in sugar sweetened cereals), the present study provides further evidence that the current regulations have simply shifted unhealthy food advertising away from children's channels and onto family channels; which accounts for the majority of children's viewing time, with potential increased exposure as a result. This is a major weakness of the current system of regulation because simply, the Ofcom rules fail to effectively regulate the unhealthy food advertising occurring in and around programmes watched by the largest amount of children. A recent study from the US examining a self-

regulatory approach (the Children's Food and Beverage Advertising Initiative) purports the insufficiency of reducing children's advertising exposure via advertising bans on child-directed programming only. Authors found that the one brand which restricted advertising exposure across all ages significantly lessened household purchasing of the confectionery product by 80% (Huang & Yang, 2013a), so this could have real potential for reducing child consumption. Moreover, a further study estimated that the number of children aged 3-11 years who are overweight could be reduced by 18% with a ban on non-core food advertising (S. Chou et al., 2008). On these grounds, there is a clear and compelling case for policymakers to carefully consider the specific detail when designing food advertising regulation to ensure they will be effective in reducing children's exposure to unhealthy food advertising on television and that the rules will substantially improve the balance of foods represented.

Indeed, consumer organisations, public health bodies, and health and medical bodies propose that a pre-9pm ban on the advertising of HFSS products on television would protect the largest amount of children and reduce their actual exposure as this covers all of the time periods when the greatest numbers of young people are watching television (RCPCH, 2015; The Drum, 2015). In contrast with Ofcom, such organisations suggest this approach to regulation would not be disproportionate as benefits to child health outcomes would far exceed the adverse impacts on broadcasters, advertisers and the food industry. In a report specific to UK television food advertising, the British Heart Foundation and the Children's Food Campaign makes two calls: 1) 'to make the responsibility for developing, monitoring, and evaluating advertising regulations to a body independent of the advertising industry' and to 2)'Amend regulations to prevent TV advertisements for unhealthy food and drinks before 9pm' (British Heart Foundation, 2014). This is further supported by guidance from NICE, which also recommends the restrictions of television advertising of HFSS foods be extended until 9pm (NICE, 2010). Briefly, this ban would: 1) restrict a large body of children's viewing which is broadcast outside children's airtime; 2) be conducive to greater promotions for healthy foods and encourage healthier eating; 3) provide a greater incentive to food and drinks manufacturers to reformulate their products; 4) benefit older children and adults as well as younger children; and 5) have a lasting impact on reducing health inequalities as it would affect the population across the board. As low SES children are

more likely than those from higher SES backgrounds to be overweight or obese (Lifestyle statistics Team, 2014a), this is a further significant benefit to this popular policy option.

Indeed, as public support was highlighted as an important barrier for policy makers in the implementation of obesity prevention policies (Chung et al., 2012; Dodson et al., 2009), it is important to note here that this policy change has widespread support from parents. Indeed, a poll of 2,000 UK parents found that 60% believe that stopping children being exposed to junk food adverts could help towards tackling the obesity crisis in children. Further to this, 69% of parents feel that the UK Government should introduce stricter regulations on the food industry to better control how junk food is advertised to children (BHF, 2015a). This suggests that it may not be excessively challenging for policymakers to implement reforms to the current restrictions, as research suggests that community support for food advertising regulations is an important factor in determining feasibility of restriction implementation (Chung et al., 2012). With gaps in current regulations in mind, potential future research avenues will now be outlined.

Results from the present study suggest that continued monitoring of this nature and detail is warranted to see trends over time, and to highlight gaps in regulatory efficacy. As there are vital quantitative differences identified between 2008 and 2010 in terms of the extent of food advertising, it remains important that this is monitored to see the long-term impact of the regulations. This would also allow for further research examining specific food item trends over time (e.g., fast food, sugary drinks), of the nature discussed in section 3.1.1. Moreover, research could further explore the theoretical impact of a 9pm watershed ban on HFSS food advertising to clearly demonstrate the comparative efficacy of this approach compared with the current rules. This would compound pressure seen from medical organisations, health charities and the wishes of UK parents. Academic research should examine the utility of a watershed ban by modelling the potential reduction in children's exposure to HFSS advertising on television. This could demonstrate the impact a ban could have on children's health and wellbeing and it's consideration is warranted considering that a clear barrier to legislation being implemented is the need for clear evidence demonstrating effective regulation (Chung et al., 2012; Shill et al., 2012).

It is critical that there is continued detailed monitoring of food and beverage advertising on television to examine the long-term impact of the regulations over time and highlight where further policy action is warranted. Crucially, as food marketing is diversifying into several new media avenues (Montgomery & Chester, 2009b), television adverts can offer a launch pad to other more immersive avenues of food promotion such as advergames and social media, which have been shown to be utilised widely by the food industry. As 36% of 8-15 year olds in the UK use smartphones or laptops 'most times' when watching television (Ofcom, 2014); failure of policymakers to reform the regulations and therefore to tackle the current integrated marketing campaigns promoting unhealthy foods and drinks could have far-reaching implications for child health. Indeed, persuasive techniques used within television food advertising practices, such as website inclusion, warrant separate investigation to help illuminate trends in the food marketing landscape overtime. Monitoring the 'power' of television food marketing is recommended by both researchers (Jenkin, Madhvani, Signal, & Bowers, 2014) and public health authorities (WHO, 2012a) and the next chapter seeks to investigate the power of food marketing children are exposed to.

SUMMARY OF FINDINGS FROM CHAPTER 3

- An overall decrease in food advertising prevalence from 2008 was observed of just 7%.
- Non-core foods made up the majority of food adverts broadcast in 2010 compared to 2008, and there were few changes in these proportions; with a small reduction in non-core food adverts and an even smaller increase in core food adverts.
- More food advertising was broadcast during peak children's viewing times in 2010, a small increase from the equivalent times in 2008.
- Sugar sweetened drinks, full fat dairy products and fast food restaurants were the food groups that demonstrated the largest rises in advertising from 2008.
- In 2010 there was a marked increase in the proportion of non-core food adverts broadcast during August when UK schools are closed for summer holiday for the entirety of the month) compared to other months of the year.

4.1 Introduction

Obesogenic food marketing, as elucidated, is a modifiable environmental influence which, if appropriately regulated, has the potential to reduce children's exposure to HFSS food advertising, with lasting improvements to child diets (WHO, 2010; 2012). As children are prime targets of commercial advertising (they have independent spending power, impact on household purchases and potential as lifelong consumers; Boyland & Whalen, 2015), it is crucial that the content of this marketing is closely monitored to assess potential impact. An expansive literature quantifies the frequency of television food adverts as explored in Chapter 3. Studies confirm that food adverts are strongly biased toward less healthy options (Boyland et al., 2011; Kunkel, Castonguay, & Filer, 2015; Kunkel, Hingle, Castonguay, Ambuel, Smith, & Kunkel, 2015; Powell, Schermbeck, & Chaloupka, 2013).

The creative content of food advertising plays a critical role in its persuasive effect (WHO, 2010) and the WHO therefore calls for governments to introduce regulation that "has the ability to reduce the power of marketing by targeting the use of specific techniques which have a particularly powerful effect, a disproportionate influence, or to which children are particularly vulnerable."(p20; WHO, 2012). For example, eliminating the use of licensed characters and sales promotions (i.e., premium offers) may be one route to effectively reduce the power of food advertising; a fundamental obesity prevention goal (WHO, 2012). Both legislative approaches (i.e., Ofcom, 2007) and voluntary initiatives (i.e., EU Pledge; EU, 2016) purport to target the content of television food adverts, with the chief objective of reducing their persuasive power. However, taking the EU Pledge as an example, the majority of signatory companies have committed to reductions in exposure whereas very few have specifically pledged to address issues of marketing power (Jensen & Ronit, 2015). Therefore more work is needed to illustrate the prevalence and impact of marketing techniques as this present chapter addresses.

Comparative to levels of food advertising exposure, few studies examine persuasive techniques used as marketing strategies (Boyland, Harrold, Kirkham, & Halford, 2012; Kraak & Story, 2014; Ng, Kelly, Se, Chinna, Sameeha, Krishnasamy, & Mn, 2014; Smits, Vandebosch, Neyens, & Boyland, 2015), a factor restricting policy development (Jenkin, Madhvani, Signal, & Bowers, 2014). There is a particular gap in terms of monitoring large television broadcast samples over time, although one existing study does address

seasonality of persuasive techniques over the course of ten months (Ng et al., 2014). Typically however, studies provide brief snapshots of food advertising power in small samples of television (Folta, Goldberg, Economos, Bell, & Meltzer, 2006; Lewis & Hill, 1998; Sixsmith & Furnham, 2010) or on specific days or during limited broadcast hours (Batada, Seitz, Wootan, & Story, 2008). Moreover, studies are limited in the range of persuasive techniques monitored, with most addressing only one of health claims (Abbatangelo-Gray, Byrd-Bredbenner, & Austin; Choi & Kim, 2011), physical activity (Castonguay, 2015) or promotional characters (Castonguay, Kunkel, Wright, & Duff, 2013). The current chapter seeks to address this gap in the literature to extensively monitor a wide range of persuasive techniques used in UK television food advertising across two timeframes points (2008 and 2010). This will help illuminate trends in the food marketing landscape, as recommended by public health authorities (WHO, 2010, 2012). Thus this work is novel and is of scientific interest as well as being useful for informing policy development in this area.

Baseline data from 2008 was collected for six factors by Boyland and colleagues (2012). The present study is particularly novel in that these existing published data (Boyland et al., 2012) is compared with the present 2010 broadcast data to observe trends in a wide range of persuasive factors over time to determine if any seasonal variation occurs (fluctuations in the prevalence of these factors across seasons). The factors covered are in line with, but more comprehensive than, the list of factors suggested by Jenkin et al. (2014) as being most prevalent within television food advertising. This systematic review (Jenkin et al., 2014) states that the most commonly reported persuasive techniques used to promote foods are premium offers, promotional characters, health/nutritional claims and the adverts' primary persuasive appeal (Jenkin et al., 2014). Their use is examined in detail in the current chapter. In addition to these factors, the present chapter will quantify use of website inclusion and physical activity depiction. This study will build on the work by Boyland et al. (2012) by providing this information for 2010 to make comparison across time. The six persuasive techniques (premium offers, promotional characters, physical activity depiction, health claims, primary persuasive appeal and website use) investigated in the current chapter will now be discussed in turn, exploring 1) experimental evidence into its impact (largely on children) and 2) literature quantifying the technique within television food advertising in the UK (where evidence exists) and internationally.

4.1.1 Premium offers

Premium offers are defined as "products or services offered for free or at a lower price in return for purchasing particular food products" (p.e48, Dixon et al., 2014) and can span giveaways, competitions, contests, vouchers and rebates (see Figure 4-1 for an example). The US Federal Trade Commission (FTC) deems cross promotion of this kind as the "hallmark of marketing food to young people, particularly children" (p.ES-9; Botha, Fentonmiller, Jennings, Johnson, Rusk, Young, 2012) and consequently this technique is frequently used in adverts for HFSS foods (Dixon et al., 2014).

4.1.1.1 Impact of premium offer use

Free gifts and tie-ins generate pester power (see section 1.3.1.3) as they stimulate attention and demand for products in children, influencing the likelihood of purchase requests being made. Limited experimental research investigates the effects of premium offers specifically, although it is acknowledged that premium offers promote brand loyalty in children (Cairns, Angus, & Hastings, 2009). Recent experimental evidence found that premium offers had little effect on children's (10-12 years) choice or perception of energy-dense, nutrient poor foods (Dixon et al., 2014). However, over half of restaurant expenditures for marketing to children are spent on toys or premiums to distribute with children's meals (Otten, 2014), therefore undoubtedly, the food industry believes this to be an effective technique. Certainly, research exists to demonstrate the widespread use of premium offers within television food advertising.

Figure 4-1. McDonald's Happy Meal featuring a 'Shaun The Sheep' Movie Tie-In (2015).

4.1.1.2 Prevalence of premium offer use

Previous studies have quantified the use of premium offers in fast food television adverts (Bernhardt et al., 2013), both internationally (Kelly et al., 2010; Ng, Kelly, Se, Chinna, Sameeha, Krishnasamy, & Mn, 2014) and in the UK (Boyland et al., 2012). A study into fast food (McDonalds and Burger King) adverts found that adult-directed adverts emphasized the taste, portion size and price of food products. Conversely, adverts aimed at children emphasized toy premiums, movie tie-ins, brands and logos (Bernhardt et al., 2013). Toy premiums or giveaways were present in 69% of child-targeted adverts and movie tie-ins in 55% of adverts studied by Bernhardt et al. (2013). A study quantifying premium offers on television across 13 research groups in Australia, Asia, Western Europe, and North and South America found that 12% of all television food advertisements contained premiums, with a range of 2% (Greece) to 34% (United States) reported. A significantly higher proportion of food advertisements containing premiums were aired during children's peak viewing times than during nonpeak times and premium offers were more frequently associated with non-core foods (Kelly et al., 2010). However, this report indicated that there is a substantial amount of cross-cultural variation, implying that analysis at an individual country level is necessary for informing national policies. A recent study of television food advertising in Malaysia also reported that premium offers were more often

associated with non-core foods (Ng et al., 2014). A strength of this study is that it compared holiday and non-holiday periods (over 88 days), therefore is not a limited, short-term snapshot of one time period. Premium offer use was reported as consistently low across both time periods. In the baseline data for this chapter, 13.4% of UK food adverts featured a premium offer on UK television in 2008 (Boyland, Harrold, Kirkham, & Halford, 2012). By investigating the use of premium offers within UK television adverts in 2010 and comparing with 2008 levels, the current study will provide a comprehensive assessment of changes in the use of premium offers in the television food advertising UK children are exposed to, as well as demonstrating any seasonality in usage, addressing a gap in existing research literature.

4.1.2 Promotional characters

Like premium offers, the use of an endorser to promote products is posited as one technique heavily used in food marketing to children (Boyland et al., 2012). Brand equity characters (created for a specific food product or brand), licensed characters (popular film or television character on used to promote a food product or brand) and celebrity endorsers (a famous person who uses public recognition to recommend or co-present with a product in an advert or marketing campaign) all constitute types of promotional characters utilised widely by food companies within televised marketing campaigns (see Figures 4-2 & 4-3 for examples).

Figure 4-2. Image from a Coco Pops Moon and Stars television advertisement - The Coco Pops Promise (2011).

Figure 4-3. Licensed characters from film franchise 'Frozen' as used on food packaging (not taken from a television advert).

4.1.2.1 Impact of promotional characters

Children are exposed to promotional characters via diverse marketing avenues, including television, where marketers aim to develop 'parasocial relationships' between children and such characters (Bond & Calvert, 2014). Through this bond characters influence children's food choices, preferences and consumption (Bond & Calvert, 2014; Kraak & Story, 2014). Using a mixed measures counterbalanced design (C. A. Roberto, Baik, Harris, & Brownell, 2010), 40 children tasted three pairs of identical foods presented in packaging either with or without a popular cartoon character (licensed characters). It was found that branding food packages with licensed characters substantially influenced young children's taste preferences and snack selection most strongly for energy-dense, nutrient-poor foods. Further research has revealed that parents perceive athlete-endorsed food products (see Figure 4-4 for a recent example) to be healthier than non-endorsed food products (Dixon et al., 2011). This implies that the presence of a sporting figure misleads consumers as to the nutritional profile of the food product they are endorsing. Given the prevalence of energy-dense nutrient-poor foods typically endorsed by athletes, this is a public health concern. Furthermore, a recent study investigating the impact of a premium sports endorser found that children who viewed an endorsed commercial or TV footage of the endorser (see Figure 4-5 for a recent example) outside of a food context consumed significantly more crisps (widely endorsed by the celebrity) compared with children in other groups (Boyland et al., 2013). Importantly, children in these groups did not reduce their intake of supermarket branded crisps to compensate, therefore the effects of celebrity endorsement contributed to overconsumption (Boyland et al., 2013).

Figure 4-4. Pepsi television advert featuring sports celebrity endorser David Beckham (2011).

Figure 4-5. Walkers Crisps television adverts featuring sports celebrity endorser Gary Lineker (2015).

A recent systematic review into the effects of cartoon food industry mascots explored the results of 11 experimental studies (Kraak & Story, 2014). The review concluded that whilst promotional characters can increase healthy food intake in children; familiar cartoon media characters have a more powerful effect for HFSS food (compared to fruit or vegetables. A further systematic review found that both familiar and unfamiliar characters have the potential to generate these effects (Smits et al., 2015), although the evidence to date suggests that the effects are strongest for familiar characters. In sum, although research in this area is still somewhat in its infancy (Smits et al., 2015), studies to date imply that character endorsement marketing is a powerful persuasion tool. Consequently, unsurprising that promotional characters are a popular marketing technique employed in traditional broadcast advertising, as content analyses purport below.

4.1.2.2 Prevalence of use of promotional characters

Of the studies quantifying promotional characters on television, a US study reported higher levels on dedicated children's channels, where 55% of food adverts on Nickelodeon and 100% of food adverts on the Disney Channel used licensed characters (Connor, 2006). A multi-country content analysis of child targeted television advertising found that, on average, 23% of food advertisements contained a promotional character (Kelly et al., 2010). These characters were found to be promoting non-core foods in 79% of cases. As briefly explored, sports endorsement (see Figure 4-4) is a further strategy used by food marketers.

A 2012 study examined supermarket foods and found that 79% of those with in athlete-endorsed advertising were energy-dense and nutrient-poor, and 93.4% of athlete-endorsed beverages had 100% of calories from added sugar (Bragg et al., 2012). Previously published data, from a large sample of broadcast TV in the UK in 2008 (baseline for the present study), found that 56% of UK food adverts used a promotional character. In addition, promotional characters were used most frequently in the promotion of unhealthy foods (Boyland et al., 2012) in line with previous research (Kelly et al., 2010). The current chapter will seek to quantify the use of promotional characters in television food adverts in 2010 and assess changes from 2008.

4.1.3 Physical activity depiction

A further marketing strategy used within television food adverts is the depiction of actors or characters engaged in physical activity. In the context of increasing regulation, food manufacturers are thought to be positioning their products in the context of a 'healthy and balanced diet' within television adverts and wider marketing (Malhotra, Noakes, & Phinney, 2015). The International Food and Beverage Alliance (IFBA) pledges to "raise awareness on balanced diets and increased levels of physical activity"(IFBA, 2014a) and the FDF states that marketing messages should communicate "healthy dietary habits and physical activity"(International Food and Beverage Alliance, 2015). One way in which food brands associate a product with health is by portraying physical activity (Folta, Goldberg, Economos, Bell, & Meltzer, 2006; Gantz, Schwartz, Angelini, & Rideout, 2007; see Figures 4-6 and 4-7 for recent examples). Such advertisements portray characters engaged in competitive sports for example, to create an implicit association between the product and physical activity without the declaration of explicit health claims (which are often tightly regulated, see section 4.1.4).

Figure 4-6. Coca-Cola's television advert: Grandpa - Living and Healthy Lifestyle (2013).

Figure 4-7. McDonald's Little Farmers television advert (2013).

4.1.3.1 Impact of physical activity depiction

Exposure to adverts with physical activity content has the potential to foster healthy habits in two ways; by prompting more nutritious food intake and facilitating exercise intentions in children (Castonguay, 2014). However, problems can arise when HFSS food and beverages are promoted with reference to physical activity. There is concern that this practise could mislead children in overestimating a product's nutritional benefits (Castonguay, McKinley, & Kunkel, 2011), in a similar way to that demonstrated by Dixon et al (2011) for the presence of athlete endorsers. Evidence indicates that children as young as 5 years old associate physical activity with health (O'dea, 2003). A recent online experiment (Chrysochou & Grunert, 2014) demonstrated that individuals rely more on health imagery than health claims when evaluating food products, with further research confirming that implicit health messages may be more powerful than explicit ones (Wagner, Howland, & Mann, 2015). Moreover, when making dietary selections, studies show that healthiness is a significant consideration for children under 10 years of age (Nguyen, McCullough, & Noble, 2012; Noble, Corney, Eves, Kipps, & Lumbers, 2000), although taste becomes the dominant factor as children approach adolescence (Noble et al., 2000).

A recent experimental study explored the specific impact of 5-6 and 10-11 year old children's perceptions of a television advert for a sugar-laden cereal depicting physical activity, compared with an advert for the same product without physical activity references (Castonguay, 2015). It was found that the sugary-cereal advert containing a physical activity reference i) led children to believe that the cereal was a healthier option, ii) led children to believe that cereal was more appealing (children aged 5-6 only), and iii) failed to encourage engagement in physical activity depicted within the advert or more general exercise. In a qualitative study of children aged 5-11, it was stated that contradictions in messages children receive were reported as barriers to healthy lifestyles (Hesketh, Waters, Green, Salmon, & Williams, 2005). HFSS foods advertised in conjunction with allusions to health thus has the potential to skew children's understanding of the nutritional value of foods and their ability to make properly informed healthy food choices. Thus prevalence monitoring is vital.

4.1.3.2 Prevalence of physical activity depiction

Despite published research findings as summarised, a very limited number of studies have sought to quantify physical activity content in television advertising. A 2006 study found that physical activity appeared in 35% of television food adverts (Folta et al., 2006) and more recent research into specific food categories found physical activity to be depicted in 11% of sugary cereal adverts targeting children in 2009 (Castonguay et al., 2013), however a comprehensive range of food groups are notably absent from this analysis. With over 70% of child-targeted food advertisements depicting physical activity for foods too high in sodium, fat and/or sugar to be consumed on a daily basis (Castonguay, McKinley, & Kunkel, 2013), this food advertising strategy may impair children's future nutritional judgements. Therefore depiction of exercise in food adverts requires monitoring and may be appropriate for future regulatory attention. Baseline data reports that in 2008, 4.4% of food adverts depicted physical activity in characters (real or animated; Boyland et al., 2012). Analysis of the 2010 broadcast sample will reveal any changes in the use of this persuasive technique between 2008 and 2010 to demonstrate for the first time, if this is a trend that is increasing in the UK and therefore whether or not this techniques should be restricted within the regulations.

4.1.4 Health and nutrition claims

As a further promotional technique, food and drinks companies may wish to highlight the nutritional properties of their goods and any potential beneficial effects on health. Health claim rulings differ internationally; no consensus exists between the United States and the EU for example (Brennan, Czarnecka, Dahl, Eagle, Mourouti, 2008). In place from 1st July 2007, the EU's rules on health claims provide a legal framework to guide product-related communications within food advertising (European Union, 2006). The rules of the regulation apply to both nutrition claims and health claims. Nutrition claims are defined as "any claim that states, suggests or implies that a food has particular beneficial nutritional properties due to the energy, nutrients or other substances it contains, contains in reduced or increased proportions or does not contain" (for example "low sugars", "high fibre"; European Union, 2006). Health claims are defined as "any claim which states, suggests or implies that a relationship exists between a food category, a food or one of its constituents and health" (such as "Vitamin D is needed for the normal growth and development of bone

in children"; European Union, 2006). A public EU Register lists all currently permitted nutrition claims (25 as it stands in 2015) for the purposes of full transparency for consumers and food business operators alike. As an example of how claims are permitted, the claim "low sugars" may only be made where the product contains no more than 5g of sugars per 100 g for solids or 2.5g of sugars per 100ml for liquids. The legislation aims to ensure that any claim made on a food product advertised within the EU (covering UK television) is "clear, accurate and based on scientific evidence" (European Union, 2006). This is intended to protect consumers from misleading claims and to promote innovation and fair competition within television advertising and wider food marketing avenues (see Figures 4-8 and 4-9 for recent examples of claims made within UK television adverts).

Figure 4-8. Cheerios - Cheerios Now Have Vitamin D! (2014).

Figure 4-9. Petits Filous Calcium and Vitamin D (2014).

4.1.4.1 Impact of health and nutrition claims

Although nutrition and health claims within food marketing are inherently adult-targeted due to their informational content, two key studies suggest that they may have a persuasive impact on pre-adolescent children's food selections. One explored the effects of health claims on Australian children's food preferences using a large sample (n=1302) and found that children were more likely to choose energy-dense nutrient poor foods when packaging featured nutrient content claims (Dixon et al., 2014). Health claims also increased participants' perceptions of the beneficial nutrient content of the foods (Dixon et al., 2014). A further study (Soldavini, Crawford, & Ritchie, 2012) using a smaller sample (n=47) reported that children judged products with a nutrient content claim as healthier (biscuit, cracker or juice) and better tasting (biscuit and cracker only) after consumption. There is

also evidence for an impact of health claims on actual food intake in adult samples (McCann et al., 2013), but this has not yet been demonstrated in children.

4.1.4 2 Prevalence of health and nutrition claims

Research quantifying health claims within television advertising is relatively limited. A Korean study of 1,479 television food adverts from 2005-2007 found health claims to be present within 29.5% of food adverts (Choi & Kim, 2011). A US study reported that health claims within food adverts were found in 14.2% of mainstream television food adverts and 37.2% on Spanish language television (Abbatangelo-Gray, Byrd-Bredbenner, & Austin, 2008), implying targeted health claims in this specific sample. A content analysis of South African television reported that health claims were present in 11% of advertisements and the most frequently used claims were "enhances well-being", and "improves performance" (Mchiza, Temple, Steyn, Abrahams, & Clayford, 2013). Notably, these health claims do not adhere to EU regulations, accentuating the need to quantify and investigate experimentally, the effects of health claims at a regional level.

There is limited research into the use of health claims within UK television food advertising. A content analysis of 45 hours of television from 2010 found that health or nutritional claims were present in 37.1% of child-directed advertisements and 17.3% of non-child-directed adverts (Sixsmith & Furnham, 2010). However authors did not differentiate between the frequencies of health claims types. This lack of detail is a weakness of existing research which the present study seeks to address by monitoring a broad range of health and nutrient claims within television food adverts. The baseline data for the current research coded for 15 different health claims used in television food advertising during 2008, which the present paper will use to measure fluctuations over time in specific health claims and overall (Boyland et al., 2012).

4.1.5 Primary persuasive appeal

An adverts' primary persuasive appeal is the nature through which it communicates its marketing message. Fun, health and nutrition, premium or contest, price and taste are all popular themes employed widely across all forms of food marketing (Boyland et al., 2012) and studies have sought to quantify food adverts' primary persuasive messages.

4.1.5.1 Prevalence of primary persuasive appeal

A recent review reported use of fun and taste as present in 17 of 38 studies examining the persuasive content of television food advertising (Jenkin et al., 2014). Themes of price (including 'value for money' or 'economy') were present in 10 studies; where they were most often found in relation to fast food adverts. Premium offers and health claims (as the primary persuasive appeal within food adverts) were discussed in sections 4.1.1 and 4.1.4. Baseline data for UK television food advertising in 2008 as published by Boyland and colleagues (2012) reported that 'fun' was the most commonly featured primary persuasive appeal appearing in a significantly greater proportion of adverts than the seven other primary persuasive appeals used in adverts aimed at children (taste; health and nutrition; product uniqueness; energy; peer status; price; general superiority). Across the whole 2008 sample, price was the most heavily used primary persuasive appeal (20.8%) followed by fun (16.3%) and taste (14.3%). The present analysis will measure change in the use of primary persuasive appeals from 2008 by quantifying levels within the 2010 broadcast sample.

4.1.6 Website inclusion

Whilst television remains a dominant form of food marketing (Calvert, 2008), the sheer popularisation of the internet and the increasing proportion of advertising budgets dedicated to online advertising necessitate immediate consideration (McGinnis, Appleton & Gootman, Kraak, 2006). Recent years have seen an emergence of new media food marketing (Kelly et al., 2015) and several studies have reported that food brand websites are promoted within television advertising (Cairns, Angus, Hastings, & Caraher, 2013; McGinnis, Appleton, Gootman & Kraak, 2006). By doing so, food marketers offer opportunity for children to engage in a plethora of digital marketing features including advergames, downloads, promotions, competitions and media players, alongside the use of animations and promotional characters. This is known as integrated marketing communications, defined as "the concept under which a company carefully integrates and coordinates its many communications channels to deliver a clear, consistent message" (Kotler, Armstrong, Wong, & Saunders, 2008).

4.1.6.1 Impact of website inclusion

In line with other advertising avenues, online advertising has been found to be able to attract attention, enhance brand awareness and increase the probability of repeat purchase (Drèze & Hussherr, 2003; Hervet, Guérard, Tremblay, & Chtourou, 2011; Manchanda, Dubé, Goh, & Chintagunta, 2006). Many companies, brands and products also use social media to alert young consumers to games, competitions, and to remind them of the brand. By following these pages, young people endorse particular food and drink brands. To illustrate; a person accessing the website for Kellogg's Krave (high sugar low fibre cereal), is directed straight through to their Facebook page which advertises a free game which can be accessible via smartphones (and offers the chance of winning daily prizes). Undoubtedly, this social aspect of food marketing is a crucial and at the time of writing, the most 'liked' food or drinks brand on Facebook is Coca-Cola with 92 million 'likes', 3 million twitter followers and close to 1 million Instagram followers. The five most valuable quick service restaurant retailers worldwide in 2015 (Statistic, 2015) are also well represented across various social media platforms, as summarised in Table 4-1 below. Therefore it is crucial to track the extent to which food advertising on television is a gateway to online engagement with brands and facilitates further, more immersive marketing exposure.

Quick service restaurant retailer	Facebook 'likes'	Twitter followers	Instagram followers
McDonalds	58m	3m	1m
Starbucks	35m	10m	6m
Subway	25m	2m	0.5m
KFC	38m	1m	0.5m
Chipotle	3m	1m	0.5m

Table 4-1. Social media popularity of the five most valuable quick service restaurants globally.

4.1.6.1 Prevalence of website inclusion

Despite the growing popularity of online marketing forms, research quantifying the appearance of web links within television food adverts in the UK is very limited. Only one study measured this particular persuasive technique in UK television food advertising (Boyland et al., 2012), where 30.8% of food adverts included websites. A lack of evidence in this area constrains policy making. Given the increasing blurring of boundaries between traditional and new media; this facet of television food adverts requires prompt research

attention. Therefore analysis of 2010 levels of website inclusion will be compared to 2008 findings (Boyland et al., 2012) and discussed in relation to 2008 levels to monitor change in website inclusion over time.

4.1.7 Seasonal variation

A final area of research related to all facets of food advertising power discussed above is the monitoring of fluctuations in their use across seasons, known as seasonal variation. Through utilising combinations of persuasive strategies, food marketers aim to cultivate brand loyalty from an early age (C. A. Roberto et al., 2015) and generate pester power. Qualitative research shows that both children and parents believe pester power is the means through which HFSS food marketing exerts its effects (Mehta, Coveney, Ward, & Handsley, 2014) although research shows it also directly influences children's' consumption (Boyland, Nolan, Kelly, Tudur-Smith, Jones, Halford, , Robinson, 2016) It can be argued that during holiday periods when children are off school, they have more time to engage in television viewing (with higher potential for food commercial exposure) and copious opportunity for pester power. Few studies examine the seasonality of marketing, with the majority providing brief snapshots of food adverts in small samples of television transmission (Folta et al., 2006; Lewis & Hill, 1998; Sixsmith & Furnham, 2010) or on specific days or broadcast hours (Batada et al., 2008). One study from 1999 showed a significant increase in television food advertisements during school holidays compared to non-holiday periods (Hammond, Wyllie, & Casswell, 1999) and recent UK research demonstrated a marginally better balance of food types represented in television food advertising during the school holiday compared with non-holiday periods (Boyland et al., 2011). However, a paucity of evidence examines seasonality of persuasive techniques used in television advertising, with only one study monitoring fluctuations in the use of promotional characters on Malaysian television (Ng et al., 2014). This study reported heavier use of promotional characters for non-core foods during the school holidays, but the same was not observed for premium offers (as discussed in section 4.1.1.2). Literature in this area fails to extend to examining the seasonal variation of additional persuasive factors (e.g., physical activity depiction and website inclusion) across school holiday and non-holiday months, so the current study seeks to address this gap.

Capturing seasonal variation in the power of food marketing strategies on television is vital considering that longitudinal research conducted in a large sample of school aged children (n=7,599) found consistent patterns of relative weight gain during summer months (Moreno et al., 2015). An understanding of the variation in powerful food marketing strategies could help untangle problematic increases in weight during observed during particular months (e.g., summer) and may be a plausible contributing factor. Therefore, the present study seeks to explore the extent of use of a wide range of persuasive techniques within non-core food adverts on UK television.

4.1.8 UK Ofcom regulations and food advertising power

The UK Ofcom regulations have ruling relating to food adverts' creative content. These state that adverts must not encourage unhealthy lifestyles, poor nutritional habits or disparage good dietary habits in children. Further to this, the rulings assert that food adverts must not condone or encourage excessive consumption, damaging oral health practises and must be accurate with regards to nutritional/health claims. More specific details of the regulations of relevance to this present chapter are the following; i) food and drink advertising must not encourage children to make purchase requests or target promotional offers at pre-school or primary school children ii) licensed characters (e.g., Minions from the film franchise) and celebrities popular with children cannot be used in HFSS advertisements targeted directly at preschool or school aged children, iii) celebrities of 'particular appeal to children' are prohibited in HRSS adverts and iv) use of celebrities to promote foods are prohibited if the celebrity 'is of particular appeal to children'. Importantly, there is no regulation of the use of brand equity characters or of celebrities of more general appeal. Concerns have been raised over the distinction between promotional characters and lack of rulings over the use of brand equity characters as research corroborates that this character type still appeals to children and is likely to affect their food preferences and choices (McGale, Harrold, Halford, & Boyland, 2015). Therefore, despite substantial changes to food and drink advertising rulings, there are still valid concerns over the power of food adverts on television and potential effects on children's diet and overall health.

4.1.9 Aims

The present study will investigate, in depth, the creative content of television food advertising broadcast in the UK in 2010 and measure changes in use over time by comparison with broadcast data from 2008. Monitoring a wide range of persuasive techniques used in UK television food advertising throughout six months of television broadcast in 2010 will help to illuminate trends in the food marketing landscape as recommended by WHO (WHO, 2012) and academics (Jenkin et al., 2014). To the authors' knowledge, no previous studies have assessed this range of persuasive techniques or seasonal variation in their use in non-core (HFSS) food advertising. For each technique (i.e., premium offer, promotional character, physical activity health claims, primary persuasive appeal and website use) we will explore, in the context of 2008 versus 2010 levels (where possible), 1) frequency across the whole samples; 2) frequency across channel types; 3) frequency during peak and non-peak children's viewing times; 4) frequency during peak and non-peak children's viewing times findings across channel types; 5) the proportion of core, non-core and miscellaneous food adverts using the persuasive technique; and, 6) any extra analyses specific to the persuasive technique (e.g., change in frequency of type of health claim).

4.1.10 Hypotheses

H1: Use of premium offers in 2010 will have increased from 2008 levels and will be most frequently used within non-core food advertising (relative to core and miscellaneous advertising) in 2010.

H2: Promotional characters (including celebrities) will more frequently promote non-core foods than core and miscellaneous food items, as in 2008.

H3: Brand equity characters will be used to advertise foods more frequently than licensed characters (due to the impact of the Ofcom restrictions).

H4: The most frequently used primary persuasive appeal would be fun, as in 2008.

H5: Use of promotional characters would display seasonality with a higher prevalence found during school holidays in line with the findings of Ng et al. (2014).

4.2 Method

Television sampling and coding was conducted as described in section 3.2. The coding system used is that published by Boyland et al. (2012) and was based on Kelly and colleagues (2010) global study. Previously published data from 2008 (Boyland et al., 2012) was re-examined and new data (from 2010) coded to examine the persuasive content of food adverts, and to enable the identification of changes over time. Television transmissions on 13 commercial channels popular with children (ITV, Channel 4, Channel 5, Nickelodeon, Cartoon Network, Boomerang, Sky, Sky Sports 1, 4Music, Smash Hits, MTV, E4, CiTV) were recorded on one weekday (Tuesday or Thursday) and one weekend day (Saturday or Sunday) during February, April, June, August, October and December 2010. These were grouped into children's (Nickelodeon, Cartoon Network, Boomerang, CiTV), sport (Sky Sports 1), family (ITV, Channel 4, Channel 5, Sky, E4) and music (4Music, Smash Hits, MTV) channel types as per Boyland, Harrold, Kirkham, & Halford (2011). The only difference between the two samples in terms of channels was that by 2010 sampling, the channel Jetix had been taken off air and thus was not included. Television was recorded from 6am until 10pm (16 hours), with the exception of CiTV which only broadcasts for 12 hours (6am-6pm). This resulted in a total sample of 1931.5 hours for the study in 2010 (missing data due to recording errors) and 5233.5 in 2008.

All food advertisements were coded for the inclusion of promotional characters and celebrities (1 for character/celebrity featured and 0 for none featured). For a coding of 1 for this variable, the character/celebrity had to prominently feature in the foreground of the advert (Gantz et al., 2007). A further variable was coded specifically categorising celebrities as an entertainment celebrity, sportsperson, business leader, politician or other (Gantz et al., 2007). An additional variable was included to record whether the promotional character used was a brand equity character ("characters which are created for the sole purpose of promoting a product or brand"(Garretson & Niedrich, 2004)), such as Coco the Monkey representing Kellogg's Coco Pops ®) or a licensed character (where the character has been created for an animated programme or movie and is then licensed by brands to appear in

their promotions, such as characters from the film franchise Frozen being used to advertise Kellogg's cereals).

Food advertisements were also observed for the use of premium offers (including giveaways, competitions, contests, vouchers and rebates) to promote foods (Gantz et al., 2007; Kelly et al., 2010). The primary persuasive appeal of each food advertisement was coded as one of 17 options as used in previous literature (Gantz, Schwartz, Angelini, Rideout, 2007; Kunkel & Gantz, 1992). The appeals that were coded were: quantity; convenience; taste; health/nutrition; energy; price; unique/new product; fun; general superiority; peer status/sex appeal; premium/contest; weight loss/diet; choices/options offered; enjoyment/satisfaction; product information; corporate information; or other. If a food advertisement did not use health/nutrition or energy as a primary appeal, use of either of these as a secondary appeal was recorded.

A variable was coded to indicate whether food advertisements depicted physical activity or a physically active lifestyle through the use of human characters (whether real or animated). As defined by the Kaiser Family Foundation (Gantz et al., 2007), to be coded as depicting physical activity the character(s) needed to be engaged in purposeful physical activity (i.e., not simply walking slowly or merely moving about). The movement was required to be reasonably prominent, for example, in the foreground or featuring in the majority of shots.

The use of health claims (verbal and textual), was coded for each food advertisement. Where more than one claim was made, the first mentioned health claim was used. 15 health claim categories were used: low fat/fat free; sugar free; no added sugar/less sugar; low calorie/light; low carbohydrate; organic; natural ingredients/all natural/no preservatives/nothing artificial; provides essential nutrients (including protein, calcium, potassium, vitamins, antioxidants); wholegrain/whole wheat; fibre/bran; heart healthy; low cholesterol; diet; baked; (Gantz et al., 2007) or part of an individual's "five a day".

Every food advertisement was also monitored for the use of disclaimers (verbal and textual). Five categories of disclaimer were used: part of a balanced/complete/nutritious breakfast or meal; part of a balanced/healthy diet; not a substitute for a real meal; enjoy in moderation; or other (Gantz et al., 2007).

Food advertisements were categorised in terms of the specific target audience the advert was aimed. This was a subjective judgement, determined by overarching themes and content within the advert. Factors that determined the decision concerning the intended target audience included the age of the actors in the advert, the channel it was broadcast on, and the nature of the persuasive appeal. Target audiences were coded as: children and/or teens; teens and adults; adults (20-64 years); older adults (65+ years); and all ages (Gantz et al., 2007).

This variable was used to indicate whether a company website was mentioned or whether a website address appeared on the screen during food advertisements. If this occurred then that advertisement was coded as directing the viewers to the company's website (Gantz et al., 2007).

4.3 Results

For clarity, given the breadth and depth of data presented, the following results section is colour coded. Purple denotes overall levels (in use of persuasive technique) and orange represents peak and non-peak differences observed. Promotional character use (e.g., brand equity character vs licensed character) is conveyed in turquoise. Core foods are represented in green, non-core foods in red and miscellaneous foods in blue throughout, as in Chapter 3. As described in Chapter 3, in 5223.5 hours of TV from 2008, 12.8% of adverts were for food, in 2010 1931.5 hours of TV coded included 11.9% of adverts for food. The results will now be presented for the use of each persuasive technique during food advertising within and across those samples. All main results will be presented, and within that the findings that relate to the specific hypotheses will be clearly marked.

4.3.1 Premium offers

4.3.1.1 Overall proportion of premium offers

Premium offers appeared in 32.9% of food adverts in 2010, an increase of 145.5% (*d*=0.5) from 2008 levels (13.4%). H1 predicted that the use of premium offers in 2010 would increase from 2008 levels and these offers would be most frequently used within non-core food advertising (relative to core and miscellaneous advertising) in 2010 and these data supported this prediction.

4.3.1.2 Differences in proportion of premium offers across channel type

Across channel types, the greatest proportion of premium offers were found on children's channels, which showed an increase of 70.3% (*d*=0.1) from 2008 (27.3%) to 46.5% in 2010. There was a tripling of premium offers use within the sports channels (+272.5%; *d*=0.6), a fivefold increase in premium offer use on family channels (+470.6%; *d*=0.3) and a tripling of premium offers on music (+266.7%; *d*=0.5) channels in 2010 compared with 2008 (see Figure 4-10).

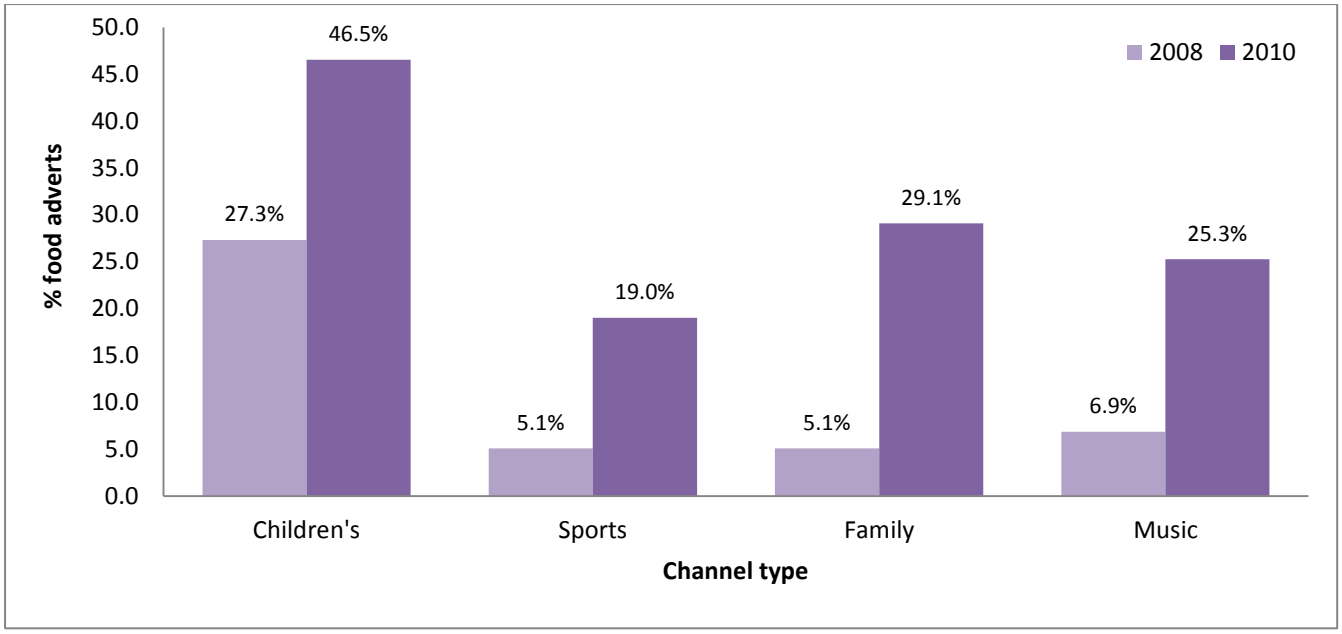

Figure 4-10. Premium offers used in food adverts across channel types in 2008 and 2010.

4.3.1.3 Peak versus non-peak differences in premium offer use

Premium offers appeared in a lower proportion of the food advertising broadcast during peak child viewing times (31.3%) compared with non-peak child viewing times (33.3%) in 2010, mirroring 2008 where there were also lower levels of premium offers used during peak child viewing times compared with non-peak viewing times (12.4% and 13.2%, respectively).

4.3.1.5 Differences in use of premium offers across food categories

Across food categories in 2010, premium offers were used less (-875.9%) than in 2008 in adverts for non-core food products (38.7%) and used more (+288.9%) in miscellaneous food adverts than in 2008 (15.3%). Therefore this part of H1 is unsupported as premium offers were not most frequently used within non-core food advertising (relative to core and miscellaneous advertising) in 2010, in contrast to predictions. There was a small decrease in the amount of core food adverts using premium offers (-2.5%) from 2008 to 2010 (see Figure 4-12).

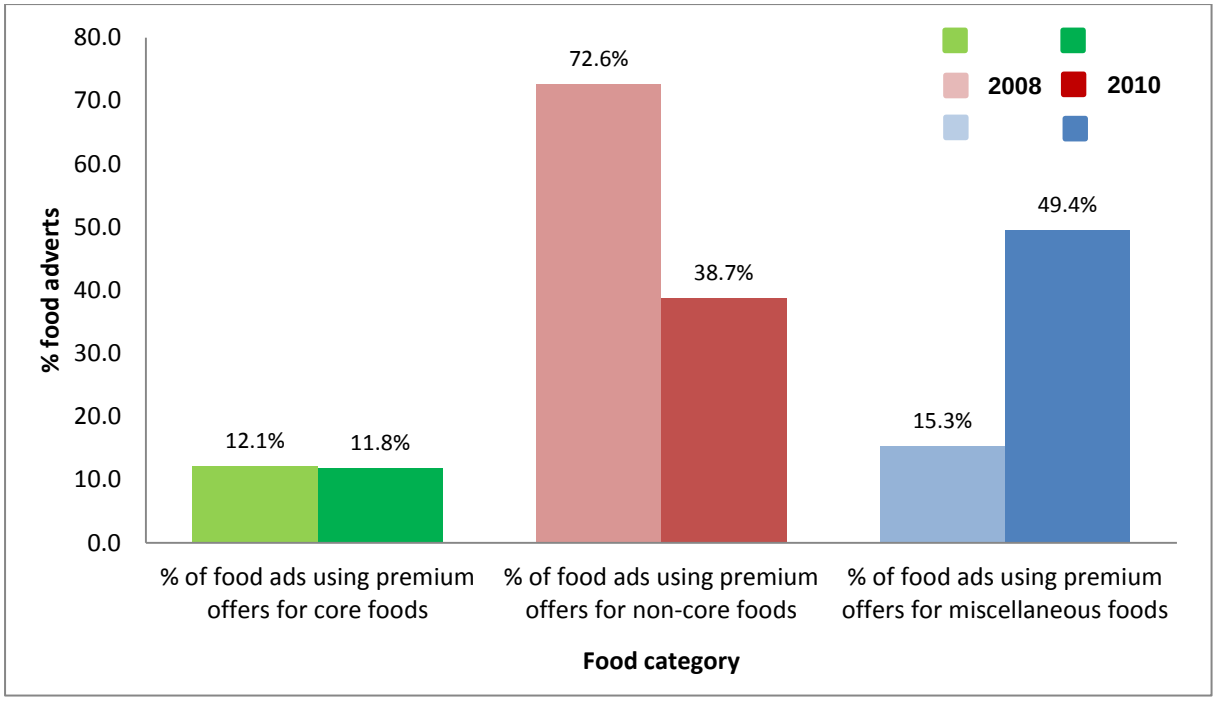

Figure 4-11. Proportion of food adverts using premium offers in core, non-core and miscellaneous food adverts in 2008 and 2010.

SUMMARY OF FINDINGS IN RELATION TO HYPOTHESIS 1:

H1 stated: Use of premium offers in 2010 will have increased from 2008 levels and these offers will be most frequently used within non-core food advertising (relative to core and miscellaneous advertising) in 2010.

Findings: In all, H1 is partially supported as although there was an increase of 145.5% in use of premium offers between 2008 and 2010, there was a 875.9% decrease in their use within non-core food promotion with a shift to higher use in miscellaneous television food adverts in 2010.

4.3.2 Promotional characters

4.3.2.1 Overall proportion of promotional characters

Across the entire 2008 and 2010 broadcast samples, use of promotional characters (brand equity/licensed characters and celebrity endorsers) increased 41.8% (*d*=0.2) from 2008 (28.5%) to 40.4% in 2010.

4.3.2.2 Differences in proportion of promotional characters across channel type

Use of promotional characters increased across all channel types, with the largest increases seen on sports channels (+227.3%;*d*=0.9) and dedicated children's channels (+29.8%; *d*=0.2), with family and music channels increasing 67.7% and 78.5%, respectively (see Figure 4-12).

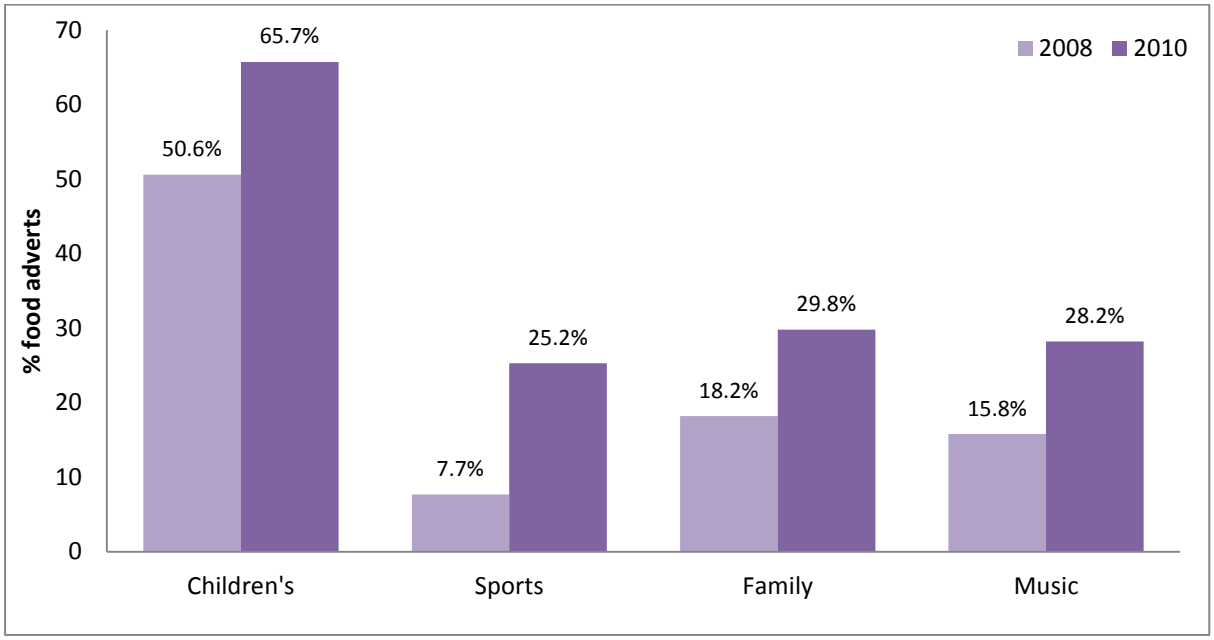

Figure 4-12. Food adverts featuring a promotional character across channel types in 2008 and 2010.

4.3.2.3 Peak versus non-peak differences in promotional character use

Lower levels (-25.9%) of promotional characters were used during peak child viewing times (29.3%) compared with non-peak child viewing times (36.9%) in 2010. In 2008 there was less of a difference (-5.5%) in use of promotional characters between peak (27.3%) and non-peak (28.8%) viewing times.

4.3.2.4 Peak versus non-peak differences in promotional character use across channel type

Across channel types, there were some changes in the use of promotional characters during peak child viewing times between 2008 and 2010. On children's channels, peak and non-peak adverts featuring a promotional character were level at 51.7% in 2008. However in 2010, a 133.3% difference was observed between adverts broadcast during non-peak (62.5%) and peak (29.3%) children's viewing time which included a promotional character. On the sports channel non-peak viewing broadcast 5.4% more food adverts featuring a promotional character in 2008 but by 2010, peak viewing broadcast 9.7% more food adverts featuring a promotional character than non-peak viewing. On family channels, promotional characters used during peak and non-peak viewing times were level in 2008 (at 18.2%) but by 2010, non-peak children's viewing times displayed 22.5% more food adverts with promotional characters in. Finally on music channels, there were 12.7% more food adverts featuring promotional characters during peak times in 2010, a change from 2008 where 11.9% fewer food adverts featured promotional characters during peak viewing times compared with non-peak.

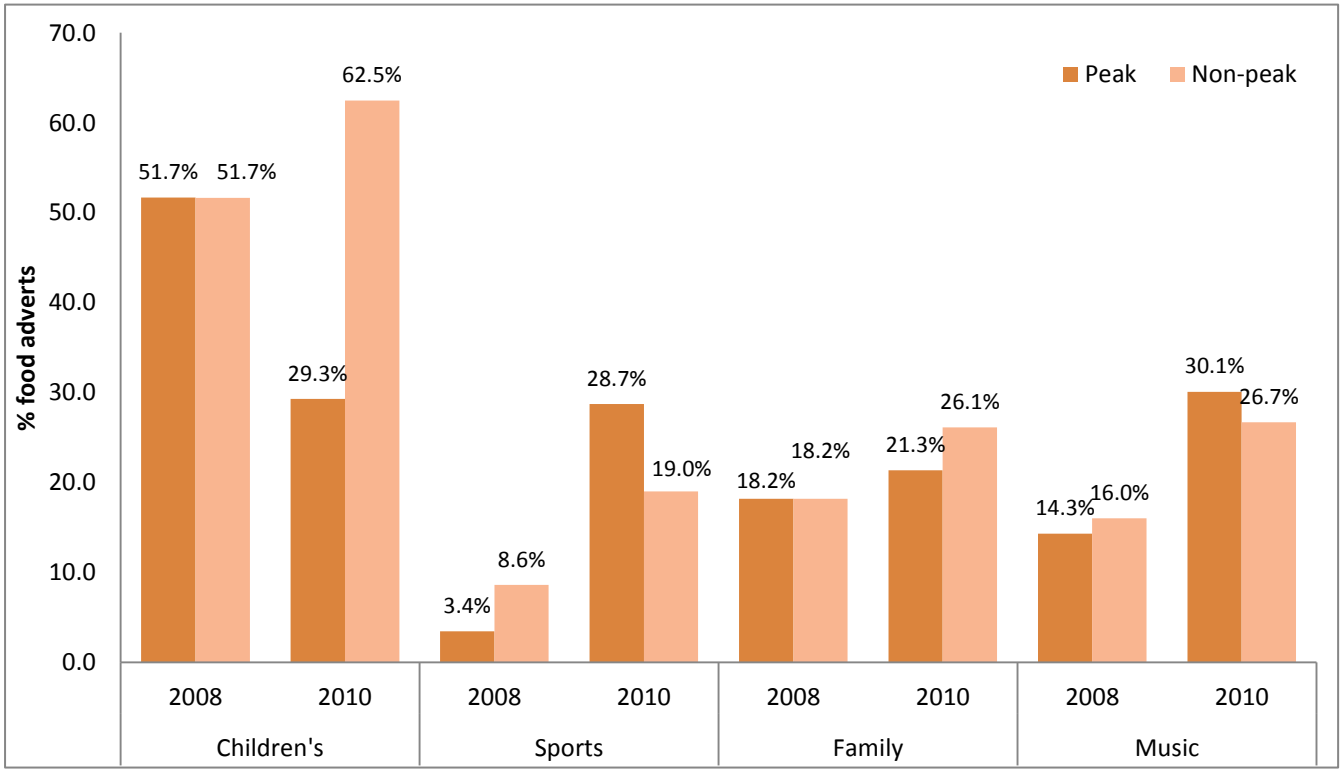

Figure 4-13. Food adverts featuring a promotional character during peak and non-peak children's viewing times across all channel types in 2008 and 2010.

4.3.2.5 Differences in use of promotional characters across food categories

In terms of the balance of foods advertised featuring promotional characters, the use of promotional characters featuring in non-core food adverts in 2010 increased 16.1% from 54.8% in 2008 to 63.6% in 2010 (see Figure 4-15), confirming H2 which predicted that promotional characters would be more frequently used to promote non-core foods than core and miscellaneous food items. There was also a small increase in promotional characters in adverts for core foods (+2.9%) and a decrease in characters shown within miscellaneous food adverts (-38%).

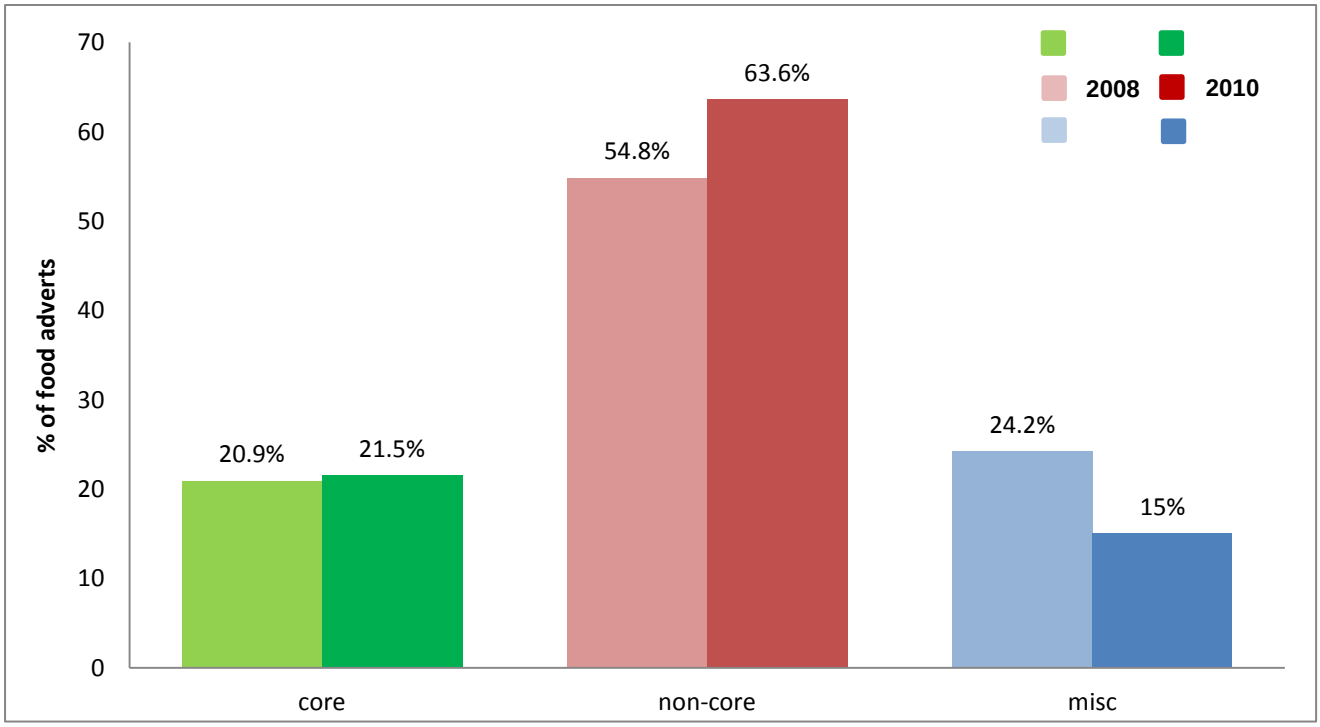

Figure 4-14. Of adverts featuring a promotional characters, the proportion of these which advertised core, non-core and miscellaneous food items.

4.3.1.7 Differences in use of brand equity and licensed characters

There was little change in use of brand equity/licensed characters between 2008 and 2010 (see Figure 4-18), despite implementation of the Ofcom regulations. Overall use of brand equity characters in 2010 increased 0.2% from 2008 and licensed character use decreased by 0.2%, therefore H3 is unsupported. Across channel types in 2010, the proportion of licensed character use was highest on children's channels (44.5% of all adverts featuring either a brand equity or licensed character), despite regulation. Use of licensed characters, specifically, increased 12.1% between the 2008 and 2010 broadcast samples. Use of licensed character was lower on all other channel types in 2010, on sports (10%), family

(6.1%) and music (3.6%) channels in 2010 with reductions from 2008 of 4.3%, 3.8% and 3.9%, respectively (see Figure 4-18).

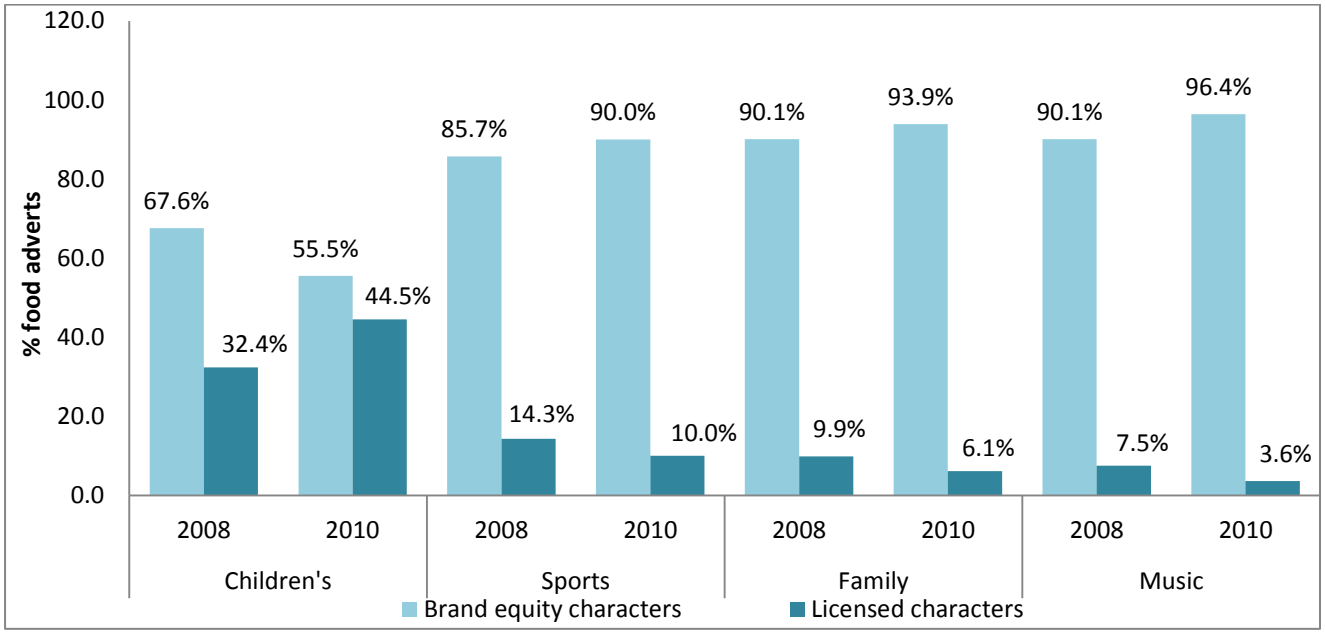

Figure 4-15. The proportions of brand equity and licensed characters used in food adverts in 2010 across channel types.

SUMMARY OF FINDINGS IN RELATION TO HYPOTHESIS 2:

H2 stated: Promotional characters (including celebrities) will more frequently promote non-core foods than core and miscellaneous food items, as in 2008.

Findings: Hypothesis 2 is supported. Of food adverts featuring promotional characters, 63.6% advertised non-core foods in 2010, an increase of 16.1% from 54.8% in 2008.

SUMMARY OF FINDINGS IN RELATION TO HYPOTHESIS 3:

H3 stated: Brand equity characters will be used to advertise foods more frequently than licensed characters (due to the impact of the Ofcom restrictions).

Findings: Hypothesis 3 is unconfirmed as there was little change in use of brand equity/licensed characters between 2008 and 2010 where overall use of brand equity characters in 2010 increased 0.2% from 2008 and licensed character use decreased by 0.2%.

4.3.3 Physical activity

4.3.3.1 Overall proportion of physical activity

Depiction of physical activity in television food adverts displayed a increase of 411.4% from 2008 (4.4%) to 2010 (23.2%).

4.3.3.2 Differences in proportion of physical activity use across channel types

Increases were seen across all channels, on sports (+21.7%, from 6.9% in 2008 to 19.4% in 2010), family (+416.2%, from 3.7% in 2008 to 19.1% in 2010) and music (+357.6%, 3.3% in 2008 to 15.1% in 2010) channels, but the largest increase (+567.3%) was on children's channels from 5.2% in 2008 to 34.7% in 2010.

4.3.3.3 Peak versus non-peak differences in physical activity depiction across channel type

During peak children's viewing times, the frequency of physical activity depiction increased 231.4%, from 5.1% in 2008 to 16.9% in 2010.

4.3.3.4 Differences in physical activity depiction across food categories

Of the food adverts containing exercise depiction in 2010, 81.1% were for non-core foods, an increase of 23.8% from 2008 levels (65.5%; see Figure 4-16). Common examples include adverts for food brands McDonalds (fast food), Robinson's (sugar sweetened drinks) and Weetos (high sugar/low fibre breakfast cereal). The proportion of adverts depicting exercise that were for core foods decreased 59.2% from 28.9% in 2008 to 11.8% in 2010.

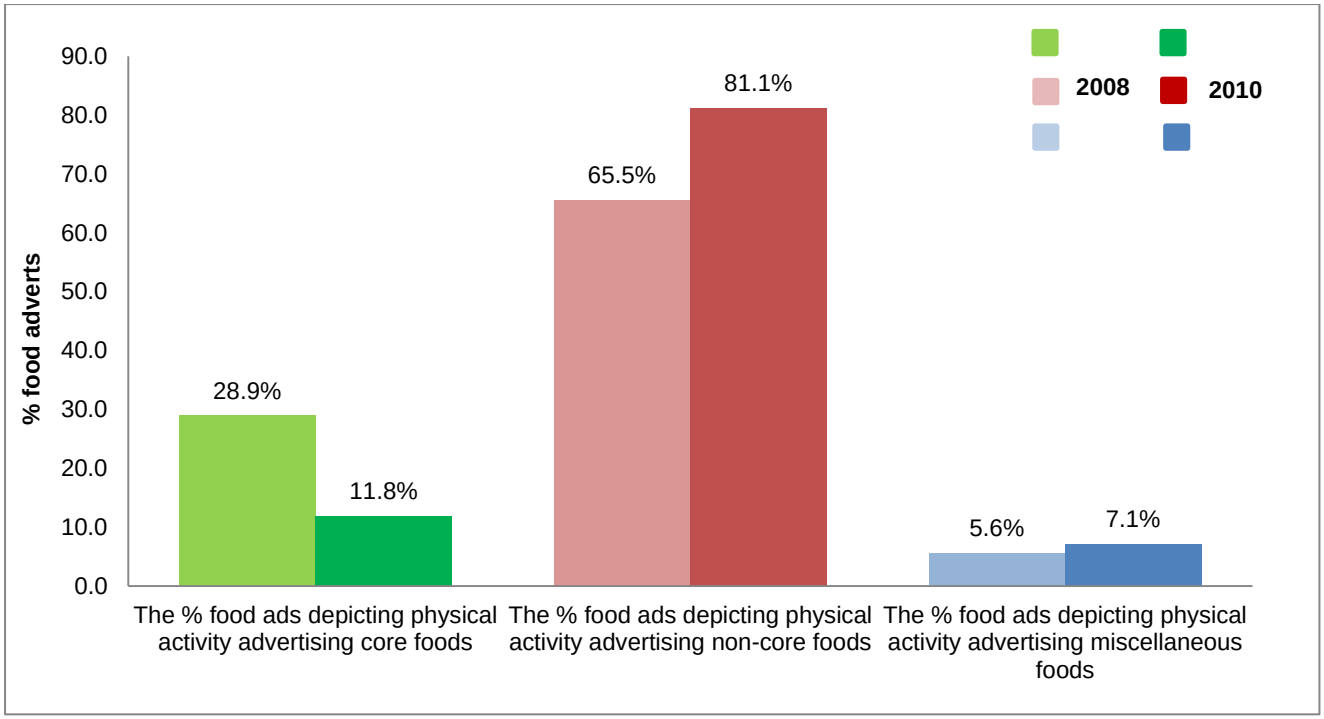

Figure 4-16. Of the adverts featuring physical activity, the proportion that advertised core, non-core and miscellaneous food items in 2008 and 2010.

4.3.4 Health claims

4.3.4.1 Overall proportion of health claims

Overall, the appearance of health claims in food adverts in 2010 had increased 19.8% (*d*=0.5) from 2008 levels (20.7% to 24.8%).

4.3.4.2 Differences in the proportion of health claim use across channel type

The largest increase was seen on children's channels (+39.6%), from 22.2% in 2008 to 31% in 2010. Increases were also seen across family (+13.6%, from 21.4% in 2008 to 24.3% in 2010) and music (+10.4%, from 21.2% in 2008 to 23.4% in 2010) channels.

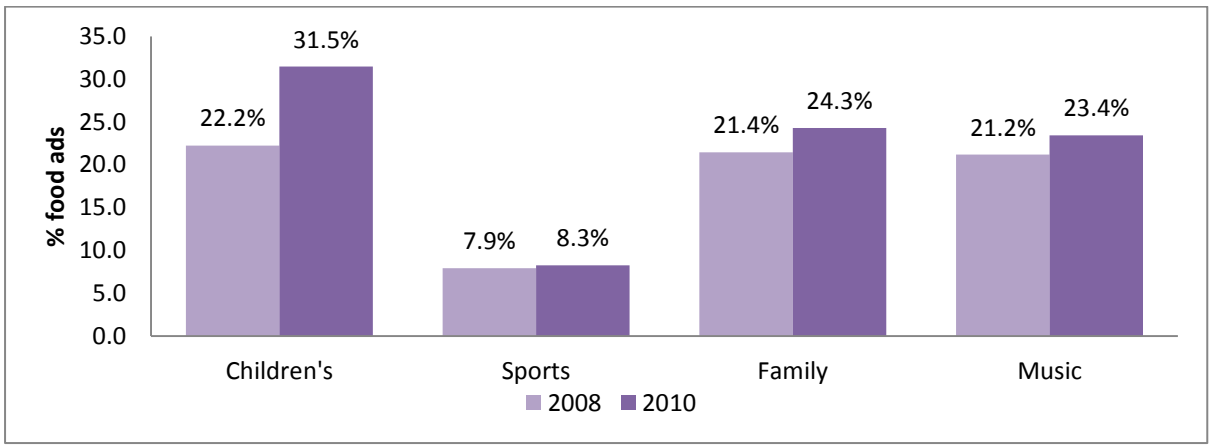

Figure 4-17. The percentage of food adverts featuring a health claim across channels types in 2008 and 2010.

4.3.4.3 Peak versus non-peak differences in health claim use

Of food adverts featuring a health claim during peak children's viewing times there was a 18.1% increase in the proportion promoting non-core foods, from 16.6% in 2008 to 19.6% in 2010. Of food adverts featuring health claims during peak child viewing times, the proportion of core food adverts decreased 27.3% (*d*=0.2) from 40.3% in 2008 to 29% in 2010.

4.3.4.4 Difference in health claim use across food categories

In 2010, the majority of food adverts featuring health and nutrition claims were for non-core foods (58.3%), a reduction of 8.6% from 2008 levels (63.8%; see Figure 4-18). Of these, the most frequent non-core food adverts featuring health claims in 2010 were for full cream milk products (25.1%), high fat spreads (14.1%) and high sugar and/or low fibre breakfast cereals (12.2%). Of all food adverts including health claims, 26.1% were for core food items in 2010 (a decrease of 34.5% from 2008) and within these, 51.1% were for low fat dairy products and 16.6% for low sugar and high fibre breakfast cereals. 15.5% of food adverts containing health claims in 2010 were promoting miscellaneous food items, an increase of 1309.1% from 2008 (1.1%), the majority of which were for infant milk formula (58.6%).

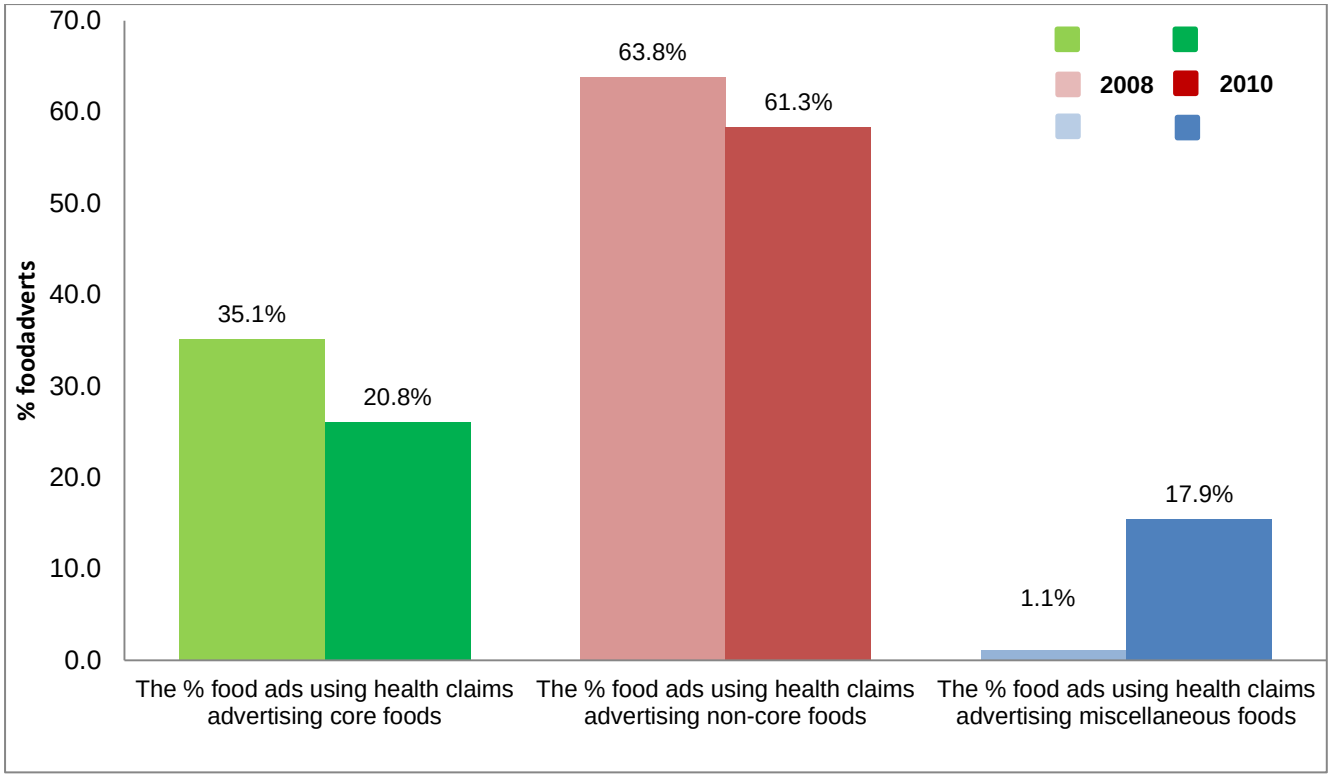

Figure 4-18. Of the adverts that feature health claims, the proportion that advertised core, non-core and miscellaneous food items in 2008 and 2010.

4.3.3.6 Overall change in frequency of health claim types

The most frequently used health claim in 2010 was "contains essential nutrients…" (see Table 4-2), which increased 92% (*d*=0.7) from 2008 levels (17.6%) to 33.8% in 2010. Of food adverts featuring this health claim, yogurts and yogurt drinks were the most common (40.9%) with claims such as "contains calcium and vitamin D which helps build strong bones". Examples of non-core food adverts using this claim include a promotion for McDonald's Happy Meal containing a milk drink: "milk contains calcium which is great for your teeth". The next largest change in health claim use was "organic" which increased 900% between 2008 (0.5%) and 2010 (5%). Consistent with the overall data, on dedicated children's channels, the most heavily used health claim in the 2010 sample was "contains essential nutrients" at 39.7%, an increase of 37% from 2008 levels (10.7%). Of these 62.9% were for yogurt/yogurt drinks with reference to calcium. Increases were also seen in use of the claim "part of your five a day" (+20.4%) from 24% in 2008 to 28.9% in 2010. These adverts were used for McDonalds for Happy Meals in 97.3% of cases, with depicted meal bundles containing and carrot sticks/fruit bag.

Health claims	2008	2010	% change
Contains essential nutrients e.g. calcium, vitamins, antioxidants	17.6%	33.8%	+16.2%
Organic	0.5%	5%	+4.5%
Contains fibre	0.2%	1.3%	+1.1%
Diet version	1.8%	2.8%	+1%
No added sugar	1.6%	2.1%	+0.5%
Low carbohydrate	0.8%	1.1%	+0.3%
Sugar free	1.8%	2%	+0.2%
Low cholesterol	2.4%	2.3%	-0.1%
Baked	0.8%	0%	-0.8%
Part of your five a day	11.4%	10.3%	-1.1%
Only natural ingredients/no preservatives	12.9%	15.9%	+3%
Low calorie/light	9.9%	5.2%	-4.7%
Low fat	15.1%	10%	-5.1%
Wholegrain	13.8%	7.8%	-6%
Heart healthy	9%	0.6%	-8.4%

Table 4-2. Change in proportion of health claims used between 2008 and 2010.

4.3.5 Primary persuasive appeal

4.3.5.1 Overall proportions of persuasive appeals

The top five persuasive appeals used across all food adverts during peak children's viewing times in 2010 were 1) health/nutrition, 2) price, 3) taste, 4) premium/contest and 5) fun (see Figure 4-19). Comparison with 2008 levels revealed an increased in use of health/nutrition appeals in 2010 to 15.9% (+13.6%), a decrease in use of price appeals (-14.4%) to 15.5%, an increase in taste (+7%) to 15.3%, an increase in premium/contest (+122.2%) to 11.9% and a decrease in use of fun (-46.6%) to 8.7% as the primary persuasive appeal.

Figure 4-19. Top five primary persuasive appeal across food adverts in 2008 and 2010.

4.3.5.2 Overall proportions of persuasive appeals across channel type

On dedicated children's channels in 2010 during peak viewing times, use of health/nutrition appeals increased 24.4% to 33% from 2008 (+35.2%). Fun appeals decreased 211.6% from 34.7% in 2008 to 18.3% in 2010. Premium/contest increased 130.7% from 11.4% in 2008 to 26.3% in 2010. Therefore H4 is not supported.

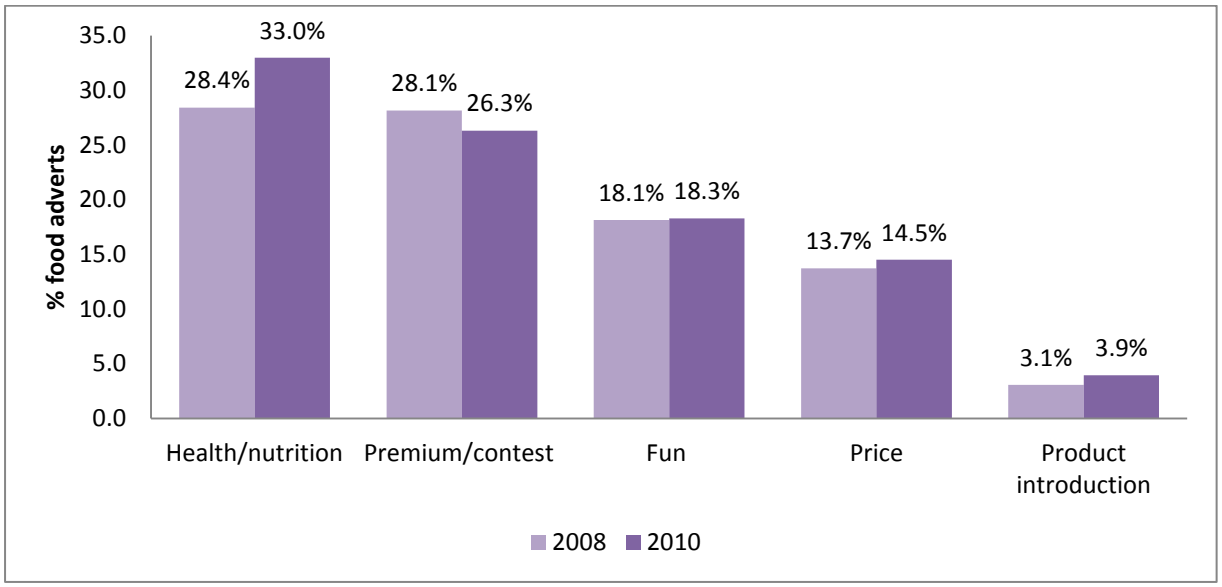

Figure 4-20. Top five primary persuasive appeals used in food adverts during 2010 on dedicated children's channels during peak viewing times.

4.3.5.3 Peak versus non-peak differences in persuasive appeal use

Small peak/non-peak children's viewing times differences were found where 9.8% more adverts focused on taste as the main persuasive appeal during peak child viewing times compared with non-peak child viewing times. However, the remaining top 5 most frequently

used persuasive appeals (health/nutrition, price, premium/contest, fun) were all used less frequently/in a lower proportion of ads during peak times (see Figure 4-21).

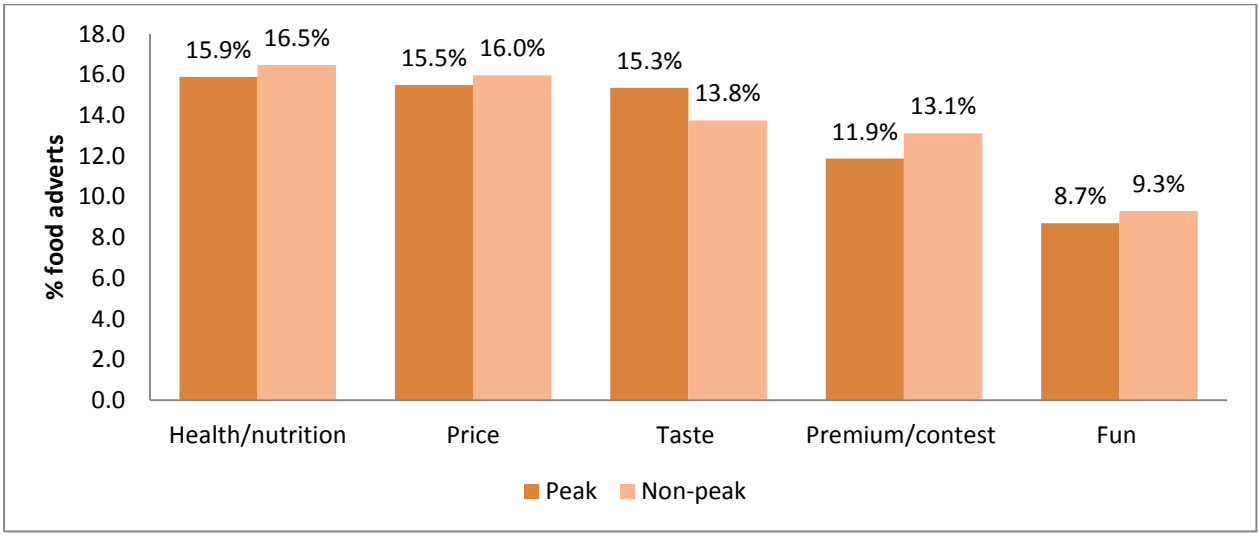

Figure 4-21. Top five primary persuasive appeals used in food adverts in 2010 during peak and non-peak child viewing times.

SUMMARY OF FINDINGS IN RELATION TO HYPOTHESIS 4:

H4 stated: The most frequently used primary persuasive appeal would be fun, as in 2008

Findings: H4 is unsupported as fun appeals decreased 16.4% from 34.7% in 2008 to 18.3% in 2010, making them the fifth most frequently used appeal.

4.3.7 Seasonal variation in the power (use of characters, premium offers, physical activity depiction and website direction) of television food adverts

There was evident seasonal variation in the use of characters, premium offers, physical activity and website references in the promotion of non-core foods. For example, there was a noticeable spike in the appearance of these techniques during August (school holiday time) with the increase in use of premium offers being most marked at this time (an increase of 40.4% between June (55.5%) and August (77.9%))

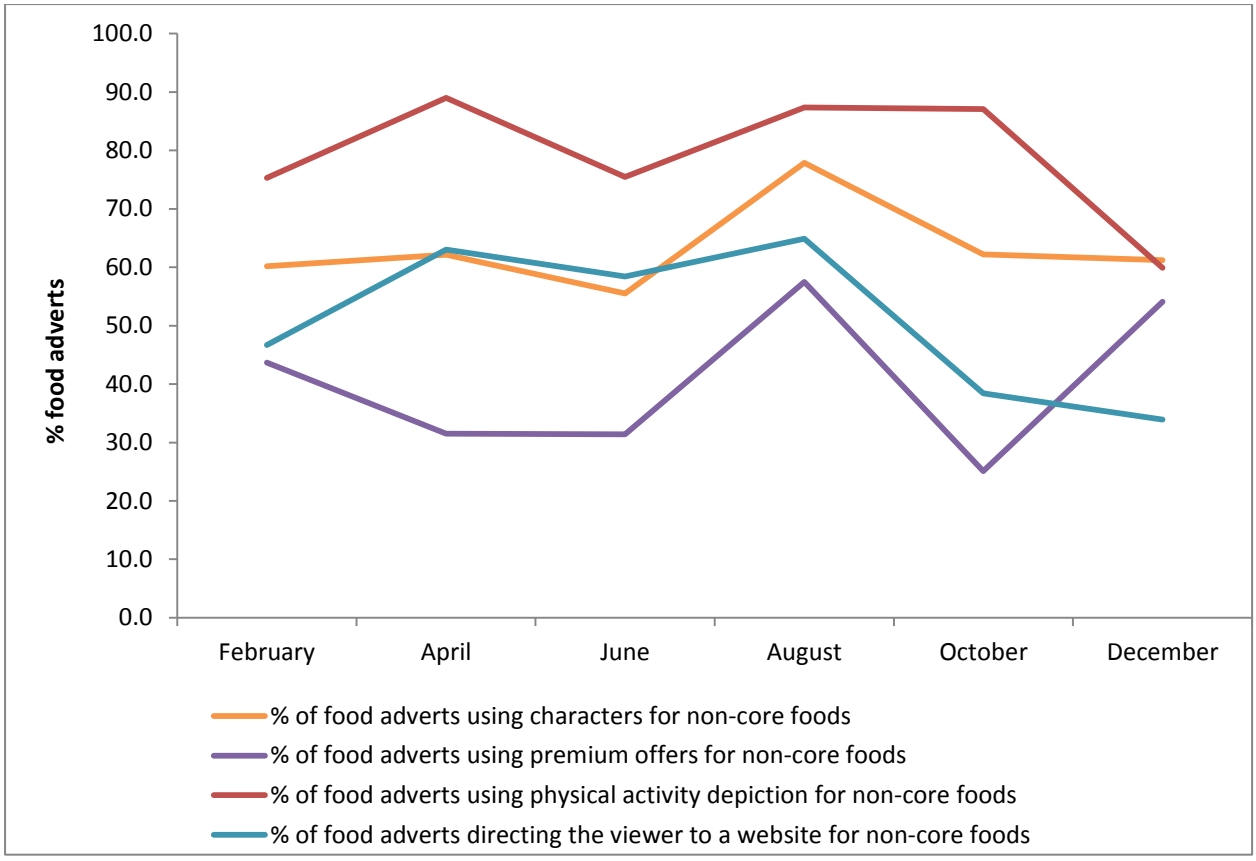

Figure 4-22. Seasonal variation in persuasive techniques across six months of 2010.

4.3.7.1 Seasonal variation in the power (use of characters, premium offers, physical activity depiction and website direction) of television food adverts on dedicated children's channels

There was evident seasonal variation on dedicated children's channels in the use of characters, premium offers, physical activity and website references in the promotion of non-core foods. For example, there was a noticeable spike in the appearance of these techniques during August (school holiday time) with the increase website use offers being most marked at this time (an increase of 39.3% between June (0%) and August (39.3%)). Peak months across the four persuasive techniques on all channels and dedicated children's channels are summarised on Table

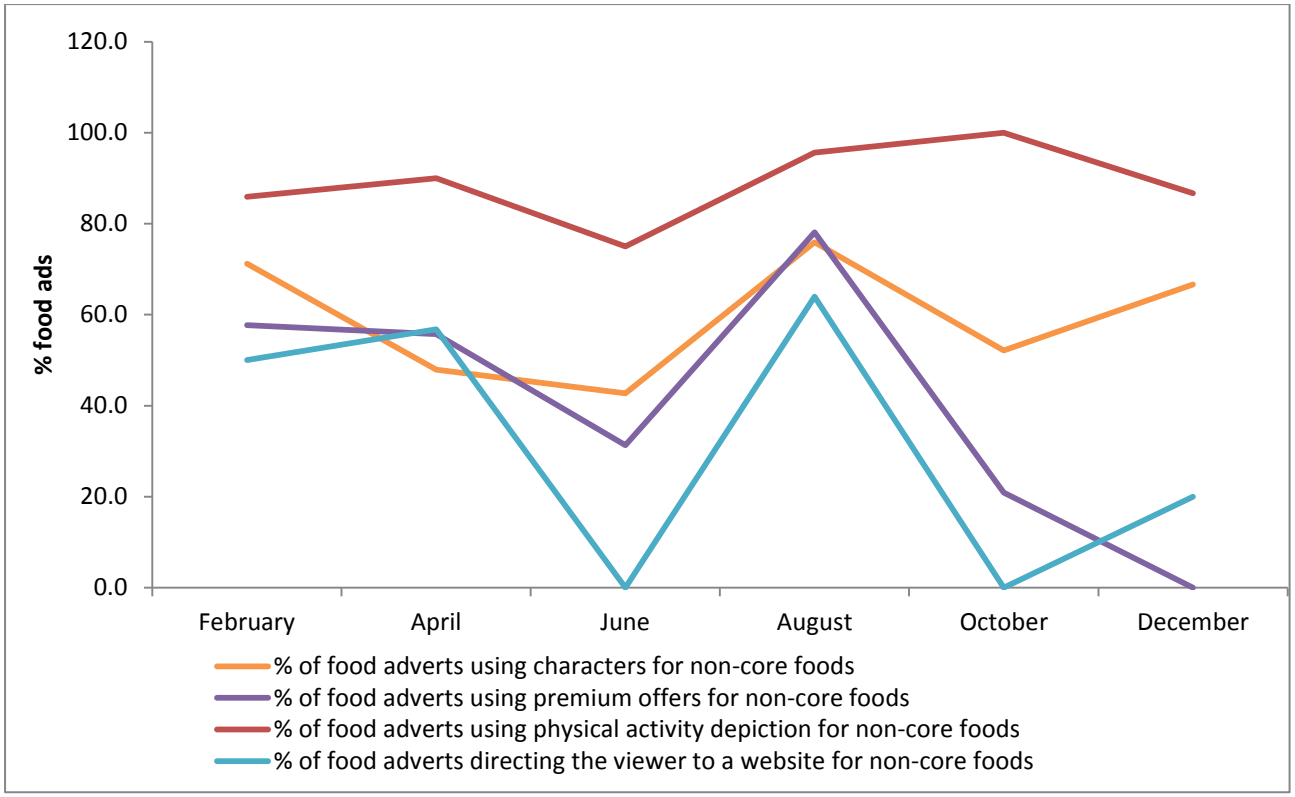

Figure 4-23. Seasonal variation in persuasive techniques across six months of 2010 on dedicated children's channels.

Persuasive technique (used in non-core food adverts)	Peak month	Peak month (dedicated children's channels)
Premium offers	August (57.5%)	August (78.1%)
Promotional characters	August (77.9%)	August (76%)
Physical activity	April (89%)	October (100%)
Website inclusion	August (64.9%)	August (64%)

Table 4-3. Peak use of persuasive techniques in 2010 across the entire sample and on dedicated children's channels.

SUMMARY OF FINDINGS IN RELATION TO HYPOTHESIS 6:

H6 stated: Use of promotional characters would display seasonality with a higher prevalence found during school holidays in line with the findings of Ng et al. (2014).

Findings: H6 was confirmed as use of promotional characters in non-core food adverts increased 40.4% between June (55.5%) and August (77.9%), in parallel with school holiday

4.1 Discussion

To our knowledge, this study represents the most comprehensive comparison of television food advertising power ever conducted at two different time points (2008 and 2010), representing an assessment of broadcasting during and after full implementation of statutory food regulations, using the UK as an example.

4.4.1 Discussion of findings in relation to stated hypotheses

Analysis of 2010 broadcast data confirms an increase in overall use of premium offers of 145.5% between 2008 and 2010. The 2010 frequency reported (33.7%) is comparable with levels found in a study of US television (34%; Kelly et al., 2010), although this multi-country study found much lower levels in other countries (e.g., Greece; 2%), implying cross-cultural variation in use of this technique. The current study also demonstrated a 46.7% decrease in the use of premium offers in non-core food adverts with a shift to higher use in miscellaneous television food adverts in 2010 (+34.1%). This finding is at odds with research by Kelly and colleagues (2010) who found that significantly more food advertisements containing premiums were for non-core foods (75% vs 13% for core and 12% for miscellaneous foods). This was a finding observed consistently across 13 countries (with the exception of China), and moreover, all food advertisements containing premiums in Germany (n=338) and Sweden (n=48) were for non-core food items (Kelly et al., 2010). Within miscellaneous food adverts in the 2010 analysis, it was predominantly generic supermarket adverts (not clearly for core/non-core) using premium offers, although supermarkets promoting non-core foods (coded as miscellaneous) also account for part of this shift from 2008 proportions across the three categories. No tangible differences were observed in peak non-peak differences in the present study; in contrast to existing research (Kelly et al., 2010) where globally, a significantly greater proportion of food adverts with premium offers were broadcast during peak children's viewing periods compared to non-peak.

In terms of policy, UK statutory regulations (Ofcom, 2007) fail to cover premium offers, potentially explaining the 20% increase in the adoption of this strategy. As other techniques are regulated, it may be that marketers are moving towards less restricted

persuasive options. Voluntary codes have failed to limit premium offers in a study of Australian television from 2010 covering 2 months of television data (76 days) across four channels (M. Roberts, Pettigrew, Chapman, Quester, & Miller, 2014). Premiums were still apparent in children's popular viewing times (10%) and outside of children's popular viewing times (8%) despite being restricted by two self-regulatory schemes (the Responsible Children's Marketing Initiative (RCMI) and the Australian Quick Service Restaurant Industry Initiative (QSRII) for Responsible Advertising and Marketing to Children). Such findings cast doubt on the ability of self-regulatory codes to adequately protect children from premium offers within television food adverts. Research should investigate the comparative impact of statutory regulation of premium offers. Experimental research found that children were three times more likely to order a healthier meal option and refuse an unhealthy meal when toys were not offered with meals that failed to meet nutritional criteria (Hobin, Hammond, Daniel, Hanning, & Manske, 2012). Therefore, a policy objective could be to restrict toy premiums to foods that meet certain nutritional criteria, with potential to positively influence children's eating choices outside of the home.

Promotional character use increased 41.8% from 2008 (28.5%) to 40.4% in 2010, with increases seen across all channel types monitored. Levels found within 2010 television transmissions are higher than those found in a multi-country content analysis of child targeted television advertising, where 23% of food advertisements contained a promotional character (Kelly et al., 2010). As with premium offers, cross-cultural variation in use of promotional characters is reported of between 9% in Italy, to 49% in the United States (Kelly et al., 2010). Dedicated children's channels broadcasted the highest levels of characters within food adverts in the current sample (65.7%), something which had increased approximately 15% from 2008. The current analysis also found marginally lower levels of promotional characters used during peak child viewing times compared with non-peak child viewing times. This contrasts with existing research which found higher frequencies of food advertisements containing promotional characters in peak viewing times, compared to non-peak viewing times (Kelly, Hattersley, King, & Flood, 2008). In terms of the balance of foods advertised featuring characters, current data found that these are most often used in non-core food adverts (compared to core and miscellaneous food adverts) and this had increased approximately 9% from the levels reported in 2008 (54.8%). This is consistent

with reports from a major multi-country study, where characters were found to be promoting non-core food items in 79% of cases (Kelly et al., 2010).

There was little change in the use of brand equity and licensed characters despite statutory legislation. Licensed characters were permitted in 18.4% of food adverts which featured either a brand equity character or licensed character. However on children's television channels, this level was greater at 44.5% of food adverts, where brand equity characters constituted 55.5%. Examples include a yogurt featuring Sex and the City characters (core food item) or crisps advertised in conjunction with characters from the television series Glee (non-core food item). Arguably, Glee has appeal to younger as well as older children, presenting an additional loophole in the UK regulations (Ofcom, 2007).

Research demonstrates that an advertising ban adopted in Quebec led to reductions in the appearance of media characters or celebrities in advertising (Kent et al., 2011a). Literature on the use of promotional characters in food marketing bares some parallels with tobacco industry marketing. During the 1990s in some countries, the tobacco industry depicted the character Joe Camel in marketing campaigns, which had similar impact to Disney's Mickey Mouse in reaching pre-school children (Chacon, Letona, & Barnoya, 2013). These types of characters were used on cigarette packages to foster brand recognition and loyalty (Fischer et al., 1991). Thus removal of all promotional techniques from snack food packages or non-core television food adverts may also be part of an effective strategy to reduce the appeal of heavily branded non-core foods. In light of the evidence discussed, there is reason to enforce tighter restrictions on the use of promotional characters on UK television also. Reforming the UK Ofcom regulations with stricter rulings on licensed characters that can be broadcast alongside non-core foods on children's channels has potential for meaningful change in improving children's consumption habits. Further to this, restricting celebrity endorsers and brand equity character use, which have shown to adversely affect children's eating behaviours (a detailed discussion of which is outside the remit of this thesis (see Boyland et al., 2013) may have potential as an obesity prevention strategy.

Experimental evidence now demonstrates the power of promotional character use in advertising heathier food items. Indeed, characters have been demonstrated to increase

children's liking of and purchase request intent for fruit up to a level similar to chocolate and sweets, and affect children's subjective taste assessment (de Droog, Valkenburg, & Buijzen, 2011; Lapierre, Vaala, & Linebarger, 2011). More effective legislation governing use of promotional characters in conjunction with HFSS foods could shift the use of characters away from non-core foods and onto core food groups with enduring effects on children's food consumption habits. Legislation should thus aim to encourage future marketing campaigns to promote children's consumption of healthy foods and reduce children's risk of obesity and diet-based non-communicable diseases (Kraak & Story, 2014).

Three persuasive factors monitored in the present study warrant discussion in conjunction with each other (physical activity depiction, health claim use and primary persuasive appeal). Together, these findings imply a greater prominence of health references in UK television food advertising, supportive of literature purporting a 'health halo' surrounding food marketing (Chandon & Wansink, 2012). Exercise depiction within food adverts increased almost 20% between 2008 and 2010, indicating that marketers are keen to align themselves with consumers' interest of health by constructing an association with activity. Through this association, the food industry is framing the problem of obesity as relating to a lack of physical activity, rather than overconsumption of heavily marketed foods. Academics argue that this false perception is evocative of big tobacco tactics (Malhotra et al., 2015). Results reported here are consistent with increases observed in a recent US study, where in 2009 exercise was depicted in 6.6% of food adverts, increasing to 20.1% in 2013 (Castonguay, 2015). Notably, the current research found the largest increase of physical activity on dedicated children's channels; an increase of almost 30% from 2008 to 2010.

Debate surrounds this trend, which is often celebrated by the food industry for encouraging children to get fit (Kolish & Peeler, 2008). However, these data found that the majority of food adverts depicting exercise were promoting unhealthy foods, and this was almost exclusively the case on dedicated children's channels. This is a concern as recent experimental research shows that exercise depiction in unhealthy food marketing skews children's perceptions of the healthfulness of foods and affect their appeal (Castonguay, 2015). As children's food knowledge has been found to impact their diet (Bannon & Schwartz, 2006; Kandiah & Jones, 2002), research must both continue to quantify this

pattern over time and further investigate the implications of these marketing trends on children's food choices in order to inform the policy debate.

There was an increase in health and nutrition claims found in television food adverts from 2008 to 2010, mirroring increases found on food and beverage packaging in UK supermarkets (Kaur et al., 2015). This is a concerning trend in light of existing evidence (Dixon et al., 2014). Studies from other countries report, on average, even higher incidences of health claim use in food adverts. For example, a Korean study of 1,479 food adverts found health claims present in 29.5% of food adverts (Choi & Kim, 2011), higher than the incidence found in the present study and a further Korean study found that adverts containing health claims constituted 33.7% of total food adverts (Moon, 2010). The frequency of adverts featuring health claims was highest on children's channels compared to all other channel types, in line with previous UK research (Sixsmith & Furnham, 2010). The most frequent health claim used on children's channels was "contains essential nutrients", used mostly in conjunction with yogurt products which is consistent with increased consumption of dairy products reported in the UK (FoodBev Media, 2014). The majority of health claims recorded in the present study promoted non-core foods (with this proportion having risen over time), with a higher rate found on dedicated children's channels. On children's channels, the most frequently used health claim was "contains essential nutrients" and an increase was observed in the use of "part of your five a day", however these adverts were almost exclusively for McDonald's Happy Meals.

When comparing the current findings to existing literature from outside of the UK, it is apparent that cultural factors may dictate health claim use. A study of television food adverts in Hong Kong defined Chinese herbs/substances as health claims (including Ophiocordyceps sinensis, Lingzhi mushrooms, bird's nest, and Ginseng), which accounted for 31 out of 76 nutrition claims (Kara, Chan Vivienne, Leung Lennon, 2013). In the present study, claims about herbs were not included as they are not legal in line with EU rulings (European Union, 2006). Thus, cross-cultural comparisons are not always meaningful when considering television food advertising as what legally constitutes a health claim differs by region. In light of the present findings, and due to the cultural specificity of health and nutritional claims, more research is needed to measure change in health claims across

various marketing avenues at a national level. Relative impact on children's capacity to make healthy food choices should be investigated.

In the context of health referencing, adverts also utilise visual elements with underlying health-related meaning, for example a picture of a woman on weighing scales. The literature indicates that visual imagery may in fact have a greater effect on the perceived healthfulness of products and purchase intention, compared to health and nutrition claims (Chrysochou & Grunert, 2014). A recent online experiment conducted in Danish participants (N=572) indicates that individuals tend to rely more on health imagery than health and nutritional claims when evaluating a food product presented in an advertisement, stressing the importance of more implicit health connotations (Chrysochou & Grunert, 2014).

Health and nutrition was the most heavily used persuasive appeal across all adverts during peak children's viewing time (15.9%) and on dedicated children's channels (33%) in 2010. Existing research into Korean television adverts (Moon, 2010) found health/well-being was the second most commonly used persuasive appeal (27%), after competitive/unique appeals (30.5%), indicating higher levels. The 2010 finding is distinct from 2008 UK television data where fun was the most used primary persuasive appeal in food adverts aimed at children (Boyland et al., 2012), supported by numerous other studies (Hastings, Stead, McDermott, Forsyth, MacKintosh & Rayner, 2003; Lewis & Hill, 1998; Rose, Merchant, & Bakir, 2013). It should be noted that themes of fun were still common (8.7%) as well as price (15.5%) in 2010, and have been frequently reported across copious research studies (Jenkin et al., 2014). Notably, studies posit that use of fun themes are likely to be more prominent during food adverts broadcast during Saturday morning television (Batada et al., 2008). The findings from 2010 indicate an interesting decline in use of these approaches, with 7.6% less food adverts featuring fun as the primary persuasive appeal and a 5.3% decrease in the use of price appeals.

Together, findings across physical activity depiction, health claim use and primary persuasive appeal denote a substantial trend in emphasising the health qualities of foods within television advertising. Health based messages and persuasive techniques are increasingly prevalent in UK television food advertising. Results from these factors demonstrate that nutritionally deficient foods are often paired with implicit and explicit

references to health; with the heaviest use on children's channels and almost exclusively promoting unhealthy foods. This marketing approach may mislead children in terms of their understanding of nutrition and lead to judgement errors with regard to healthy food choices. Researchers should explore further the impact of health messages used in conjunction with unhealthy foods on children's food attitudes and intake. Policy makers should consider amendments to existing statutory and voluntary approaches (e.g., Ofcom, 2007; Children's Food and Beverage Advertising Initiative, 2014) as they currently fail to cover these widespread and misleading marketing strategies.

Use of premium offers, promotional characters, website inclusion, physical activity depiction within non-core food adverts displayed distinct seasonal variation in the 2010 data, a novel finding not observed in the 2008 data (Boyland et al., 2012). Results from 2010 monitoring demonstrate that the two most commonly frequently quantified persuasive techniques in the literature, premium offers and promotional characters (Jenkin et al., 2014), displayed distinct seasonal variation coinciding with UK school holidays. Use of premium offers and promotional characters in non-core food adverts peaked during August across both the whole broadcast sample and on dedicated children's channels, signifying that more powerful advertising is broadcast when children typically have the opportunity for increased television viewing. Findings here partially support existing research where use of promotional characters in Malaysian television doubled for non-core foods during school holidays compared to normal days (Ng et al., 2014). The present study found a 22% increase in use of promotional characters from June to August and an approximate 19% increase in use of premium offers from June to August, representing meaningful increases in the power of food adverts during the holiday month across these two strategies. Seasonal variation of other persuasive strategies were apparent. Website inclusion peaked in August across both the whole broadcast sample and on dedicated children's channels. This novel finding implies that marketers target children more heavily during summer months to create immersive brand exposure via both traditional and non-traditional marketing forms. Physical activity depiction peaked in April across the broadcast sample and in October (100%) on dedicated children's channels, however levels reported for August were still high (approximately 96%). Knowledge of this is crucial, as evidence indicates that increased exposure to unhealthy

food adverts featuring exercise depicted exercise during summer holidays may skew children's nutritional perceptions of unhealthy foods (Castonguay, 2015).

Taken together, results here illustrate that more powerful advertising for nutritionally poor foods is broadcast during holiday months, most prominently during the month of August. By use of these means, marketers are promoting brand awareness and loyalty in children with the aim to generate pester power to impact on product purchases. In previous qualitative research, parents and children have raised ethical concerns surrounding the powerful marketing of HFSS foods and links to increased pester power and family conflict (Mehta et al., 2014). An important debate here may consider whether more powerful food marketing during children's holidays may be undermining parental efforts to instil healthy eating habits in their children. In addition, exposure to more powerful food marketing may be a contributing factor to weight increases observed during summer months in a longitudinal study (Moreno et al., 2015) alongside numerous other factors (e.g., sedentary behaviours). Public health advocates may be missing out on a crucial opportunity to have a positive impact on children's eating during these summer months. For example, a systematic review (Smits et al., 2015) of studies with child-aged participants concluded that characters have the capacity to increase the liking of and preference for foods. Therefore more powerful marketing (e.g., using familiar characters) could promote nutritious food options during summer months. Analysis of seasonal fluctuations is a distinct strength of the research study, as to the authors' knowledge, seasonal trends in use of websites and physical activity depiction in television advertising has yet to be examined before now. As this is unique to television food advertising, future monitoring of these facets is crucial to examine if higher prevalence of persuasive techniques persists during times when children are more likely to engage in heavy television viewing.

To summarise, the present chapter addresses a gap in the research literature with improved monitoring of televised food advertising to highlight the extent of children and young people's exposure to HFSS food and beverage marketing; critical in obesity prevention efforts (Freeman, Kelly, Vandevijvere, & Baur, 2015). Results from the present chapter highlight a surge in persuasive techniques used within UK television food advertising in 2010, predominantly found in non-core food adverts relative to core food adverts, in support of previous research (Boyland et al., 2012; Kelly et al., 2010).

Promotional characters (brand equity/licensed characters and celebrities), premium offers and website depiction displayed increased use on children's channels in 2010 compared to 2008; a concerning trend in the power of food television food adverts. Persuasive techniques also exhibited patterns of seasonal variation in 2010; a novel and significant finding of this chapter warranting future examination.

A final key message of this chapter relates to escalations in use of exercise depiction, health claims and health/nutrition as the primary persuasive appeal of food adverts. Taken together, these results demonstrate that nutritionally deficient foods are being increasingly paired with implicit (physical activity depiction) and explicit (health claims) health references, with the heaviest use seen on children's channels for proportionally more unhealthy food. By capitalising on this trend, food companies aim to secure brand loyalty and may be misleading consumers in their understanding of nutrition. With this practice increasing, exposure to television food advertising could lead to poor consumption habits and calorie underestimation in children with lasting impacting on health outcomes. As this is something likely to be replicated in wider forms of food marketing, future monitoring of the trends identified in this study are warranted across all advertising avenues and increased understanding of the mechanisms behind aspects of persuasion quantified. In addition, research around tools which may help children and adults discern such juxtaposition may be useful. Policy makers should question the extent to which marketing that hinders children's knowledge about the nutritional content of food is responsible, as current UK statutory restrictions (Ofcom, 2007) and voluntary approaches abroad (Children's Food and Beverage Advertising Initiative, 2014) overlook these widespread strategies.

SUMMARY OF FINDINGS FROM CHAPTER 4

- Premium character use increased between 2008 and 2010, but there was a decrease in their use within non-core food promotion with a shift to higher use in miscellaneous television food adverts in 2010.
- Promotional characters (including celebrities) were used more frequently to promote non-core foo items than core and miscellaneous food items, as in 2008. This was also the case on dedicated children's channels in 2010, however a small decrease was observed from 2008. There was little change in use of brand equity/licensed characters between 2008 and 2010.
- Physical activity depiction increased almost 411% between 2008 and 2010, indicating that marketers are keen to align themselves with consumers' interest of health by constructing an association with activity.
- Health claim appearance increased approximately 19% from 2008 levels and the majority recorded in the present study promoted non-core foods, with a higher rate found on dedicated children's channels.
- Use of fun appeals as the primary persuasive appeal decreased approximately 16% from 2008 to 2010; making them the fifth most frequently used appeal in 2010. Health and nutrition appeals were the most frequently advertised, having increased 2%.
- Use of premium offers, promotional characters, website inclusion, physical activity depiction within non-core food adverts displayed distinct seasonal variation in the 2010 data, a novel finding not observed in the 2008 data.

Chapter 5: Do verbal and textual warnings limit the impact of television food adverts on food intake? A study in a sample of Brazilian children

5.1 Introduction

Brazil, a developing country, is in a period of rapid economic change and has recently undergone significant shifts in its food environment, with the traditional diet being displaced by ultra-processed products promoted by multinational food corporations (Monteiro & Cannon, 2012) as discussed in Chapter 1, section 1.1.2.3. Child nutrition has long been the primary concern in Brazil, but over the last 40 years, a wealth of literature documents the reduction of child under-nutrition (Monteiro, 2009), once the primary health concern. Levels of food poverty have decreased considerably. Percentages of households living in HFI fell from 34.8% to 30.5% between 2004 and 2009 (IBGE, 2006; Ministério Da Saúde., 2011). Extreme poverty (characterized by "severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information"; United Nations, 1995) dramatically decreased from 17.4% in 2001, to less than 9% in 2008 (Levy-Costa, Sichieri, Pontes, & Monteiro, 2005; Ministério Da Saúde., 2011b). This is thought to be due, at least in part, to effective health and nutrition policies, such as the Brazilian school feeding programme (PNAE; Programa Nacional de Alimentação Escolar), providing 47 million children with lunchtime meals at their school (United Nations World Food Programme, 2013).

However, concurrent with decreasing levels of poverty and malnutrition has been a profound change in Brazilian diets, as the consumption of highly-processed food products has become frequent and commonplace. Research from Brazil documents an increase in the availability and consumption of meat and HFSS foods, twinned with a reduction in the consumption of fruits, vegetables and basic traditional foods such as beans and rice (Aranha & Lunas, 2009). Monterio and colleagues (2011) monitored nutrition patterns over two time periods (1997-1998 and 2002-2003) and found that consumption of ultra-processed foods significantly increased during the two time frames, whereas intake of unprocessed and processed foods declined (Monteiro, Levy, Claro, de Castro, & Cannon, 2011). A recent paper by the Pan American Health Organization/World Health Organization (PAHO/WHO)

has found that by volume, sales of ultra-processed food and beverage products increased 48% between 2000 and 2013 in Latin America, compared with 2.3% in North America. Ultra-processed foods now constitute 28% of calories in the average Brazilian diet (Monteiro, Levy, Claro, de Castro, & Cannon, 2011), and Brazilian men are posited to have the highest daily levels of sugar intake internationally (Datamonitor Research Store, 2015). This "nutrition transition" is defined as "major shifts in the nutritional profile of human populations directly related to modifications in dietary intake and nutrient expenditure patterns" (p.433; Monteiro, Moura, Conde, & Popkin, 2004). It is thought to be a result of the actions of transnational food corporations which, having reached saturation point in countries such as the UK (where ultra-processed products constitute 60% of total daily calories) now focus on Brazil; considered one of the most important packaged food markets in the world (Monteiro et al., 2011). Brazil is an especially attractive market for the food industry due to fast population growth, urbanization, and increasing incomes in the country (PAHO/WHO, 2015). As such, burgeoning obesity rate in Brazil is very likely to be linked to increased consumption of ultra-processed foods (Rtveladze et al., 2013). Increased food marketing accompanies this shift and will be discussed below.

Now overweight and obesity are the most prevalent nutritional problem in the Brazilian population; with prevalence in adults increasing 18% to 50% in males and 29% to 49% in females between 1975 and 2009 (IBGE, 2010). Childhood obesity prevalence in Brazil was discussed in depth in section 1.1.2.3 of this thesis. Medical costs for overweight and obesity in the entire Brazilian population averaged $2.1 billion (US dollars) per year across 2008-2010, the primary associated costs being hospitalizations (68.4% of total costs), and ambulatory procedures (31.6% of total costs; Bahia et al., 2012). A recent modelling study projects that the total health care cost of obesity in Brazil over 40 years (2010-2050) will be over $330 billion (Rtveladze et al., 2013). The model shows that a 1% decrease alone in mean BMI would lead to a saving of over $27 billion in the same time period (2010-2050) and large changes in NCD rates. Gortmaker and colleagues put forward multiple policy recommendations for preventing and controlling obesity (Gortmaker et al., 2011a) and cite regulation of advertising of junk food and beverages to children as a cost-effective solution. The UK is a country with statutory television food advertising regulation in place (the efficacy of which has been discussed in Chapters 3 and 4 of the present thesis). Brazil is a

country where attempts to introduce similar statutory regulation are being strongly impeded by the food industry. This current study will consider non-regulatory alternatives that may assist children in resisting responsivity to food advertising. The following section will discuss research into television food advertising in Brazil and attempts to regulate it.

5.1.1 Television food advertising in Brazil

Television ownership in Brazil is now common place. As of 2008, 94.5% of households in Brazil own a television (IBOPE National Panel of Television, 2011). Recent statistics purport that the average Brazilian child (aged 4-11) spends just 3 hours in school and 5 hours watching television daily (IBOPE National Panel of Television, 2011). Therefore, television viewing is the dominant daily activity for Brazilian children, and this televivion content is entirely commercial. Brazil's most popular television network, O Globo, is the fourth largest commercial network in the world (Brasil, 2005) where more than 16 million advertisements are aired per year, serving over 6 thousand agencies (http://redeglobo.globo.com, 2016). Links between television viewing and obesity are well established (see section 1.4.1. of this thesis). Six of eight studies in a systematic review reported a significant relationship between watching television and obesity in Brazilian children and adolescents (Rossi, Albernaz, Vasconcelos, Assis, & Di Pietro, 2010). Moreover, in a large sample of 4,452 Brazilian children aged 10-12 years, Wells and colleagues (2008) report that increased television exposure was associated with greater body fat and blood pressure, independent of levels of physical activity.

Research into television food advertising in Brazil remains relatively sparse despite reported high levels of television viewing (IBOPE, 2011). The majority of existing studies have sought to quantify food adverts shown on television. A 2003 content analysis of food advertisements on Brazilian television found that 58% were promoting HFSS products with no advertising for fresh fruit and vegetables reported (Sawaya, Martins & Martins, 2003). Recent studies suggest that this has worsened in the last decade; with more than two-thirds of adverts promoting ultra-processed products (e.g., fast foods, breakfast cereals, packaged snacks, soft drinks; Ministry of Health of Brazil, 2014). A recent analysis by Costa and colleagues (2013) report that sugar and sweets constituted 48.1% of foods advertised (13.8% of all adverts shown) and oils and fats accounted for 29.1%, confirming the

abundance of unhealthy foods advertised on Brazilian television (Costa, Horta, & Santos, 2013).

Interestingly, cultural factors specific to the Brazilian population may elicit unique repsonses to food advertising. Data from a worldwide survey into national trust levels towards advertising concluded that out of 47 countries, Brazilians were found to place the highest levels of trust in advertisements (The Nielsen Company, 2007). Additionally, particular highly branded foreign food and beverage products may carry underlying images of aspiration in this market (Stoebe, Hampp, & Munchen, 2013). These cultural vulnerabilities to marketing and food marketing specifically, may be rooted in the recent economic shift (i.e., the nutrition transition), and have the potential to compound the influence of food adverts. Existing literature shows that children are already more susceptible to the impact of marketing at a younger age because their conceptual knowledge of advertising has yet to fully mature (Rozendaal, Lapierre, Reijmersdal, & Buijzen, 2011). We could expect Brazilian children's grasp 'media literacy' in particular, to be potentially diminished by their high levels of trust in corporate promotion and naivety towards marketing, making them especially vulnerable consumers. Empirical evidence confirms an impact of television food marketing on children's food preferences and consumption (Boyland et al., 2013; Boyland, Kavanagh-Safran, & Halford, 2015; Forman, Halford, Summe, MacDougall, & Keller, 2009; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008). With copious television food marketing accompanying the rapid change in the Brazilian food environment, and a worrying absence of regulation as it stands (as explored below, section 5.1.2), the present research looks to mitigate its effects in a sample of Brazilian children.

5.1.2 Television food advertising regulations in Brazil

As discussed in detail in section 1.4.5, international public health organizations advocate the restriction of food marketing, in particular food adverts broadcast on television (WHO, 2010; WHO, 2012). Television food advertising is easier to regulate through national legislation than online forms. However, Brazil's strong anti-regulatory food lobby is currently thwarting attempts at regulation of television food advertising. Briefly, in 2006 the

Brazilian National Health Surveillance Agency announced a proposal to regulate the marketing of HFSS food products and drinks (WHO/FAO, 2003). After four years of discussions including public consultations and hearings, 2010 saw the regulation (RDC 24) finally published (ANVIS, 2010). During this time however, transnational food product manufacturers constructed a case against the proposed restrictions, arguing that their products are not harmful to health, alluding to freedom of commercial expression (Gomes, Castro & Monteiro, 2010). They succeeded in their arguments and the regulations did not progress further (Gomes, Castro, & Monteiro, 2010).

However, there is a growing awareness of the impact of unhealthy food marketing to children in Brazil. New national dietary guidelines, published in 2014, outline ten steps to healthy diets (Ministry of Health of Brazil, 2014). These include "Be wary of food advertising and marketing" (p128, Ministry of Health of Brazil, 2014). Parents, guardians and educators are encouraged to explain to children that the function of advertising is "to increase the sale of products, and not to inform or educate people and limit the amount of time children are exposed to media" (p118). Despite this increased attention, with no statutory regulation in motion, there is clear need for alternative solutions and studies such as this one seek to assess the effectiveness of strategies to negate the impact of unhealthy television food advertising, especially in children. This is crucial considering the nation's growing economy, globalized food network and the Brazilian population's unparalleled trust in the advertising industry. Literature surrounding the potential use of warnings to mitigate the harms of television food advertising is addressed below.

5.1.3 Use of warnings

Considering the global failure of self-regulation in reducing the harmful effects of HFSS food advertising on children's food consumption (Hawkes, & Harris, 2011; Kent, Dubois, & Wanless, 2011) and the absence of national policy in the vast majority of countries including Brazil; it is crucial that other non-regulatory options are explored in this literature. One such possibility is the provision of warnings during the broadcast of unhealthy television food adverts, to raise children's awareness of their effects. Currently in place on French television (see section 5.1.3.1), warnings are proposed to compete with other elements of

adverts for consumer's cognitive resources and attention (Krugman, Fox & Fletcher, 1994), but have the potential to prompt a more skeptical or critical view of a product; facilitating more informed purchase or consumption decisions (Effertz, Franke, Teichert, 2013). For warnings to be effective, they not only need to be attended to and understood (Barlow & Wogalter, 1993), but also recalled and taken into account when behavioural decisions are made (Monaghan & Blaszczynski, 2010). This study considers the value of health and persuasiveness warnings, with the literature pertaining to each outlined below.

5.1.3.1 Health warnings

Television viewers are routinely bombarded with health messaging within food marketing. For example, health claims such as "low fat" and "provides essential nutrients" are commonplace within HFSS television adverts, as explored at length in Chapter 4 of this thesis. Such themes of health are salient within television food advertising demonstrable in their use as popular persuasive techniques. It is feasible that warnings alluding to the health and facilitating nutritional awareness may aid consumers to think about the effects of HFSS food products being advertised as a defense again their impact on behavioural decisions. However, to the author's knowledge, research exploring the impact of health warnings within television food advertising is non-existent.

Studies have however explored the impact of nutritional knowledge on wider food-related behaviours. Women with better nutritional knowledge exhibited healthier dietary behaviours in one study (De Vriendt, Matthys, Verbeke, Pynaert, & De Henauw, 2009), and in another, nutritional knowledge was positively related to food label use, which in turn was related to more healthy food intake (Fitzgerald, Damio, Segura-Pérez, & Pérez-Escamilla, 2008). However, one ecologically valid study in a supermarket setting found that nutritional knowledge appeared to have only a minor effect on product selection (Saarela, Lapveteläinen, Mykkänen, Kantanen, & Rissanen, 2013). Research in adult participants is mixed and implies that the possession of nutritional knowledge may not directly translate into consistently healthy food-related behaviours.

In children, one study conducted in Brazil found obesity to be associated with limited nutritional knowledge and unhealthy eating habits (Triches & Giugliani, 2005). However, the available literature into health warnings and children only extends to exploring the

impact of tobacco warnings on young children aged 5 and 6 in an international sample (including Brazil). This study found low levels of awareness and understanding of health warnings featured on cigarette packages (Borzekowski & Cohen, 2014). However, cigarettes are not a child targeted product, where children will have had little to no experience of consumption of cigarettes. Contrary to this, food is an omnipresent feature in children's lives and therefore warrants it's own specific investigation.

As previously mentioned, health warnings are currently used on French television, radio and print advertisements for all food and drinks products targeted at adults and children (C. Hawkes, 2007). Advertisements must carry a mandatory health warning based on principles of dietary education, as approved by the French National Institute of Health Education (World Cancer Research Fund International, 2016). On television, warnings appear at the bottom of the advertisement (see Figure 5-1 for an example). To the author's knowledge, no evaluation has been published on the efficacy of this approach. However, one research study has however demonstrated that the warning effect is diluted when embedded in an advert with "pictoral framing", in a sample of 10-22 year olds (Effertz, Franke, & Teichert, 2014). Children were found to consider the warnings to a lesser extent when the warning was competing with pictoral content, running a greater risk of consuming unhealthier food products. In all, limited research exists in addressing the impact of health warnings displayed around HFSS television food adverts.

Figure 5-1. Example of a health warning used in French television food advertisements. Translation: "for your health eat at least five fruits and vegetables per day www.mangerbouger.fr"

5.1.3.2 Persuasive warnings

Unlike health warnings, warnings highlighting the persuasive intent of advertising, to the author's knowledge, are not presently utilized within television food advertisements. However, a reasonable body of literature explores the issue of persuasive intent, as children's aptitude in their understanding of the commercial intent of advertising has been central to the debate about their susceptibility to food advertising (Martin, 1997). Freistad and Wright argue that knowledge of persuasive intent "enables them [consumers] to recognize, analyse, interpret, evaluate, and remember persuasion attempts and to select and execute coping tactics believed to be effective and appropriate" (p.3; Friestad & Wright, 1995). This warning type (e.g., "adverts try to make you buy things"), aims to undermine the overall coherence and trust towards marketing messages; deemed as the detachment effect (Friestad & Wright, 1994; Wright, Friestad, Boush, 2005). Studies into the tihs effect have demonstrated that consumers heightened recognition of the persuasive basis of advertising leads to more sceptical attitudes, decreasing the messages persuasive effect. However all published studies cited here used undergraduate student samples limiting their generalisability to child populations (Campbell & Kirmani, 2000; Morales, 2005; Wei, Fischer, & Main, 2008).

Researchers posit that persuasion knowledge does not necessarily lead individuals to resist advertising. This is something accepted by The Food Marketing Defense Model (Jennifer L Harris, Brownell, & Bargh, 2009). Harris and colleagues suggests four necessary conditions for individuals to effectively resist food marketing stimuli: 1) Awareness, defined as the conscious attention to individual marketing stimuli and comprehension of their persuasive intent; 2) Understanding of the effects resulting from exposure to marketing and how to effectively defend against those effects; 3) Ability, including cognitive capacity and available resources to effectively resist; and 4) Motivation, or the desire to resist. This implies the challenges associated with generating a notion of persuasive awareness around television food advertising.

Research investigating television food advertising (without warnings) demonstrate that overweight and obese (OW/OB) participants consume more than normal weight (NW) participants in one study (Halford et al., 2008b). These findings are in line with the externality theory, which as previously discussed, posits that OW/OB children are more

reactive to external cues to eat (such as television food advertising) and less sensitive to internal hunger and satiety signals than NW children. Additional research implies that OW/OB children may be more brand loyal and hence more immune to warnings as a form of food marketing defense, with research demonstrating a link between brand recognition and preference, and weight status (Arredondo et al., 2009; Forman et al., 2009). Further to this, children with higher levels of habitual media exposure were found to have higher BMIs and were more responsive to food promotion than children with lower levels of media exposure, in terms of food preference after exposure to food adverts (Boyland et al., 2011). This has yet to be explored in experiments with adverts that feature warnings. This has yet to be explored in a sample of Brazilian children.

Research into the use of warnings is crucial to help identify whether there are effective interventions that warrant use. Due to a worrying absence of regulations as it stands in Brazil, other options must be considered to mitigate the detrimental effects of increased HFSS food advertising on Brazilian children's dietary health. This novel study aimed to measure *ad-libitum* eating opportunity after children had been exposed to television food adverts across three distinct groups (no warning, health warning and persuasiveness warning), to provide insight on the impact of warning type of these on children's food intake. To the author's knowledge, this is the first study to consider the effect of unhealthy food advertising on children's food consumption in a Brazilian population, as well as to assess a potential public health strategy to reduce its impact.

5.1.4 Aims

The present study aimed to investigate the impact of two warning types displayed around television food adverts on children's *ad-libitum* consumption of snack foods. The impact of textual warnings regarding a) the healthiness of the food and, b) the persuasive nature of adverts on Brazilian children's food choice and intake response were explored. A further aim was to explore whether weight status impacts the effect of warnings, i.e. whether or not OW/OB children's intake response will be influenced to a lesser extent than NW children. Finally, I aimed to explore the role of habitual television exposure in this

population, to examine whether these children would display increased consumption behaviours.

5.1.5 Hypotheses

Based on previous research as discussed, it was hypothesised that

H1: Food advertising exposure will produce a significant increase in caloric intake in all children compared to control adverts.

H2: The difference between control condition and food advert warning conditions will be significantly smaller than those participants in the non-warning food advert condition

H3: For OW/OB children, increase in intake in the food advert condition will be of a greater magnitude than for the NW children.

H4: Those participants with high media exposure will have higher BMI and would be more affected by the food adverts.

5.2 Method

5.2.1 Ethics and recruitment

Due to the collaborative international nature of this study, approval was granted from the University of Liverpool's Sub-Committee for Non-Invasive Procedures (Ref: RETH000618) because this was a novel procedure in collaboration with institutions abroad (see Appendix 5a). Ethical approval was also required from 1) the collaborating institution (Instituto Nacional do Câncer; INCA), and 2) Rio de Janeiro City Hall (Health and Education departments). Local ethical approval from INCA was granted on 29/05/2013. Ethical approval from Rio de Janeiro City Hill required more lengthy documentation. Project details were submitted to the Ethics Review Board of the Rio de Janeiro City Hall including: a completed submission form (including details of the project and research coordinator), details of the project in full, a cover letter from the Institution ahead of the research, authorisation from the Education Department of the Rio de Janeiro City, project timeline, detailed budget, questionnaires and data collection forms, declaration informing funds source and the curriculum vitaes of all researchers involved. Ethical approval from Rio de Janeiro City Hall was granted at a later date (21/05/2014; see Appendix 5b).

Participants were recruited from one primary school in the Maracanã district of Rio de Janeiro, Brazil. As school staff spoke limited to no English, school recruitment was conducted through contact between the Head teacher via researchers at one of the collaborating institutions (Instituto Nacional de Câncer, INCA; Brazil). Due to low literacy rates in adults within the relevant population in Brazil, parents/guardians of appropriately aged children were invited by school staff (as requested by INCA researchers) to attend meetings in groups of 10-20 where the study was presented to them by researcher from INCA, using visual aids to support understanding of the aims and procedures. This aided the recruitment process in Brazil by allowing parents/guardians a better understanding of the aims and procedure of the study. Parents were also given the opportunity to interact with the researchers and have any questions they had concerning the research addressed promptly. If they were willing for their children to take part in the research, parents/guardians signed the parental consent form at this meeting, with assistance from researchers. Children were talked through the procedure by the study assistants in small

groups of between 5 and 10 before being asked verbally whether or not they wished to take part. This verbal assent was required from children and confirmed by researchers who signed the child consent form in authorisation.

5.2.2 Participants

Data were collected between August and October 2014. A total of 120 participants aged 7-11 years (Mean=9.3; SD=1.19) completed both conditions of the study. The age range is consistent with previous studies of the effects of television food advertising on children's food intake (Anschutz, Engels, & Van Strien, 2009; Halford et al., 2004). Children with any food allergies (as confirmed by parents) were excluded from study participation. In this sample, 66.7% of children were NW, 20.8% were OW and 12.5% OB (OW/OB combined = 33.3%). Levels found in the current research are higher than previously reported in a study from the South East of Brazil, where excessive weight was present in 25.8% participants (Costa, Horta, & dos Santos, 2012). When observing levels of overweight and obese separately, the 12.5% obesity rate reported in this study is higher than a 2010 study of Brazilian children, where the prevalence of obesity and overweight was 8% and 19.9% respectively (Rech et al., 2010). Similarly, the prevalence of obesity in 7-10 year olds between 2009 and 2011 in another study was reported as 5.6% (Flores, Gaya, Petersen, & Gaya, 2013). Specific to Brazil, the present findings support data that demonstrates that, currently, the overweight problem affects not only the affluent, but also the economically deprived, in this developing country (Monteiro, Conde, & Popkin, 2007).

5.2.3 Design

This study employed a within-subject, counterbalanced design featuring two conditions: control (toy advertisement exposure) and experimental (food advertisement exposure). Using PC-based DVD editing software (Adobe Premiere 6), 10 previously televised food advertisements were placed onto a DVD for use in experiments in Chapters 5. Food and toy advertisements that were believed to be aimed at children and young people were selected from YouTube (www.youtube.com). All adverts were broadcast on Brazilian television during the years 2012-2013. This ensured all food and toy advertisements were culturally

familiar to Brazilian children in the required age range. Equal numbers of gender- targeted toy adverts were selected to ensure all children were equally engaged (see Table 5-1). Each advert was approximately 30 seconds in length, totalling an advertising exposure time of 5 minutes in each condition for both experiments. As stated, the adverts were followed immediately on the same DVD by the same 20-minute episode of the cartoon (Sponge Bob Square Pants). The same episode was used on both DVDs to ensure that only the advert content varied between conditions. The toy and food adverts were not matched, and the nutritional content of the foods in the adverts was not analysed. This allowed both to examine the beyond-brand effects of typical television food advertising rather than specific effects relating to the types of food products or brands shown within the DVDs. In each condition, the adverts were followed immediately by an identical cartoon, ensuring that only the advertising content varied between conditions.

In the experimental condition, participants were exposed to one of three warning conditions; one group were shown a warning explaining about the (un)healthfulness of typically advertised foods “avoid foods high in fat, sugar and salt like these”; one group were shown a warning concerning the persuasiveness of advertising “remember, adverts are there to try to get you to buy things”, and the third group had no warning exposure. Warnings were displayed three times, before the adverts started, in the middle of the 10 adverts (i.e., between the 5th and 6th advert) and at the end of the 10 adverts, and were accompanied by an audio track to accompany the phrase. For each of the three exposures, warnings were displayed for approximately 10 seconds. Following advert exposure, participants’ *ad-libitum* intake of 6 different snack foods was measured (detailed below). A two week interval between advert conditions (control and experimental) was enforced in order to minimize the likelihood that participants would recall their responses from the first session.

5.2.3.1 Warning materials

Warnings were adapted from existing mandatory warnings compulsory across all television advertising (targeted at children or adults) that processed food and drinks, or food and drinks containing added fats, sweeteners and/or salt are accompanied by one of a series of health messages approved by the National Institute of Health Education. The messages as defined by a 2007 Decree include: "For your health, avoid eating too many foods that are

high in fat, sugar or salt". This was adapted and edited for use between food advertisements to read “avoid foods high in fat, sugar and salt like these” and translated into Portuguese for use in Brazil. Persuasiveness warnings, as far as the author is aware, are not currently mandatory as part of any existing legislation. This warning was adapted from existing literature into the detachment effect (Friestad & Wright, 1994; Wright, Friestad, Boush, 2005) where an example of a warning is given (e.g., “adverts try to make you buy things”), which aims to undermine the overall coherence and trust towards marketing messages. This was adapted to “remember, adverts are there to try to get you to buy things” and translated into Portuguese. All warnings were displayed in black text displayed on a white background to avoid any distracting imagery on screen (Effertz et al., 2014). Moreover all warnings had accompanying audio recording so as not to discriminate against children on the basis of reading ability. This represented a key difference between the messages used on French television and warnings used in Chapter as on French television; warnings were displayed throughout the advert at the bottom of the screen in smaller text. We did not want the warnings to go unnoticed and thus ensured that all warnings were prominently displayed between food adverts so as children could not be distracted by advert content.

	Food adverts	Food advert type	Toy adverts
1	Habibs	Fast food chain	Monster High
2	Cheetos	Crisps	Hot Wheels Ballistiks
3	Toddynho	Chocolate milk	Barbie Casa de Férias
4	Baton ao leite	Milk chocolate bar	Max Steel
5	Bobs	Fast food chain	Interactive Minnie Doll
6	Ovomaltine	Chocolate milk	Spock dog toy
7	McDonalds	Fast food chain	Lalaloopy Doll
8	Fini	Sweets	Disney AppMates Cars 2
9	Lays	Crisps	Emotion Pets
10	KitKat	Chocolate bar	Robo Fish

Table 5-1. Experimental and control adverts. N.B. Adverts listed in order of appearance on DVD. In both the warning conditions, warnings were displayed before food advert 1, between food adverts 5 and 6, and after food advert 10.

5.2.4 Procedure

As instructions to participants required delivery in Portuguese, test days were led by study assistants from INCA under supervision of the present researcher. Study assistants followed standardized instructions using documentation translated from English by Dr Fabio Gomes.

During the first test day, children were provided with a child-friendly study information sheet which was read out loud by a study assistant. Following this, children were asked if they wished to participate in the study, and the study assistants documented the receipt of verbal assent from those who wished to participate. Next, all children were shown a DVD in small groups of 5 to 10 children which was projected onto a large screen in a classroom setting. In the control condition, participants viewed the 10 toy adverts followed by a cartoon. For the experimental condition, participants viewed the DVD containing the food adverts and dependent on their condition, the appropriate warning or no warning. All participants completed both conditions (with the aforementioned two week interval between sessions).

Immediately after viewing on both occasions, children were asked to provide a hunger measure on a scale depicting faces of varying emotion (see Appendix 5g). Next, children were presented with identical amounts of 6 different every day snack foods and had 10 minutes to eat as much or as little as they liked. The study foods used were selected (in consultation with INCA) to be approximately equivalent to those used in Halford et al. 2007. They were 24g of Ruffles crisps (high fat savoury), 23g Fandangos crisps (low fat savoury), 90g Nestcau chocolate balls (high fat sweet), 80g Ana Maria cake (low fat sweet), 155g grapes and 110g cherry tomatoes. Children were instructed to let the researchers know if they ran out of foods and were told not to share and to only eat from their designated tray. The six bowls were weighed individually before and after eating opportunities to ascertain consumption. This gram weight was converted into kcal using manufacturer nutrition information as denoted on the packaging for each product. For the two non-packaged products, nutritional information was obtained online.

In the experimental condition only, children completed a measure of warning recognition. They were asked 1) whether they had seen a warning when they watched the DVD, 2) whether they thought they had understood the warning and 3) what, in their own words, they thought the warning meant. The final task on the two occasions differed; on the first test day, all children completed a Habitual Television Viewing Questionnaire (HTVQ-R) to assess television of habitual television exposure, a proxy of television food advertising exposure. On the second test day, measures of height (recorded to the nearest 0.1 cm using a stadiometer) and weight (measured to the nearest 0.1 kg with a recently calibrated

weighing scale) were taken from all children. BMI was converted to an age and gender appropriate SD score using WHO AnthroPlus software (which uses WHO 2007 growth reference data for 5-19 year olds; WHO, 2011). After all participants had completed all conditions, study assistants conducted an age-appropriate verbal debrief which disclosed the aims of the study, and any questions were answered.

5.2.5 Statistical analysis

Data analysis was conducted using SPSS version 20 (SPSS Inc., Chicago, US). To check for normality, a Shapiro-Wilks test was conducted across BMI groups (NW and OW/OB) and conditions. Food intake was normally distributed for each combination of the groups. There was homogeneity of variance, as assessed by Levene's test ($p > .05$) in the within-subjects data. A paired samples *t*-test, a one-way analysis of variance (ANOVA) and a 2x3 mixed ANOVA conducted to examine differences in food intake (kcal). Significance was taken at $p<0.05$. Data handling occurred in calculations of participant's intake (grams were converted to kcals using a formula in excel). A median split was calculated to previous media exposure. Baseline-adjusted intake was also conducted (kcal intake in the food advert condition minus kcal intake in the control advert condition) to allow for the examiniation of the three experimental groups. To establish habitual media exposure, the number of hours of television each child watched on a typical weekday (before and after school) was ascertained and multiplied by 7 to indicate a week's viewing.

5.3 Results

Table 5-2 shows the mean age, gender, BMI, BMI z-score, weight status category and food intake (kcal) for the hungry and sated conditions. Standard deviations show that all groups had similar levels of variability and no between-group differences were observed in these variables, indicating that the groups were well matched. There were no differences between the food warning conditions regarding participants' age, gender and BMI indicating that the randomisation was successful. Means and SDs for all variables, separate for food advertising groups, are displayed in Table 5-2.

	Food advert condition			
	No warning (n = 38)	**Health warning (n = 38)**	**Persuasiveness warning (n = 44)**	**P value**
Age	9.2 (SD=1.3)	9.2 (SD=1.0)	9.5 (SD=1.2)	0.449
Gender	19 M 19 F	22 M 16 F	21 M 23 F	0.642
BMI	19.0 (SD=4.7)	17.9 (SD=3.3)	18.6 (SD=3.3)	0.489
BMI z score	.8	.6	.8	
Food intake (kcal)	386.8 (174.1)	389.3 (SD=166.1)	477.0 (SD=199.8)	0.093

Table 5-2. Demographic information for participants randomised to the food advert warning conditions.

Manipulation check

A warning manipulation check found that 94.7% of children in the health warning group and 87.5% of children in the persuasiveness warning group acknowledged viewing the warnings displayed around the food adverts (see Table 5-3).

Warning type	**Seen**	**Perceived understanding**	**Understood**
Health warning (N=38)	94.7%	65.8%	60.5%

Persuasiveness warning (N=44)	87.5%	62.5%	37.5%

Television viewing questionnaire	Mean responses
How many hours of TV watched before school?	1.6
How many hours of TV watched after school	3.4
Total amount of average hours of television watched per day	5
How many meals do you eat in front of TV on Sat?	1.7
How many meals do you eat in front of TV on Sun?	1.6
How many televisions are there in your house?	2.5
Do you have a television in the room you sleep in?	80% responded yes

Table 5-4. Mean responses from the Habitual Television Viewing Questionnaire (HTVQ-R).

Results from the Habitual Television Viewing Questionnaire (HTVQ-R) demonstrate that children in the sample watch a mean amount of 1.6 hours of television before school and 3.4 hours of television after school (average of 5 hours during a weekday). On average, 1.6 meals are consumed in front of the television on Saturday and 1.7 on Sunday. An average of 2.5 televisions was reported per household with 80% of participants sleeping in the same room as a television (see Table 5-4).

H1: Food advertising exposure will produce a significant increase in caloric intake in all children compared to control adverts.

Table 5-3. Manipulation check information for participants randomised to the health and persuasiveness warning groups.

A paired sample *t*-test revealed a significant average difference between control advert exposure and food advert exposure ($t118 = 2.311$, $p=0.023$). Total kcal intake was significantly higher after exposure to control adverts than after the food adverts. Children consumed 33.48 more kcal after exposure to control adverts compared to food adverts (see Figure 5-2.) Therefore hypothesis 1 is not supported.

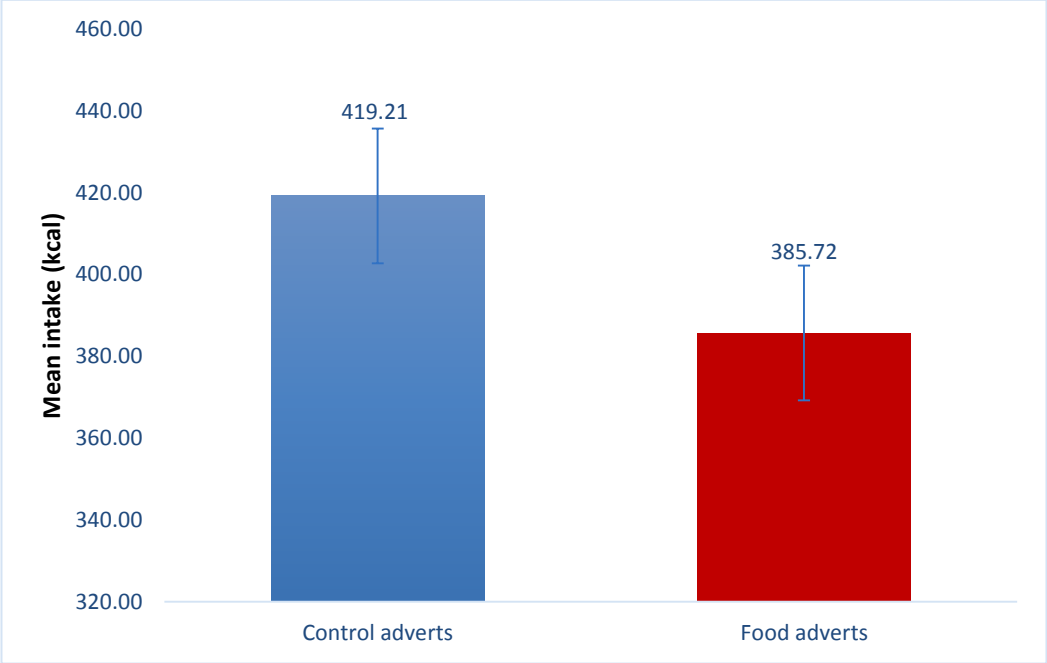

Figure 5-2. Mean intake (kcal) following control and food advert exposure.

H2: The difference between control condition and food advert warning conditions will be significantly smaller than those participants in the non-warning food advert condition

Baseline adjusted intake was calculated and a one-way ANOVA (levels: no warning, health warning and persuasiveness warning) was conducted. There was no statistically significant difference found in baseline-adjusted intake between food advert exposure groups ($F(2,116) = 1.243$, $p=.292$). A Tukey post-hoc test revealed no statistically significant differences between groups. Means indicate that participants in the no warning condition consumed 66.68 kcals less than in the control condition, 15.67 kcals less in the health warning condition and 19.79 kcals less in the persuasiveness warning condition (see Figure 5-3).

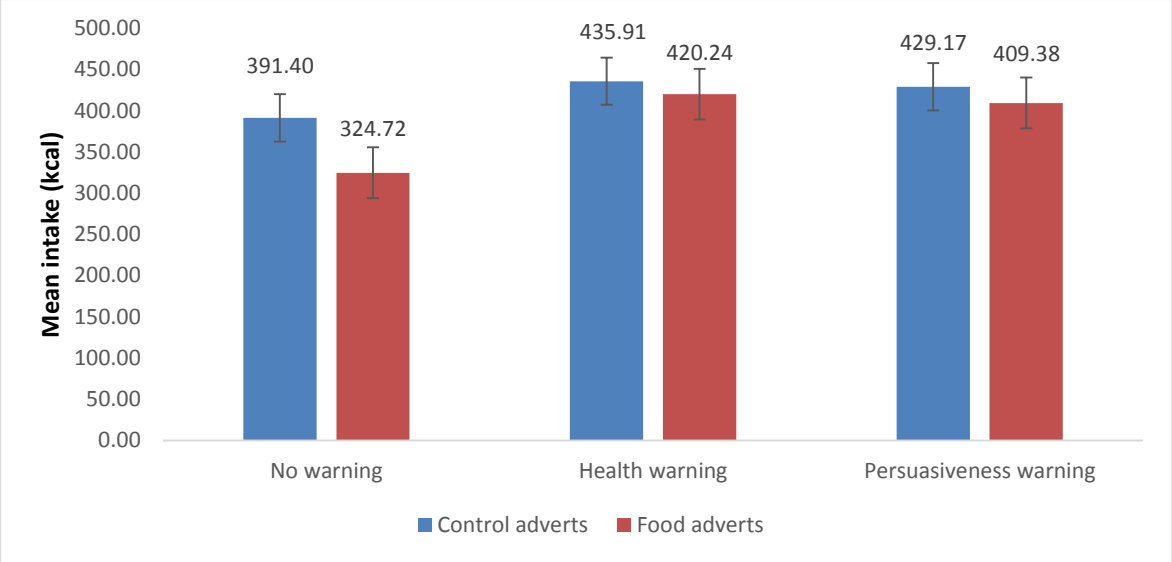

Table 5-3. Mean intake (kcal) following control advert exposure and food advert exposure groups.

H3: For OW/OB children, warnings will have less of an effect on intake, where there difference between control condition and food advert warning conditions will be significantly smaller in the non-warning food advert condition compared to NW children

A 3x2 ANOVA found no significant main effect of weight status group [F(1, 113) = .486, *p*=.487, ηp2=.004], on baseline-adjusted intake (kcal). No significant interaction was found between weight status group and advert condition [F (2,113) = 1.368, *p*=.254, ηp2 = .024]. NW participants displayed a mean intake of -28.52 kcal (baseline-adjusted intake) whereas OW/OB participants displayed a mean intake of -50.09 kcal. Means are displayed in Figure 5-4 and means across food warning conditions in Table 5-5.

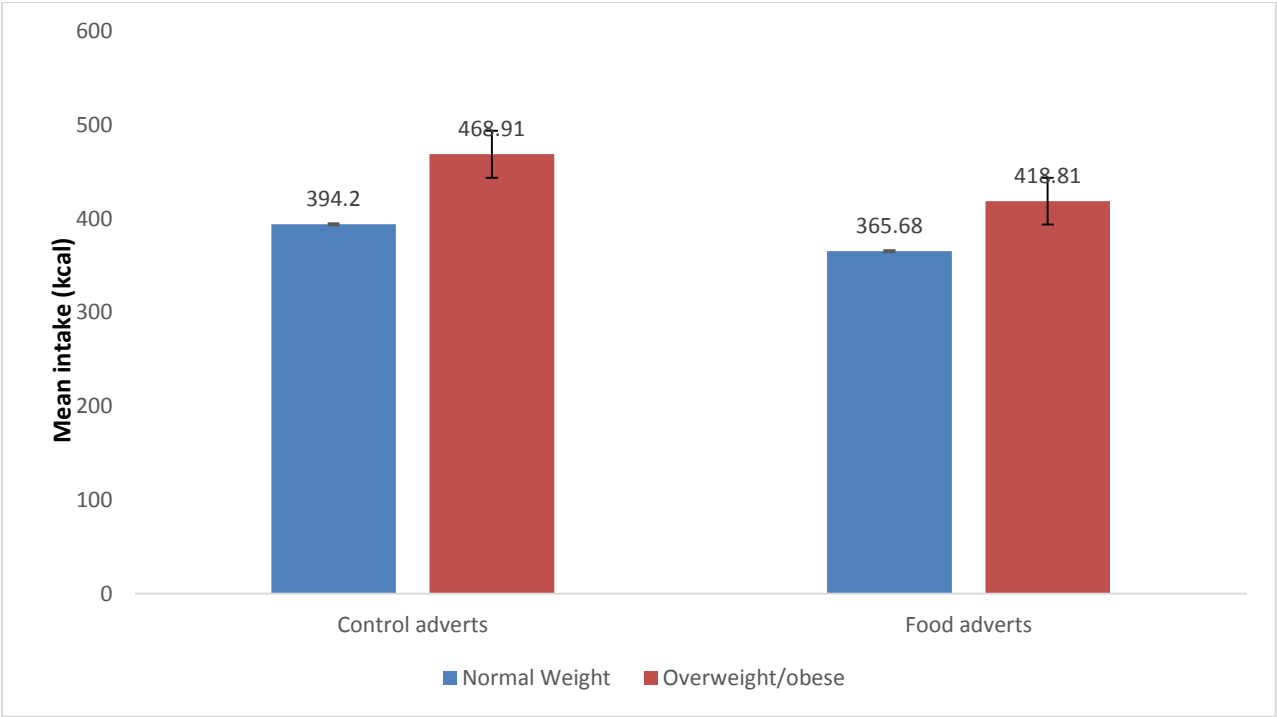

Table 5-4. Mean intake (kcal) for OW/OB and NW children following control advert exposure and food advert exposure.

Weight status	Warning condition	Advert condition	Mean intake (kcal)
NW	No warning	Control	354.71
		Food	271.39
	Health warning	Control	401.33
		Food	410.41
	Persuasiveness warning	Control	426.56
		Food	415.25
OW/OB	No warning	Control	454.30
		Food	416.15
	Health warning	Control	517.65
		Food	443.47
	Persuasiveness warning	Control	434.77
		Food	396.82

Table 5-5. Mean intake (kcal) for OW/OB and NW children across warning conditions and control condition.

H4: Those participants with higher levels of habitual media exposure will increase their intake more than those participants with lower levels of habitual media exposure.

An independent *t*-test showed no significant differences in baseline-adjusted intake between the habitual media exposure and the low habitual media exposure groups (*t*117 = -.627, *p*=.532) . See Table 5-6. Therefore hypothesis 4 is unsupported. No significant differences were found in BMI between children with high habitual media exposure and low habitual media exposure (*t*118 = -.990, *p*=.324).

Condition	Habitual Media Exposure Group	Mean
No warning	Low	-95.58
	High	-43.29
Health warning	Low	-38.58
	High	1.78
Persuasiveness warning	Low	-9.65
	High	-33.13

Table 5-1. Mean baseline-adjusted intake (kcal) across food advert gorups for low and high television exposure groups.

5.4 Discussion

To our knowledge, this is the first study to explore the potential mitigation of the effects of television food advertising on children, as a cost-effective approach, for use in the absence or alongside governmental regulations. By measuring *ad-libitum* eating opportunity after children had been exposed to television food adverts across three distinct food advertising groups, this study aimed to explore the impact of health and persuasiveness warnings displayed around food adverts. The present section will discuss findings, with Chapter 8 (section 8.4) exploring the broader issues relating to the results of this experimental chapter within the context of other findings from this present thesis.

A main effect of control advert exposure on kcal intake was found; such that exposure to control adverts significantly increased intake by approximately 34 kcals relative to the food advert exposure, and not food adverts, as hypothesised. Notably, results here are in direct contrast to published research using samples of UK children (Boyland et al., 2013; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008), where main effects of food advert exposure are repeatedly reported. In line with the studies mentioned above, the present study employed a paradigm with the same outcome variable (intake in kcal), similar but not exact manipulations (three food advert warning groups included in this study) and child samples from a markedly distinct population. Certainly, it is likely that this latter factor and associated cultural and SES dissimilarities could potentially explain differences in this finding (see Dicscussion, section 8.4).

Closer examination of selected study materials utilised may also be implicated in this unhypothesised finding. Firstly, the cartoon featuring in both control and food advert conditions contained characters engaged in eating behaviours, which have been shown to impact on *ad-libitum* intake in published studies (Jennifer L. Harris et al., 2009; Kemps, Tiggemann, & Hollitt, 2014b). Food cues encompassed within television programming may unconsciously prime people to directly consume more food by activating food related cognitions, food craving and motivation to eat. Unhealthy food cues are prominent within children's cartoon programming, where a study of UK and Irish television channels found

that 30.8% of cartoons contained food placement (Paul Scully et al., 2016). Importantly, one recent qualitative study into the food perceptions of Brazilian children found that television programs (and not just television advertising per se) increased children's desire to consume energy-dense, nutrient poor foods (Mazzonetto & Fiates, 2014). Therefore, it could potentially be that television programming and snack food consumption are more synonymous in this population than in other samples (e.g., UK children).

Moreover, the prominent character featured within the cartoon has previously been used to market HFSS snacks in Brazil (e.g., mini eggs chocolates), not known at the time of editing study materials. Currently, this licensed character promotes flavoured milk drinks, yogurt drinks and desserts promoted by Brasil Foods, a long-time beverage partner of the television channel Nickelodeon. World Cup 2016 merchandise has been released also featuring the character (e.g., clothing for toddlers and teens, stationery and gift ranges). Thus, with this particular promotional character being heavily associated with both HFSS foods and toy products; a potentially less powerful contrast between control and experimental conditions may have been produced, which may explain why the effect of food advert exposure was not replicated here. If this character is more closely associated with toy products than food, but still holds partial promotional influence to unhealthy food products, then this is a speculative explanation of the significant effect of control advert condition. These factors may go some way in partially explaining why there was a significant effect of control advert found in this sample. In future, studies could be replicated using a lesser known, gender-neutral cartoon, in which characters are not utilised in the promotion of foods or any other brands or products. This would allow for the examination of whether this effect of control adverts still holds. Alternatively, in light of research as stated above, a different task could be used in place of television viewing (i.e., a colouring task or game), although demand characteristics would be compromised due to less naturalistic advert exposure stimuli.

In all, warnings did not reduce children's consumption of unhealthy snack foods and may be ineffective at negating the harmful effect of television food advertising on children's food intake. Increased intake was displayed for the two warning groups relative to no warning although, notably, intake across all food advert groups was lower than intake after control advert exposure. This was a 96 kcal increase for health warnings groups compared

to the no warning group and an 85 kcal increase for the persuasiveness warning group compared to the no warning group. This indicates a potential harmful impact on children's food intake and is in line with research into children's media literacy; where children who were exposed to a media literacy video exhibited higher preferences for the advertised products in the video than children who were not (Chernin, 2008). Indeed, warnings have been shown to have similar unintended consequences when misunderstood, and researchers advocate caution if public health organizations or government pursue counter-advertising as a strategy to reduce the negative influence of unhealthy food marketing (Dixon, Scully, Kelly, Chapman, & Wakefield, 2014).

Results here may support the assertions of researchers in the field, who argue that it is a common misperception in the literature that "increased knowledge of nutrition, health and the persuasive intent of marketing will counteract food marketing effects" (p.223; Harris et al., 2009). Indeed, reviews into the efficacy of advertising literacy interventions have demonstrated little evidence that presenting children with advertising based knowledge is insufficient in helping children to adequately comprehend the costs and benefits associated with a persuasive message (Buijzen, Schuurman, & Bomhof, 2007). However, this is unsurprising in the context findings reported within this thesis. As demonstrated in Chapter 4, rather than connecting with children by means of rational or direct persuasion attempts, marketers go to lengths to nurture strong and lasting emotional ties with children through the use of techniques like premium offers, promotional characters and use of 'fun' appeals. Consequently, television food advertising operates on a nuanced persuasive level with affect laden messages, something that is internationally observed (B. Kelly et al., 2010b). Considering how often food adverts reply on emotional appeals, using rational and informational approaches and presentation (as described) as a defense against increased consumption behaviours are perhaps unlikely to show impact in the short-term. Undoubtedly, more research in necessary to clarify if this is a cost-effective and scalable means to convincingly restrict the power of television food marketing. It is worth assessing the value of warnings in other countries where the intake response to food advertisements has been found to be robust and replicable (i.e., in the UK; see Chapter 6).

Importantly, both the health and persuasiveness warnings were not widely understood by all children. Warnings manipulations data demonstrated that 60.5% of

children in the health warning group and 37.5% of children in the persuasiveness warning group correctly interpreted the warning as it was meant. As the health warning was based on the mandatory warnings currently used in France, this has implications for their existing use. Although this suggests that they may not be widely understood by child populations, results here cannot be generalised to French children due to SES and cultural factors. These results confirm that food marketing defense is difficult to summon and emphasises that in line with the food marketing defense model (Harris et al., 2009) which states that awareness and comprehension of the persuasive intent of food advertising is the first step to meaningful mitigation of food advertising. Chapter 8 (section 8.4.1) discusses theory and research behind this model (Harris et al., 2009).

The present study also examined whether the intake response of OW/OB children was less influenced by warnings relative to that of NW children. No significant differences were reported between OW/OB and NW children on baseline-adjusted intake. This is contrary to existing research in UK samples, where exposure to food adverts increased energy intake in all children, but the largest magnitude of increase was observed in OB children (Halford et al., 2008). Potentially, alternative indications of weight status differences (e.g., greater recognition of food adverts in OW/OB children) may have been apparent. One study found that OB children recognised a greater number, and a greater proportion, of television food advert adverts compared to control adverts (Halford et al., 2007). Thus, this could be measured in a similar sample of Brazilian children in future research to see if weight status differences are implicated in the effectiveness of warnings. Notably, due to the nature of television broadcasting, warnings cannot be tailored to target individuals with higher BMIs. However, such tailored approaches to warning exposure within specific sub-groups may have more applicability in online forms of HFSS marketing, where targeted advertising exists based on demographic factors. Thus future research could explore the applicability of tailored warnings in other forms of food marketing (e.g., online pop-up warnings or messages).

No significant differences were found in BMI SD score between the high and low television viewing groups and there were no significant differences in intake across these groups. These results differ from existing research where BMI SD score was significantly higher in a high television viewing group than in a low television viewing group (Boyland et

al., 2011). The study by Boyland (2011) revealed that high television viewers selected significantly more branded and non-branded food items than the low television viewers. In contrast, the present study found that previous exposure to food advertising did not play a role in determining children's responsiveness to advertising messages in this particular sample. In terms of habitual media exposure, children in the sample watched a mean of 5 hours of television per day, higher than reported in a study of Brazilian children, where self-reported data averaged at 3 hours for children's daily television viewing (Costa et al., 2012). Differences in findings might be due to a wider age range being used by Costa and colleagues (7-15 years) or potential recall inaccuracies in this sample. However, this demonstrates the potential utility of future research to explore whether or not the impact of warnings is heightened with repeated exposure over weeks or months. It could be that long-term exposure to the proposed warnings, adapted to naturalistic televised exposure within home settings, may have a demonstrable impact considering such high levels of daily television exposure reported. Crucially, this study investigated the immediate impact of one warning exposure session. The omnipresent status of the current food marketing environment allows for repetitive, engaging and reinforced marketing messages via multiple avenues. Therefore, to compete with these ubiquitous promotions, textual warnings may necessitate multiple, longer-term exposure to allow children to generate and build up cognitive defense over time.

To conclude, it is critical to fully investigate the available routes to meaningfully reduce the impact of television food advertising at an environmental level across varying cultures. Although a main effect of food advert exposure was not found in the present study, results imply that in this population, the utility of generating health and persuasiveness awareness before, during and after television food adverts is not an effective strategy to mitigate the damaging effects of food promotion on children's unhealthy food intake. Results here may indicate that statutory legislation remains the only worthwhile and cost-effective route to limiting children's exposure to unhealthy television food advertising in Brazil, and worldwide. Efforts in counter advertising (i.e., messages challenging industry marketing) show successes in smoking prevention, however this public health measure was introduced in conjunction with taxes, reductions in marketing and changes in indoor smoking law (Wisotzky, Albuquerque, Pechacek, & Park, 2004).

Therefore, the introduction of television food advert warnings would unequivocally necessitate wider policy efforts to help support this strategy, to lead to any meaningful improvements in child health. As noted in a recent report, asking consumers, especially children, to defend against food marketing places a huge burden onto the individual (C. a Roberto, 2014) and when used isolation, may even lead to negative outcomes on food choice and consumption. Other means to protect against television food adverts are hence required, and this is likely to involve a multi-pronged approach that includes, but not it confined to, regulation of television marketing.

Chapter 6. Do television food adverts increase eating in the absence of hunger behaviours in children?

6.1 Introduction

As discussed in this thesis thus far; energy-dense foods are heavily marketed on television (see Chapter 3) with increasingly sophisticated and powerful techniques (see Chapter 4), via progressively broader avenues (see Chapter 1, section 1.3.1.3 for a brief summary of the food marketing literature). Evidence implies that unhealthy food marketing is contributing to the current high levels of childhood obesity globally (G. Cairns et al., 2013; M. Ng et al., 2014) and a well-established literature documents the impact of food advertising on children's consumption (Boyland et al., 2016). However, studies measuring the impact of food advertising on specific appetitive behavioural traits are currently absent from this established literature.

There is increasing recognition that variations in adiposity are the consequence of interactions between individual susceptibility and exposure to the obesogenic environment (Hill, Wyatt, Reed, Peters, 2003). Alongside biological mechanisms, behavioural processes may constitute an important level of individual vulnerability to such influences (Blundell & Gillett, 2001) and as such, measurement of behavioural traits help to ascertain if they may confer susceptibility to the obesogenic environment. As food marketing is one of the key characteristics of an obesogenic environment, it is important to understand if eating or susceptibility to eating in response to food adverts is a discrete behavioural trait. Therefore, the present chapter aims to manipulate children's physiological state (i.e., hunger levels) to explore the role of televised food promotion on children's food intake in the absence of hunger. No studies yet consider whether this may be facilitated by exposure to HFSS television advertising; a considerable research gap as distinguished by a recent review of the existing eating in the absence of hunger (EAH) literature (Lansigan, Emond, & Gilbert-Diamond, 2015). Gaining an understanding of individual risk factors which may prompt EAH behaviours in children as a result of food promotion is crucial from a childhood obesity prevention and policy perspective. This introduction will continue by outlining existing research into EAH and individual differences found. Other evidence bases linked to EAH and

its relationship with food promotion (i.e., the food-cue literature and disinhibition) will also be summarised.

6.1.1 Eating in the Absence of Hunger

EAH is a term used to describe a behavioural trait which refers to children's susceptibility to eating when sated, and was first coined by Fisher and Birch (1999). In a laboratory setting, Fisher and Birch aimed to explore young children's (aged 3-5 years) post-meal intake of snack foods that were made freely available. They provided an *ad-libitum* meal to children until they self-reported that they were full (preload phase), after which children had the opportunity to eat snacks while playing with toys for 10 minutes without supervision (free access phase; Fisher and Birch, 1999). Snacks were weighed before and after *ad-libitum* consumption to measure each child's caloric intake from these foods. The design of this paradigm allows EAH to be easily operationalised and has since been used widely and replicated in laboratory settings. A recent review of studies following this 'gold standard' EAH experimental design found 19 eligible for inclusion (Lansigan et al., 2015), where studies were limited to children aged 3-12 years. Of these 19 studies, twelve were cross-sectional, six prospective cohorts, and one was a behavioural intervention study. The majority (N = 15) of studies reviewed operationalized EAH as the total amount of intake in kcals (Birch & Fisher, 2000; Birch et al., 2003; Boutelle et al., 2011; Butte et al., 2007; Cutting et al., 1999; Faith et al., 2006; Fisher & Birch, 1999, 2002; Fisher et al., 2007; Francis & Birch, 2005; Francis, Ventura, Marini, & Birch, 2007; Hill et al., 2008; Kral et al., 2012; Moens & Braet, 2007; Shunk & Birch, 2004), while in three studies EAH was operationalised in grams of food consumed (Blissett et al., 2010; Wardle, Guthrie, Sanderson, Birch, & Plomin, 2001; Wardle, Llewellyn, Sanderson, & Plomin, 2009).

Two of these studies which hold particular relevance to the current study will now be briefly discussed. One study with a similar age range to the present study (aged 7-13 years; n=52) used a typical family dinner as the pre-load, and provided 10 sweet and savoury snack foods to measure *ad-libitum* EAH (Moens & Braet, 2007). It was found that overweight boys engaged in twice as much EAH as normal weight (NW) boys and a significantly larger percentage of NW girls engaged in EAH than overweight (OW) girls (see section 6.1.2.2 for more discussion of research into EAH and gender). A further study

examined two treatments targeted at reducing EAH in overweight and obese (OW/OB) children (n=36) aged 8-12 years (Boutelle et al., 2011). Parents of participants were randomly allocated to an 8-week children's appetite awareness training or cue exposure treatment. Assessments (including the EAH paradigm, height and weight measurements and three 24 hour dietary recalls) were conducted at baseline, post-treatment, and at 6 and 12 months post-treatment. It was found that participants who had received the food cue exposure treatment showed significant decreases in EAH immediately post-treatment and 6 months post-treatment, but children in the appetite awareness training showed no change in EAH behaviours across the duration of the study. However, neither treatment produced significant effects on caloric intake (as measured by three dietary recalls) in children. This research demonstrates that training has the potential to be efficacious for reducing EAH and binge eating in children. Although EAH behaviours may be malleable, this is a very time intensive route and produces mixed findings. These two studies were selected out of the wider literature for discussion as, in contrast to the majority of studies measuring EAH in a laboratory environment, they explored EAH and the efficacy of interventions targeting the reduction of EAH behaviours in naturalistic settings with a similar age range to that used in the current study. The present research also aims to explore EAH in an externally valid setting to address weakness in the existing EAH literature (Lansigan et al., 2015).

Although the current study will be focusing on observable individual differences (e.g., age, gender) and their relationship with EAH, it is worth briefly noting here that there is also some (limited) evidence to suggest a genetic basis for EAH, which may confound the role of other factors. One study specifically compared EAH across variations in the FTO SNP rs9939609 (the first gene identified to be associated with 'common' obesity; Dina et al., 2007; Scuteri et al., 2007). Faith et al., (2006) provided evidence that EAH behaviour may be a genetically loaded eating phenotype which may promote positive energy balance. The study found that 5 year old boys who were born at high risk for obesity (determined on the basis of maternal prepregnancy body weight) consumed over twice the energy in EAH as boys born low risk for obesity. Authors posit that obesity risk and EAH behaviours were unrelated in girls suggesting that variability in the trait may be less genetically loaded and more susceptible to environmental factors (Faith et al., 2006). Studies have however sought to explore the numerous individual characteristics which may influence EAH behaviours,

including children's race/ethnicity, affect, genotype, and parental adiposity, disinhibited eating style and feeding restriction (Lansigan et al., 2015). A reasonable body of evidence now exists to show that these factors may be important determinants of EAH, but no one has yet studied these in relation to food advertising and EAH before. It is important to understand the evidence to date of their link with EAH before exploring the interrelationship between them (e.g., age, EAH and advert exposure). Therefore, I will now summarise the literature regarding children's weight status, age and gender in relation to EAH.

6.1.2 EAH and children's weight status

In their review, Lansigan and colleagues (2015) report consistent evidence for a positive association between EAH and increased weight status, where OW/OB children engaged in greater levels of EAH than NW children in several cross-sectional studies (Birch & Fisher, 2000; Cutting, Fisher, Grimm-Thomas, & Birch, 1999; Fisher, Cai, Jaramillo, Cole, Comuzzie, Butte, 2007; Hill et al., 2008; Kral et al., 2012; Moens & Braet, 2007). However, two studies reported an inverse association in overweight girls, such that they engaged in fewer EAH behaviours compared to NW girls (C. Hill et al., 2008; Moens & Braet, 2007). Both studies recruited older children where in one, children were videotaped in a home setting (Moens & Braet, 2007) and the other was conducted in a school environment (C. Hill et al., 2008). One explanation for the unusual findings is that the overweight pre-adolescent girls restrained from EAH in settings where they were potentially being observed by peers or others.

Increased weight status was also positively correlated to levels of EAH over time in prospective studies (Birch, Fisher, & Davison, 2003; Butte et al., 2007; Fisher & Birch, 2002; Francis & Birch, 2005; Francis, Ventura, Marini, & Birch, 2007; Shunk & Birch, 2004). Butte et al. (2007) investigated a large sample of Hispanic-American children and found that EAH was significantly predictive of weight gain one year later, but interestingly, was no longer significant when child baseline BMI was included in the model. Prospective studies also support a positive association between greater weight and EAH. Greater weight was positively associated with greater EAH over time, amongst girls in a series of studies of 197 parent-daughter dyads (Birch et al., 2003; Fisher & Birch, 2002; Francis & Birch, 2005; Shunk

& Birch, 2004). In sum, of all the empirical evidence into EAH to date, the most consistent finding is the support for increased levels of EAH among OW/OB versus NW children (Lansigan et al., 2015). Thus, it is feasible that one explanation for the weight status differences reported in response to food advert exposure (Halford et al., 2008) is that OW/OB children are more likely to EAH; the presence of EAH arguably being a response to an external cue to consume, as described in Schachter's externality theory of obesity (Schachter, 1971), which will be discussed in further depth below. Fundamentally, food marketing aims to provide salient cues that accompany foods and beverages to promote the repeated purchase of advertised products. These cues that accompany food can be conditioned in vulnerable individuals through pavlovian conditioning to elicit a physiological response (Bouton, 2011). Therefore, it is plausible to suggest that when sated, OW/OB children may be impacted by food promotion to display greater EAH behaviours than their NW peers.

6.1.3 EAH and children's age

Age has also been explored in relation to EAH, where cross-sectional studies propose that EAH behaviours may occur in children from as young as 3 years. The majority of studies in the literature test children aged 3-6 years. In a recent review, only four studies included older children (up until the age of 18 years; Lansigan et al., 2015). One of these four studies investigated Hispanic children aged 5-18 years (Fisher et al., 2007), reporting that EAH was significantly greater among older children compared to 5 year olds, levelling off at age 13. Therefore, the literature to date suggests that EAH is likely to be present among children as young as 3 years and displays increases with age, at least until age 13. Age differences in the EAH-food promotion intake response relationship will be investigated in the current research. By recruiting children aged 7-11, we can capture the middle range of EAH behaviours to observe any apparent age differences. Thus, children's weight status, and age are both implicated in EAH behaviours. It is plausible to consider that the mechanisms underlying EAH may involve food-cue reactivity (the increase in sensitivity to external cues to eat) and disinhibition (loss of inhibition through influence of external stimuli), therefore these literatures will now be briefly summarised.

6.1.4 Food-cue reactivity

A literature pertinent to the current chapter considers research into environmental food stimuli (i.e., food-cues). The food-cue literature maintains that individuals with less capacity for behavioural inhibition are more likely to react to external cues, such as food marketing. Food-cue exposure influences both momentary desire for food (Fedoroff, Polivy, & Herman, 1997) and our preparedness to consume it (Brunstrom, Yates, & Witcomb, 2004). The potential role of attentional bias for food-cues in obesity was first identified by Schacter (1971). Schacter's (1971) externality theory purports that OW/OB individuals are hypersensitive to, and more efficient information processors of, environmental food stimuli than NW individuals. More recent research has established a dual process model with two higher-order processes implicated in the modulation of behaviours such as i) an attentional bias towards foods cues and ii) a deficit in self-control (i.e., disinhibition, see section 6.1.5) leading to an inability to resist tempting foods (Graham, Hoover, Ceballos, & Komogortsev, 2011; Werthmann et al., 2011).

As a consequence of the associations between external food-cues and food consumption, conditioned stimuli come to elicit activation of a central appetitive state, resulting in eating behaviours (Jansen, 1998). This intensified responsiveness to external food-cues that predict food consumption (known as food-cue reactivity) is posited as one of the potential mechanisms promoting overeating behaviours (e.g., EAH) and may facilitate weight gain in some adults (Yokum, Ng, & Stice, 2011) and in children (Jansen, Theunissen, Slechten, Nederkoorn, Boon, Mulkens, & Roefs, 2003). Data from Jansen and colleagues (2003) illustrate that OW children do not regulate their food intake like NW children do and are more vulnerable to the triggers of overeating. Moreover, fMRI research exposing NW and OB children to food and non-food logos found that OB children showed significantly less brain activation to food logos in the bilateral middle/inferior prefrontal cortex, an area involved in cognitive control (Bruce et al., 2013). Intrinsic to food advertising as a form of food-cue is that it typically focuses on the immediate sensory pleasures of consumption (i.e., appetitive features), which makes resistance to such promotional messages even more demanding on the rational process of self-restraint (Loewenstein, 1996) especially in OW/OB children. As such, it is proposed that palatable food stimuli can trigger 'hedonic

hunder' defined as "thoughts, feelings and urges about food in the absence of energy deficits" (p.433; Lowe & Butryn, 2007). Thus, it remains crucial to continue to explore the impact of television food advertisements on children's food choices because food choices as a response to food-cues are considered to be one of the most important environmental instigators of the obesity crisis (Rosenheck, 2008).

6.1.5 Disinhibition

Together with food-cue reactivity, disinhibition is the second process implicated in reward-driven 'hedonic feeding' (Appelhans, 2009). Disinhibition is defined as the loss of cognitive self-control over eating in response to external or emotional stimuli (Lindroos et al., 1997). In terms of understanding of the mechanisms of EAH, research purports that EAH is a form of disinhibited eating (Arnold, Johnston, Lee, & Garza, 2015) and that EAH in children shares behavioural characteristics with disinhibition in adults (Kral & Faith, 2009). There is consistent evidence that a disinhibited eating pattern differentiates OB and non-OB adults; where obese individuals display greater disinhibition than non-OB individuals (Westenhoefer, Stunkard, & Pudel, 1999). Moreover, disinhibition has been found to be associated with body fat (Provencher, Drapeau, Tremblay, Després, & Lemieux, 2003), energy intake (Lawson et al., 1995) and binge eating (Howard & Porzelius, 1999) in adults. Thus, to summarise, EAH in childhood may be a behavioural precursor to disinhibited eating in adulthood, which implies the importance of EAH as an early behavioural risk factor for obesity onset.

Research has yet to explore the relationship between EAH and food marketing (a form of food-cue), to measure the impact of food advertising on established eating characters observed in children. A better understanding of the extent to which food advertising influences EAH behaviours is needed, and this is the purpose of the current study.

6.1.6 Aims

The present study aimed to examine the potential association between food and beverage advertising and EAH among children, as evidence shows that acute exposure to food advertising increases food intake in children (Emma J Boyland et al., 2016) and also

demonstrates the role of food-cues in promoting EAH behaviours (Lansigan et al., 2015). This novel study aimed to provide further insight into television food advertising to investigate the interaction with individual eating behaviours, in order that this may help explain differences in intake response to food advertising that has previously been observed between OW/OB and NW children (Halford et al., 2008). The current study also aimed to address a weakness of the existing EAH literature (Lansigan et al., 2015) by exploring EAH in an externally valid school-setting where primary school children routinely consume their lunches in groups; in contrast to the majority of previous literature testing children in isolation in university labs.

6.1.7 Hypotheses

Based on previous research as discussed, it was hypothesised that

H1: There will be an increase in food intake in the experimental condition (food adverts) relative to the control condition (toy adverts) in all children.

H2: For OW/OB children, this increase in intake will be of a greater magnitude than for the NW children.

H3: When sated, OW/OB children will still respond to the food adverts by increasing their intake (relative to following the toy adverts) but NW children will not.

H4: When sated, older children will still respond to the food adverts by increasing their intake (relative to following the toy adverts) but younger children will not.

6.2 Method

6.2.1 Recruitment and ethics

Ethical approval for the study was provided by the Institute of Psychology, Health and Society (IPHS) Research Ethics Committee (Ref: PSYC08090066) in 2009 and then extended to cover the present researcher (see Appendix 6a). Participants for this study were recruited from three primary schools in the North West. Informed consent was obtained from the school Head teacher, the parents and consent was required from the children themselves. Parents of potential participants for the study were sent home study information (see Appendix 6c) and were asked to sign and return a slip at the bottom of the letter if they were happy for their child to participate in the study. In small groups, children were talked through the procedure by the researchers before being asked verbally whether or not they wished to take part. Their response was recorded by the researchers and those who did not wish to take part were given alternative tasks to complete by the teachers.

6.2.2 Participants

Data were collected between February 2013 and May 2014. A total of 148 participants aged 7-11 years (Mean=9.06; SD=1.20) completed both conditions of the study. The age range is consistent with previous studies of the effects of TV food advertising on children's food intake (Anschutz, Engels, & Van Strien, 2009; Halford, Gillespie, Brown, Pontin, & Dovey, 2004). Children of this age with any food allergies (as confirmed by parents) were excluded from study participation.

6.2.3 Design

This study employed a 2x2x2x2 fully randomised, counterbalanced mixed factorial design. Children were fully randomised to hunger groups and the order of advert condition (food advert exposure and control advert exposure) was counterbalanced. There were two between-subjects independent variables, each with two levels: i) hunger state (hungry or sated) and ii) weight status (NW or OW/OB). Children in the hungry condition were tested right before lunch and children in the sated condition were tested directly after the lunchtime break. A single measure of hunger (5 point scale) was taken on each of the test

days (test days 1 and 2), to ensure that this natural manipulation was successful. There was one within-subjects independent variable of advert type, with two factors i) food (experimental) or ii) toy (control). The dependent variable was total food intake and intake from specific food groups; measured in both grams and kilocalories (kcal). A two-week interval between advert conditions (control and experimental) was enforced in order to minimize the likelihood that participants would recall their responses from the first session and to reduce the likelihood of demand characteristics. Television advertisements, and the programme in which they were embedded, were recorded from popular children's and family programming in the UK in 2010 (see Chapter 2). The products featured in the selected advertisements for each condition are displayed in Table 1. Each commercial was <30 seconds long and the total advertising exposure for each condition was approximately five minutes. Attempts were made to balance the number of male and female oriented adverts for both the experimental and control adverts, and neutral adverts were also included. In each condition, the adverts were followed immediately by an identical cartoon ensuring that only the advertising content varied between conditions. Following advert exposure, participants' *ad-libitum* intake of 6 different snack foods was measured (as detailed below).

Order	Food Adverts	Toy Adverts
1	Aero Biscuits	Angry Birds Splat Strike
2	Chocolate Cheerios (cereal)	Bratzillaz
3	Coco Pops Moon & Stars (cereal)	Build-a-Bear Workshop
4	Fruit Pastilles (sweets)	Buzz Lightyear
5	Haribo Tangfastic (sweets)	Disney Fairies
6	KFC (fast food)	JCB Multi Construct
7	Burger King (fast food)	Leli Kelly Shoes
8	Oreos (biscuits)	Freaky Forms Deluxe for 3DS
9	Snickers (chocolate bar)	Play Doh Candy Cyclone
10	Starburst (sweets)	Spiderman Web Shooter

Table 6-1. Experimental and control adverts. *Note. Adverts listed in order of appearance on DVD.*

6.2.4 Procedure

Depending on what group children were randomly allocated to (hungry vs sated), children were either tested at approximately 11:30 am before the lunch break (hungry), or at 1:10pm after the lunchtime break (sated) and were tested at the same time on each occasion (1 and 2). During the first test day, children were provided with a child-friendly study information sheet which was read out loud by a study assistant. Standardised instructions were read to

the children before commencement of the study. All children were shown a DVD in small groups of no more than six. The DVD was projected onto a large screen. In the control condition, participants viewed the 10 toy adverts followed by a cartoon. For the experimental condition, participants viewed the DVD containing the food adverts. All participants completed both conditions (with the aforementioned two-week interval between sessions).

Immediately after viewing on both occasions, children were asked to complete a measure of hunger using a five point scale (see Appendix 5g). Next, children were presented with identical amounts of six different every day snack foods and had 10 minutes to eat as much or as little as they liked. The study foods used were selected to be approximately equivalent to those used in Halford et al (2004). The foods were 66g Cadbury's chocolate buttons, (high fat sweet), 26g Walker's Ready Salted crisps (high fat savoury), 27g Snack-a-Jacks salt and vinegar rice cakes (low fat savoury), 6 McVitie's Jaffa Cakes (low fat sweet), 110g carrot sticks (vegetable) and 155g grapes (fruit). Food was weighed using a set of food scales and was served on identical trays in individual, identical bowls. Children were instructed to let the researchers know if they ran out of foods and were told not to share, only eating from their designated tray. For each participant, the six bowls were weighed individually before and after the eating opportunity to ascertain consumption (after participants had left the area). This gram weight was later converted into kcal using manufacturer nutrition information for each food item.

The final task on the two occasions differed; on the second test day, measures of height were recorded to the nearest 0.1cm using a stadiometer (SECA Leicester Portable Height Measure) and weight was measured to the nearest 0.1 kg with a recently calibrated digital weighing scale (SECA 770). BMI was converted to an age and gender appropriate SD score using WHO AnthroPlus software (which uses WHO 2007 growth reference data for 5-19 year olds; WHO, 2011). After all participants had completed the study, an age-appropriate verbal debrief was delivered, which disclosed the aims of the study and any questions were answered.

6.2.5 Statistical analysis

6.2.5.1 Assumption checking

Data analysis was conducted using SPSS version 20 (SPSS Inc., Chicago, US). To check for normality, a Shapiro-Wilks test was conducted across BMI groups (NW and OW/OB) and conditions (hungry/sated). Food intake was normally distributed for each combination of the four groups. Significant outliers (defined as a Z-score outside the range of -3 to +3) were removed (n=2). There was homogeneity of variance, as assessed by Levene's test ($p > .05$) in the within-subjects data. A 2x2x2x2 mixed analysis of variance (ANOVA) and independent groups *t*-tests were conducted to examine differences in food intake (kcal). Significance was taken at $p<0.05$. Data handling occurred in calculations of participant's intake (grams were converted to kcals using a formula in excel). A median split was calculated to determine age groups.

6.3 Results

Table 2 shows the gender, mean age, BMI, BMI z-score, weight status category and food intake (kcal) for the hungry and sated conditions. The standard deviations show that all groups had similar levels of variability and no between-group differences were observed in these variables indicating that the groups were well matched.

	Hungry (n=74)	Sated (n=74)	P value
Gender (n)	41 M 33 F	42 M 32 F	0.870
Age (years)	9.19 (± 1.24)	8.93 (±1.16)	0.175
BMI (kg/m^2)	17.36	17.81	0.356
BMI z-score	0.37	0.57	0.311
Weight status	62 NW 12 OW/OB	56 NW 18 OW/OB	0.223

Table 6-2. Demographic information for participants randomised to the hungry and sated conditions.

To assess the effectiveness of the hunger manipulation, hunger scores across the hungry and sated groups were assessed (see Table 6-3). Children randomly allocated to the hungry group rated themselves on average 4.26/5 for hunger, falling between the 'Quite hungry' and 'Hungry' rating. Children assigned to the sated condition on average rated themselves as 3/5 for hunger falling into the 'Not hungry or full' rating. The children in the two hunger conditions differed significantly in self-reported hunger at testing times one [$t(146) = 6.664$, $p=0.000$], and two [$t(146) = 7.979$, $p=0.000$] indicating that the manipulation was successful. Whilst the hungry group weren't reporting substantial hunger, there was a significantly different motivation to eat across the two groups.

Hunger State		Mean score	Std. Deviation	Overall mean
Hungry (n=74)	Hunger measure 1	4.16	0.92	4.26
	Hunger measure 2	4.35	0.77	
Sated (n=74)	Hunger measure 1	2.97	1.22	3
	Hunger measure 2	3.03	1.21	

Table 6-3. Mean hunger scores across all participants in the hungry and sated conditions (1 = Full, 1= Quite full, 3 = Not hungry or full, 4 = Quite Hungry, 5 = Hungry).

H1: There will be an increase in food intake after the experimental condition (food adverts) as opposed to the control condition (toy adverts) in all children.

A 2 (hungry versus sated) x 2 (NW versus OW/OB) x 2 (younger children versus older children) x 2 (food advert versus control advert) mixed ANOVA was conducted with three between subjects factors (hunger condition, weight status and age group) and one within subjects condition (advert exposure condition) to address all hypotheses. There was a significant main effect of advert type on intake (kcal) across all children [$F(1, 140) = 4.781$, $p=.030$, $\eta p^2= .033$]. Mean kcal intake following the food advert exposure was 657.6 kcal, an increase of 30.9 kcal intake compared to the mean intake following control advert exposure (626.7kcal) irrespective of physiological state.

H2: For OW/OB children, this increase in intake will be of a greater magnitude than for the NW weight children.

Results found a significant main effect of weight status group [$F(1, 140) = 6.840$, $p=.010$, $\eta p^2=.047$], where OW/OB participants displayed higher intake than NW participants across both advert conditions. NW participants displayed a mean intake of 601.4 kcal across both advert conditions whereas OW/OB participants displayed a mean intake of 682.9 kcal (a difference of 81.5 kcal). No significant interaction was found between weight status group and advert condition [$F (1,140) = .174$, $p=.677$, $\eta p^2 = .001$]. However, means show that NW participants increased their kcal intake by 25.02 kcal in the food advert exposure (relative to control advert exposure) and OW/OB participants increased their intake by 36.82 kcal following food advert exposure (relative to control advert exposure; see Figure 1 for

means). Therefore, both weight status groups performed similarly to each other (i.e., increased caloric intake to a similar extent) after food advert exposure relative to control advert exposure). Hypothesis 2 is therefore partially supported as OW/OB children displayed increased intake following food advert exposure (relative to control advert exposure). However, NW children also increased their intake, but that increase was of a smaller, although not significantly smaller, magnitude.

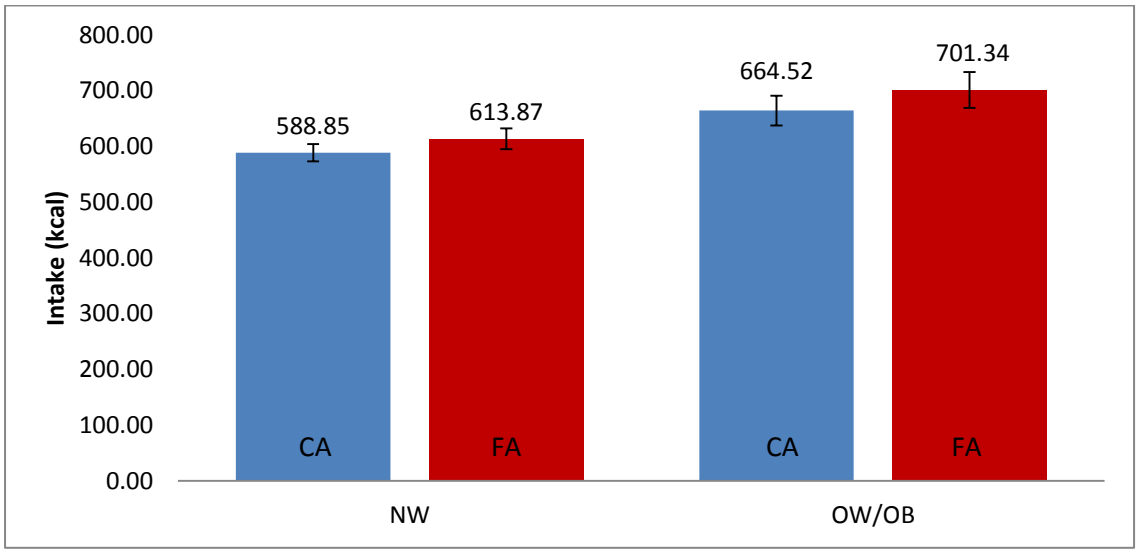

Figure 6-1. Mean intake (kcal) for NW and OW/OB children after food advert and control advert exposure.

H3: When sated, OW/OB children will still respond to the food adverts by increasing their intake (relative to following control advert exposure)

Results found no significant main effect of hunger group [$F(1, 140) = .651$, $p=.421$, $\eta p^2=.005$] and no significant interaction between hunger group and advert condition [$F(1, 140) = 1.034$, $p=.311$, $\eta p^2=.007$]. Means show that participants in the hungry group ate 25.17 kcal more (654.73 kcal) than participants in the sated group (629.56 kcal) across both advert conditions. When split across advert condition, mean difference in intake were larger in the sated group (+45.31 kcal) following food advert exposure (relative to control advert exposure) than mean difference in the hungry group (+16.55 kcal). Figure 2 displays mean intake across advert condition for both hunger groups.

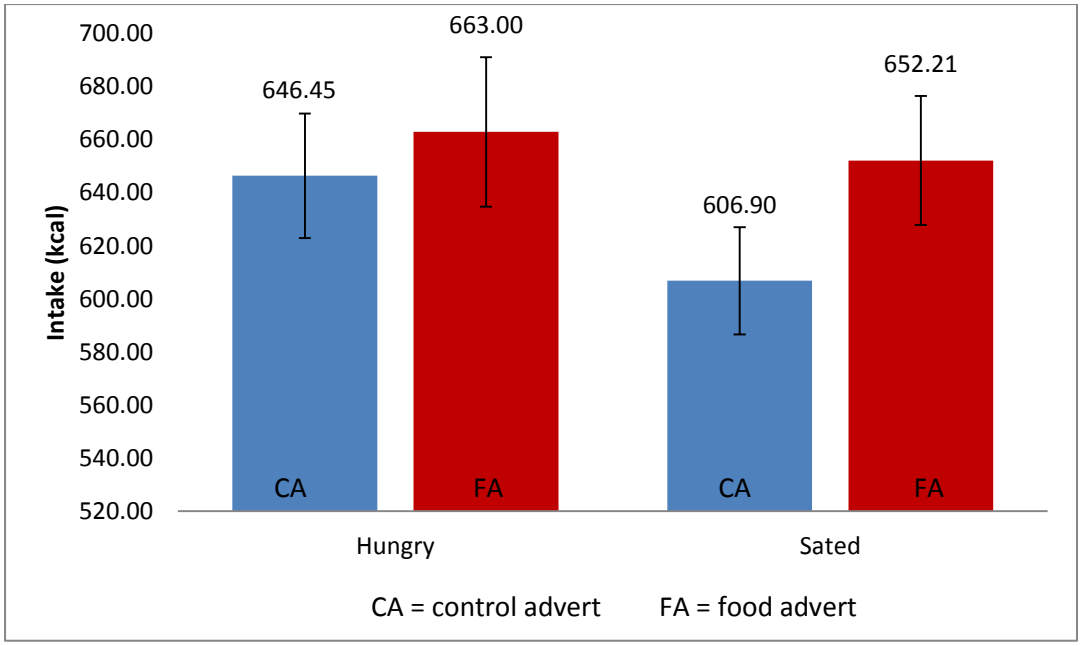

Figure 6-2. Mean intake (Kcal) following advert exposure across hungry and sated groups.

No significant interaction was found between advert condition, weight status group and hunger group [F(1, 140) = .028, p=.869, ηp2=.001]. However, means displayed in Figure 3 illustrate that OW/OB children in the sated condition showed the largest increase in intake following exposure to food adverts, relative to control adverts (+58.04 kcal). Therefore, H3 is partially supported.

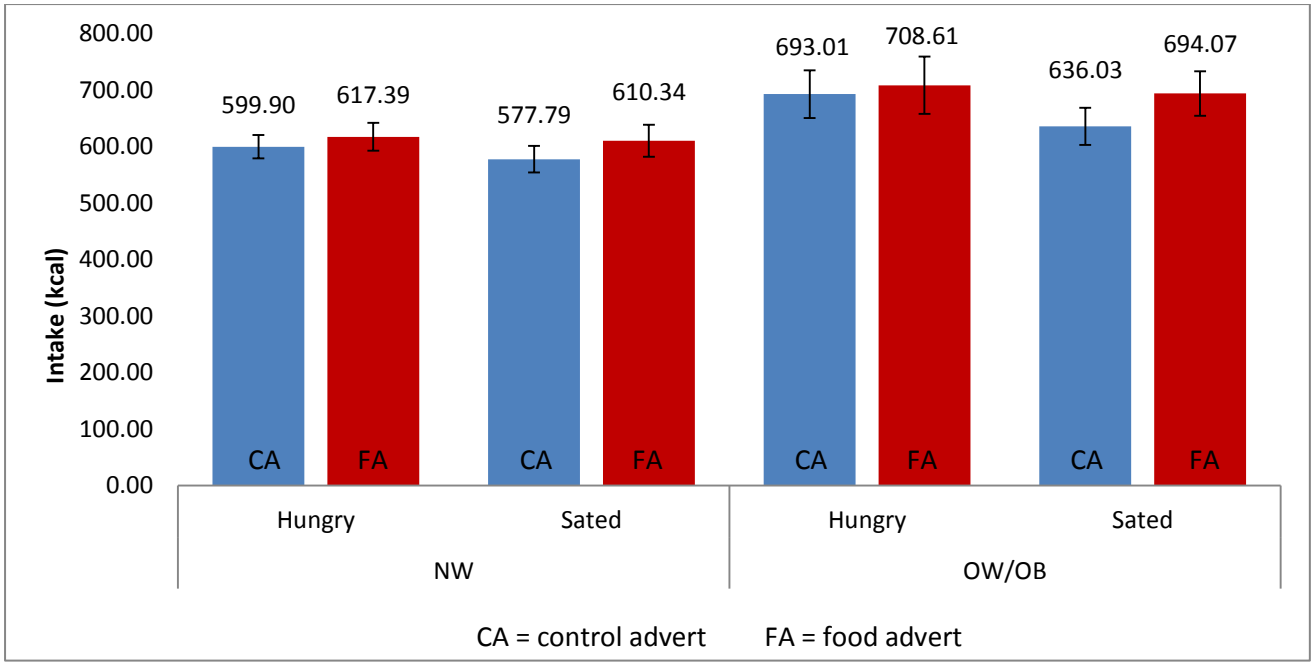

Figure 6-3. Mean intake (kcal) following advert exposure across hunger conditions in NW and OW/OB participants.

H4: Older children will display more EAH behaviours than younger children after exposure to food adverts

Results found a significant main effect of age group [F(1, 140) = 3.905, p=.027, ηp2=.027] and a significant interaction between age group and advert condition [F(1, 140) = 4.470, p=.031, ηp2=.007]. However no significant interaction was found between age group, hunger group and advert condition [F(1, 140) = .000, p=.990, ηp2=.000]. Therefore H4 is unsupported (means displayed in Figure 4).

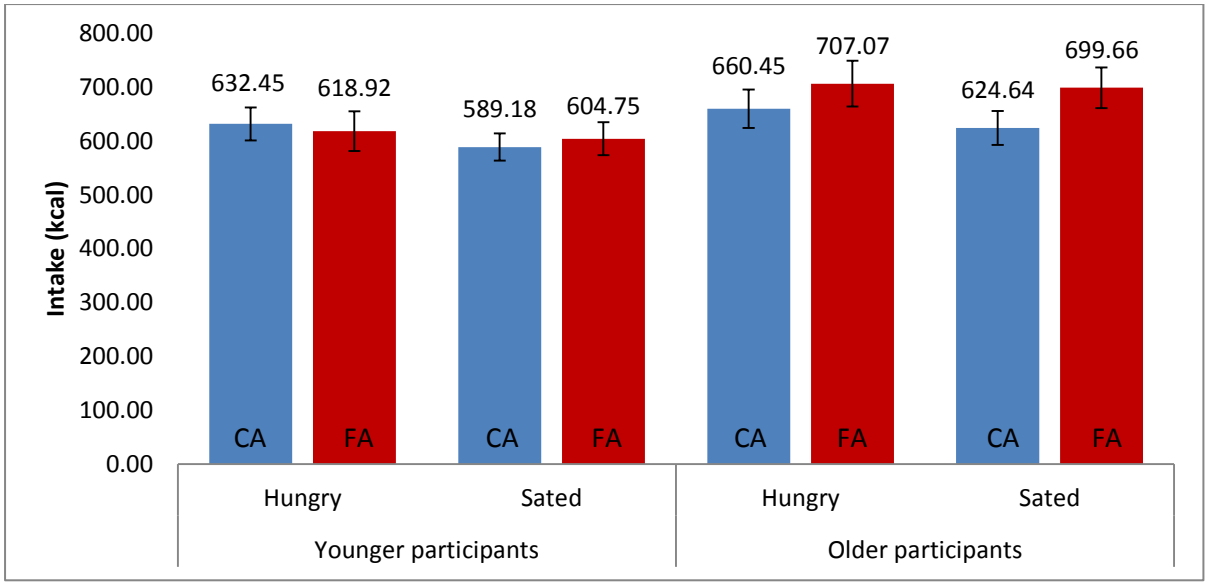

Figure 6-4. Mean intake (kcal) following advert exposure across hunger conditions in younger and older participants.

However, to follow up the significant interaction found, independent samples *t*-tests were conducted. Age groups did not differ on intake in the control condition [t(146) = -1.103, *p*=.272], but analysis revealed a significant difference in intake response between age groups in the food advert condition [t(146) = -2.578, *p* = .011]. Older children displayed a greater difference in kcal intake between the food advert and control advert exposure, consuming 82.84 kcals more following the food advert exposure relative to the control advert exposure.

6.4 Discussion

To our knowledge, this is the first study to explore the impact of food promotion on EAH. EAH was operationalised as an *ad-libitum* eating opportunity after children had been exposed to television food adverts across two distinct groups based on motivational state (hungry vs sated). The present section will start with a discussion of the broader findings from the data before then exploring the findings relating to the EAH elements of the study.

Results show an overall main effect of food advert exposure, such that it increased food intake across all participants in both the hungry and sated groups by approximately 31 kcal, compared to the control advert condition. Increased caloric intake was observed in both NW children (approximately 25 kcal) and OW/OB children (approximately 37 kcal) after food advert exposure relative to control advert exposure. This significant finding supports previous data in the literature in children aged 5-7 years (Halford, Boyland, Hughes, Oliveira, & Dovey, 2007), although notably, the magnitude of increase in intake was higher for both groups in the Halford study (112 kcal and 97 kcal, respectively). Although the mean kcal intake figures reported here for NW and OW/OB children are lower than previously found in other research (Halford et al., 2007), potentially due to the function of collapsing the OW and OB groups together, the cumulative impact of such eating behaviours (i.e., additional caloric intake after multiple meals in one day) may contribute to excess weight in children over time (C. Hill et al., 2008). As introduced in Chapter 1 section 1.3.1.3, modern food marketing is repetitious and multi-platformed, therefore small increases replicated across multiple exposures occurring over the course of a lifetime may lead to the amplification of effects (Emma J Boyland et al., 2016).

The present research also found weight status differences in both advert conditions. OW/OB children consumed significantly more energy than NW children following both control advert exposure (approximately 76 kcal more) and food advert exposure (approximately 87 kcal more). This parallels recent research with OW/OB siblings who, on average, consumed 93 more calories than their NW siblings did during an EAH protocol (Kral et al., 2012), albeit on that occasion without the presence of food promotion. However,

there was no significant interaction found between weight status and advert condition in the current study.

Therefore, both weight status groups increased their caloric intake to a similar degree in response to food advert exposure relative to control advert exposure. However, when looking at means, the OW/OB participants did this to a greater extent than NW children, in line with previous research into television food adverts (Halford et al., 2008). Indeed, following food advert exposure, OW/OB children in the sated group increased their intake by approximately 58 kcal compared to control advert exposure whereas for NW children in the sated group the increase between advert conditions was 33 kcal. Findings here demonstrate that although all children displayed substantial EAH behaviours, OW/OB children appear more responsive to environmental, hedonic food cues and react with an increased kcal intake following exposure to television food advertising, even when sated in a naturalistic environment. A recent intervention study demonstrated that eight weekly sessions built up self-efficacy in children to help avoid consuming foods in the absence of hunger as a response to food-cues (Boutelle et al., 2011). Therefore, studies provide promise that behavioural training of this type may help to reduce EAH in OW/OB children.

In the sated condition, participants consumed approximately 607 kcal after exposure to control adverts and 652 kcal after exposure to food adverts. This kcal intake response is considerably higher than that found in previous EAH studies (Butte et al., 2007; Fisher & Birch, 2002; Hill et al., 2008; Kral et al., 2012). Interestingly, the majority of other studies offered 10 different types of snack foods, often providing a total of 2495 kcal (e.g., Butte et al., 2007) in the *ad-libitum* task. Due to these studies providing larger amounts and more diverse snack foods in the consumption task, it would be expected that intake would be larger in those circumstances, given the evidence shows when larger amounts are served, significantly greater amounts of food are consumed (Levitsky & Youn, 2004). An important difference in study design was that these studies placed children in individual experimental rooms in isolation for the *ad-libitum* intake task. Conversely, in the current study, participants were eating in groups of 5-6 at tables. This may have given the task a social perspective that other laboratory-based research has avoided. It could be that social norms may be encouraging children to increase their intake as a result of eating around their peers. Research demonstrates that children have been found to adjust their intake to that of a

present peer (Bevelander, Anschütz, & Engels, 2012). This social aspect of eating must be tapped into in future EAH-food promotion research for a fuller understanding of processes at play here. Indeed, eating is a social occasion for primary school aged children especially, and they may be easily influenced by their peers and caregivers (Leann L Birch et al., 2003; Cutting et al., 1999). A future study could compare one child's EAH response when tested in isolation versus EAH response found in social groups in order to explore the extent to which observing others eating in a disinhibited EAH way gives children license to over consume.

A further explanation of the heightened EAH found in this study might be that unlike laboratory based studies, the present study was required to work around existing school timetables and therefore, study sessions for the sated groups commenced after the lunchtime break (i.e., not immediately after lunch consumption, as in some lab-based research). Therefore, participants may not have been as full as in other studies, although this is a more real-world example of everyday EAH behaviours, participants in the sated condition did on average report being 3 out of 5 on the hunger scale (where 5 represented hungry). Improved training in use of the hunger scale using dolls may be appropriate in future studies for younger participants as a general consideration (Soltero, Ledoux, & Lee, 2015).

When weight status differences were analysed in the sated group, no significant interactions were found. However, OW/OB participants in the sated condition consumed a mean intake of approximately kcals (71 kcal more than NW children) representing 3.9% of a 9 year old child's (the approximate average age of children in this study) recommended daily calories per day according to NHS recommendations (1840 kcal for boys and 1721 kcal for girls; NHS, 2015). As food is almost omnipresent in children's lives and easily accessible both at home, outside of the home and often in schools where multiple snacking opportunities are available, EAH behaviours could lead to a large energy surplus, which if repeated over time, would lead to weight gain. Findings are also in line with previous research showing that OW/OB children engaged in greater levels of EAH (Birch & Fisher, 2000; Cutting, Fisher, Grimm-Thomas, & Birch, 1999; Fisher, Cai, Jaramillo, Cole, Comuzzie, Butte, 2007; Hill et al., 2008; Kral et al., 2012; Moens & Braet, 2007).

Explanations of these differences in mean intake by weight status may be explained by hormonal variances, resulting in a diminished satiety responses in OW/OB children (Klok, Jakobsdottir, & Drent, 2007). Conversely it may be that EAH are driving weight status differences; more research is needed to specifically address causality (Lansigan et al., 2015). In the sated group, food adverts may have primed EAH behaviours in OW/OB children, as described by the externality theory (Schachter, 1971). As the theory of external eating states, OW/OB children may be displaying heightened sensitivity to environmental food stimuli compared with NW children due to a more pronounced reaction to food cues translating into increased kcal intake.

A significant interaction found between age group and advert exposure in the present study indicates that younger and older children behaved differently in response to the advert exposure condition. Indeed, older children aged 9 and a half to 11 years were more influenced by the food adverts and increased their kcal intake in response to this more than the younger age group (7 to 9 and a half year olds). No interaction effect was found between age group, hunger condition and food advert condition. This is in contrast to a previous study indicating linear effects of age on EAH behaviours, reporting a 44 kcal increase with each year of age, levelling off by age 13 (Fisher, Cai, Jaramillo, Cole, Comuzzie, Butte, 2007). A difference in mean kcal intake of approximately 84 kcals was found between age groups which could lead to weight gain; especially when repeated after multiple eating opportunities throughout the day. When we consider the sated group in isolation, we found that after exposure to food adverts, older children (700 kcal) consumed approximately 95 kcal more than younger participants (605 kcal); indicating that food adverts prompted a substantial intake of excess calories in older children and not just that older children eat more per say. This age dependent response in intake when sated may be one of numerous explanations of national statistics for England which demonstrate that OW/OB increases from 1 in 5 children at the start of primary school to 1 in 3 children when children are in year 6 (the final year of primary school education (Lifestyle statistics Team, 2014b). Notably, EAH behaviours were observed in younger children as a response to food adverts, but this was a mean difference of approximately 16 more kcal in the food advert condition relative to the control advert condition compared to a mean difference of 75 kcal between advert conditions for older children. This supports a recent review which found

that EAH was observed across all age groups (Lansigan et al., 2015) but suggests that older children, who may be eating more autonomously and have their intake monitored less closely by parents, need guidance in responding to internal signals to consume.

Interestingly, in the current study, the manipulation of fullness, as self-reported by children was not very strong (in contrast to the self-reported mean hunger ratings, see Table 3.). Children reported feeling moderately hungry after their lunch, something that a published EAH study conducted within a school setting in the Netherlands also found (Nederkoorn, Dassen, Franken, Resch, & Houben, 2015). It is possible that generating stronger satiety in children may reduce the EAH behaviours reported in the present study. However, the lunch consumed by children who participated in the present study represents a typical lunchtime eating situation for children in the UK, thereby giving high external validity to the intake response after a meal results found. This represents an issue with psychological research more generally, in balancing the dual factors of experimental control and ecological validity.

A primary strength of this study is that the majority of existing EAH research has come from clinical settings (Lansigan et al., 2015), limiting our understanding of this behaviour in real-world surroundings where children routinely consume snack foods. The current study adapts the existing 'gold standard' operationalisation of the established EAH paradigm (Fisher & Birch, 1999) to a classroom setting to explore EAH behaviours within a primary school aged child's typical school day. Conducting this experiment within a classroom environment and not a laboratory allowed children to potentially be more comfortable, allowing for unregulated behaviours. Notably, children are used to consuming foods and watching DVDs regularly within school classrooms and were able to consume foods where a large portion of their daily eating experiences take place. This more ecological method may have reduced feelings of self-consciousness children may experience within laboratory setting if they detect that they are being observed (Madowitz et al., 2014), and therefore provided a more realistic insight into EAH behaviours.

For future research, it would be useful to have observers present to supervise children's consumption of lunch to help ensure that children in the sated condition had the opportunity to consume the meal to the point of satiety prior to the DVD watching activity.

In the present study, assessments in the sated condition were scheduled within the school timeframes following lunchtime. However, I was unable to verify that children participating in the study ate their lunch to the point of satiety. It would also be useful in future work to look at EAH behaviours straight after lunch has been consumed and run the activity within the lunchtime break itself (instead of after the break, when children were reconvening for afternoon lessons). However, this would be challenging as different groups of children would finish their lunch at different rates adding to variability in terms of fullness; whereas in the present study, participants in the sated condition all started the activity after the lunchtime break. A further recommendation would be to physically manipulate this situation by requesting that children do not eat for a certain period of time for the hungry group and offering a fixed load meal for the sated group.

Moreover, future research could sample a wider age range to observe the EAH response to food promotion in pre-schoolers (Soltero et al., 2015) through to adolescents, something that was outside the remit of this PhD research. Indeed, as EAH is related to daily energy intake and appears to be a behavioural trait that is consistent over time (Kral & Faith, 2009), it warrants investigation longitudinally. EAH has recently been observed in toddlers (Asta et al., 2016) and it is known that marketers aim to intensify their efforts in developing brand relationships with young consumers, to foster 'pester power' with resultant influence on purchasing habits. Therefore this line of enquiry warrants specific research attention. When using a younger age-range, it would be recommended to teach children about the concept of hunger using games or established methods to improve measures of satiety in this age group. As 3-5 year old children may not entirely understand the concept of hunger (Piaget, 1970), researchers should seek to generate a fuller understanding in children before testing for more accurate hunger measurements. Thus, EAH could be investigated using classroom based paradigms and age-appropriate measures to see the effects across childhood, from pre-schoolers to adolescents.

As this is the first study to explore the influence of food marketing on EAH behaviours, it is clear that more research is needed to understand the extent to which food adverts trigger EAH behaviours. The current study used television food advertising, but studies exploring outdoor food promotion (i.e., outdoor/point of sale food promotion) in relation to EAH are absent. US research shows that a greater availability of HFSS snack foods

and drinks in neighbourhood shops has been positively correlated with excess weight in children aged 6-7 years of age (Leung et al., 2011). Future research could explore and clarify how this availability of highly palatable foods within the school vicinity relates to a child's EAH behaviours. It would be plausible to expect higher levels of marketing exposure and increased EAH behaviours in areas with greater access to HFSS snack foods. It could be that more implicit food-cue exposure, as found in advergames, where the advert is embedded and the boundaries between entertainment and advertising are blurred, has a greater effect than explicit food marketing media like television food adverts on EAH intake.

Additional research into EAH following unhealthy food marketing should also include measures of the social environment. In the present study, as previously mentioned, higher levels of EAH were found in comparison to existing research where *ad-libitum* eating exercises took place in isolation. Eating is a social activity for young children and other peers may easily influence them (Leann L Birch et al., 2003; Cutting et al., 1999). Therefore, as mentioned earlier in this discussion, it would be worthwhile to examine the difference in intake response in the absence of hunger between participants consuming in isolation and in groups of their peers to explore differences. Future research could also examine psychological factors integral to the food promotions-EAH relationship, for example impulsivity. Higher levels of impulsivity have been found to relate to higher external eating (Farrow, 2012; Hou et al., 2011) and greater responsiveness to food cues (van den Akker, Stewart, Antoniou, Palmberg, & Jansen, 2014) which could lead to increased momentary desire for food (Fedoroff, Polivy, & Herman, 1997) and preparedness to consume it (Brunstrom, Yates, & Witcomb, 2004) as stated within the food-cue reactivity literature (discussed in section 6.1.5). Therefore, it could be that impulsive children are unable to control their food intake after exposure to television food advertisements in the sated and hungry conditions as they are less able to exert self-control over eating in response to external cues, displaying more disinhibited eating. Nederkoorn and colleagues (2015) measured impulsivity in children (n=88) aged between 7 and 9 years where they completed a school-based EAH task. Results showed that impulsive children demonstrated an abnormal response to high energy-dense foods, rendering them potentially vulnerable to environmental cues like food marketing. This is further supported by literature purporting higher impulsivity levels in obese children (Braet et al., 2007 and Nederkoorn, Jansen,

Mulkens and Jansen, 2006; Wirt et al., 2014). Therefore, personality traits like impulsivity may be implicated in this food promotion-EAH relationship and warrant future exploration.

To conclude, it is vital to appreciate fully the characteristics of individuals that interact with omnipresent food promotion to either magnify or minimize environmental risk factors that may contribute to overeating in children (Blundell et al., 2005). The present study demonstrates that all children increased their kcal intake in response to food adverts. However OW/OB responded to a greater extent in both advert conditions, demonstrating that OW/OB children are more prone to overeating snack foods than low NW children in the absence of hunger and consumed approximately 58 kcal more after the food advert exposure compared with the control advert exposure when sated. Crucially, after exposure to food adverts in the absence of hunger, older children consumed on average 95 kcals more than younger children, and consumed 74 kcal more after the food advert compared with the control advert when sated. Overall, results indicate that EAH behaviours can be heightened by television food advertising; especially in OW/OB and older children, rendering them potentially vulnerable to future weight gain. As EAH emerges early in the developmental pathway, shows levels of continuity within individuals comparable to stable personality traits, and is a child eating behaviour that is potentially modifiable through interventions aiming to reduce overeating, especially in OW/OB children (Boutelle et al., 2011, 2014), results here present a promising target for pediatric obesity prevention via interventions or food marketing policy change.

Chapter 7: Synthesis of research findings

7.1 Introduction

This thesis explored i) the drivers of food advertising impact (exposure and power; chapters 3 & 4), ii) the efficacy of a potential intervention to mitigate advertising effects (Chapter 5) iii) the actual impact of eating behaviours including individual differences in susceptibility (EAH; Chapter 6). This chapter collates and compares research findings across chapters and describes how the original contributions from this thesis relate and integrate with the literature in order to aid our understanding of investigation of the obesogenic environment. Consideration is given to the implications of the most prominent findings from this thesis, and potential future work in these important areas is identified.

Children's exposure to food advertising (Chapter 3)

The aim of Chapter 3 was to compare a substantial sample of 2010 UK commercial television with equivalent baseline data from 2008 (Boyland et al., 2011) to monitor trends over time, offering the opportunity to observe changes associated with the UK television food and beverage advertising regulations. This addressed a distinct gap in the literature of long-term, systematic monitoring studies of television food advertising; offering a distinctive contribution to the UK literature base (as discussed in section 3.1.1.1) and the field more broadly. A key strength of this study is that it compared long-term data over the duration of a year (at 6 month intervals). Further to this, a range of channels popular with children were monitored for 32 hours per month for 6 months of the year (not just examining specific channels at specific times). Food items were categorised into one of 29 categories to allow for item level analysis and were also coded for peak children's viewing hours. This allowed for capturing seasonal trends, a key strength of the study design. Data from Chapter 3 revealed little meaningful change in the general food advertising landscape as a result of the Ofcom regulations, suggesting that the regime has not achieved its stated aim to reduce children's exposure to HFSS food advertising on television. Without dismissing the small number of positive changes observed (increases in fruit and vegetable advertising and decreases in sugar sweetened cereals), the chapter provides evidence that this avenue of regulation has simply shifted unhealthy food advertising away from children's channels and onto family channels. As family channels account for the majority of children's viewing time,

increased exposure is the likely result. A recent study from the US examining a self-regulatory initiative notes the insufficiency of reducing children's advertising exposure via advertising bans on child-directed programming only (Huang & Yang, 2013b). Authors found that the one brand which restricted advertising exposure across all ages significantly lessened household purchasing of the confectionery product by 80% (Huang & Yang, 2013b), with real impact for reducing child consumption.

Chapters 3 and 4 together highlight a clear and compelling case for policymakers to carefully consider the specific detail when designing food advertising regulation, to ensure they will be effective in reducing children's exposure to unhealthy food advertising on television, as advocated by WHO (WHO, 2010, 2012). Whilst legislation is viewed as superior to self-regulation, in and of its self, it has little to no substantive overall effect if the total child audience not is used as a criterion and brand advertising can get around nutritional profiling models. Results emphasise this critical loophole of 'audience indexing' which raises debate surrounding parental responsibility in sheltering children from HFSS food marketing. One way in which parents may protect children is via restrictive mediation (i.e., reducing their exposure; Buijzen, 2009). However, with primetime entertainment shows positioned as peak opportunity for family viewing, parents and guardians are placed in a difficult position with regards to restricting children's viewing. Appropriate statutory policy addressing the most popular television programming, not just that which is 'child directed/of particular appeal' would help parents and guardians to promote healthy food environments for their families.

To readdress this loophole and the associated implications, leading public health figures and advocacy groups have called for a 9pm watershed ban in the UK (RCPCH, 2015; The Drum, 2015). Research from Ofcom shows that a pre-9pm ban would reduce the amount of HFSS adverts seen by children by 82% (compared to 37% for the current regulations; Ofcom, 2006) Importantly, stricter regulations of food marketing are popular with parents, where 69% of parents polled thought that the UK Government should introduce stricter regulations to better control how junk food is advertised to children (BHF, 2015b). Considering research suggests that evidence of community support is a vital factor in determining feasibility of television food marketing regulations (Chung et al., 2012), this would be an realistic amendment to the present regulations. In 2015, the Health Select

Committee recommended this following an enquiry. The report published after the enquiry states that "In our view, a logical way to do this [reduce children's exposure to television food adverts]would be by restricting all advertising of high fat, salt and sugar foods and drinks to after the 9pm watershed." (p.45; House of Commons, 2015). Because of this, it is possible that the 9pm watershed will introduced as part of the upcoming obesity strategy. Irrespective of the form of control, or absence of, it is critical that there is continued robust monitoring of food and beverage advertising on television in the UK and across all nations to examine the long-term impact of the regulations and highlight which system is superior. Consistent and systematic monitoring of television food adverts is required to allow trends to be tracked over time. As there are vital quantitative differences identified between 2008 and 2010 in terms of the extent of UK food advertising on television, it remains important that this is monitored to see long-term impact of regulations (e.g., 2012, 2014, 2016). This would also allow for further research examining specific food item trends over time (e.g., fast food, sugary drinks; discussed in section 3.1.1) and would differ from the vast majority of food advertising literature published to date, offering a unique contribution to the field.

UK-specific research could explore the theoretical impact of a 9pm watershed ban on HFSS food advertising to clearly demonstrate the comparative efficacy of this approach compared with the current rules. This would help to compound pressure seen from medical organisations, health charities and the wishes of UK parents. Academic research should modell the potential reduction in children's exposure to HFSS advertising on television in the context of a 9pm ban. This could demonstrate the impact a ban could have on children's health and wellbeing. Its consideration is warranted since a noted barrier to legislation implementation is the need for clear evidence demonstrating effective regulation (Chung et al., 2012; Shill et al., 2012).

A third trajectory of research could explore differences in a range of outcome variables applied to the same data set. For example, research could compare Ofcom's own variable (impact), with nutrient profiling, and the core (healthy) and non-core (unhealthy) criteria utilised in this thesis. With regards to nutrient profiling, establishing whether an advert should be permitted or not in line with the Ofcom regulations may lack accuracy, as there is no guidance for certain advert types (e.g., branding only). However applying multiple coding systems to enable between-study comparisons as well as evaluations of the

usefulness of coding models would provide a sound contribution to this field. This would be useful as simpler coding systems enable quicker data processing to support monitoring work in the absence of an officially sanctioned (and financially supported) system.

The emerging issue in this field relates to the detailed measurement of the exposure and power of new media food marketing. It is paramount that progress is made in quantifying these emerging forms (see section 1.3.1.3). Logical reasoning might suggest that children are more at-risk from new media forms compared with traditional routes (Kelly, Vandevijvere, Freeman, & Jenkin, 2015). Lessons learnt here in 'traditional advertising' quantification can be used as a foundation for this field as it develops in the next 5-10 years. The continued investigation of all forms of implicit and explicit energy-dense, nutrient-poor food and beverage marketing will aid in shifting both public opinion and government decision-making to help protect and promote children's health. As well as quantifying alternative media, it is important that we understand how promotions inter-relate across platforms. Moreover, there is a need to examine integrated marketing to clarify whether or not cumulative exposure across multiple media results in additive effects.

The power of food advertising to children (Chapter 4)

The aim of Chapter 4 was to compare a substantial sample of 2010 UK commercial television with equivalent baseline data from 2008 (Boyland et al., 2011) to evaluate the power of UK television food and beverage advertising and examine change in power over time. Chapter 4 found premium offer use increased between 2008 and 2010, but there was a decrease in their use within non-core food promotion in 2010. Promotional characters (including celebrities) were used more frequently to promote non-core foods than core and miscellaneous food items, as in 2008 and there was little change in use of brand equity/licensed characters between 2008 and 2010. Physical activity depiction increased almost 20% between 2008 and 2010, and health claims increased approximately 4% from 2008 levels where the majority promoted non-core foods, with a higher rate found on dedicated children's channels. Website inclusion displayed a small increase of around 5% from 2008 to 2010 and the majority of 2010 food adverts including a website were promoting non-core foods. Use of premium offers, promotional characters, website

inclusion and physical activity depiction within non-core food adverts displayed distinct seasonal variation in the 2010 data, a novel absent in the 2008 data.

Of these numerous results, arguably the most critical finding in Chapter 4 was the growth of health based messaging, which displayed increasing prevalence within UK television food advertising. Escalations in nutritionally deficient foods paired with implicit (physical activity depiction) and explicit (health claims) health references were observed. The heaviest use was seen on children's channels for proportionally more HFSS food. This greater prominence of health references is supportive of literature purporting a "health halo" surrounding food marketing (Chandon & Wansink, 2012). Health halos are when an aspect of the food is portrayed as healthy, leading to consumers tending to categorise the entire food item as healthy, leading to an underestimation of calories and an increased likelihood to overeat (Andrews, Netemeyer, Burton, 1998; Chandon & Wansink, 2007). Often, it is HFSS food items which carry this "health halo". By capitalising on this trend for health in both adult and child populations, but applying it to the promotion of unhealthy foods, food companies aim to secure brand loyalty and may be potentially misleading consumers by compromising their understanding of nutrition.

The health reference findings of Chapter 4 should be considered in the context of wider research that has tapped into this phenomenon. Survey data exploring the wider food context within television adverts found that approximately one third featured an 'incidental food' appearing alongside the focal item of the commercial (the 'primary food'). The most common food group represented among primary foods was 'foods and drinks high in fat and/or sugar' (e.g. full-sugar soft drinks), whereas the incidental foods were most likely to be fruit and vegetables. There is concern that these techniques could add an unfounded notion of 'healthiness' to unhealthy foods advertised this way (Adams, Tyrrell, & White, 2011). Further research indicates that such subtle cues provide an effective way to infer product benefits (MacInnis & Jaworski, 1989), without overloading individuals with nutritional information. A recent online experiment (Chrysochou & Grunert, 2014) demonstrated that individuals rely more on health imagery than health claims when evaluating food products, with further research confirming that implicit health messages may be more powerful than explicit messages (Wagner et al., 2015). Moreover, when making dietary selections, studies show that healthiness is a significant consideration for children under 10 years of age (Nguyen et al., 2012; Noble et al., 2000), although taste

becomes the dominant factor as children approach adolescence (Noble et al., 2000). Therefore, this discussion of the relevant literature adds weight and importance to this finding, with increased health messaging reported within UK television food advertising, exposure could indeed lead to poor consumption habits and calorie underestimation in children with lasting impact on health outcomes.

Policy makers should question the extent to which marketing that hinders children's knowledge about the nutritional content of food is responsible, as current UK statutory restrictions (Ofcom, 2007) and voluntary approaches abroad (Children's Food and Beverage Advertising Initiative, 2014) overlook these widespread strategies. Interestingly, rulings on advertising are very restrictive on the notion of food advertising being misleading in other ways. Ofcom regulations state that "Advertisements must not, for example, suggest that consuming the advertised product will enable children to resemble an admired figure or role-model or that by not doing so children will fail in loyalty or let someone down." (p.50; Ofcom, 2007). Therefore, restriction should be as strict concerning the advertising of HFSS food adverts with "health halos".

In the context of health referencing, adverts also utilise visual elements with underlying health-related meaning, for example a picture of a woman on weighing scales. Based on these findings, future monitoring research could therefore adopt a coding framework that categorizes health communication elements of television food advertisements into three types: health claims, nutrition claims and health imagery. Researchers and policy makers should consider monitoring the use of such visual cues rather than focusing solely on monitoring health-related claims on food products. Experimental research could also test their impact in isolation and when presented in combination. Taken together, Chapters 3 and 4 have added substantially to our knowledge of the exposure and power of foods being advertised on UK television over time in the context of the UK Ofcom regulations. Results here provide context for the rest of the thesis which considers the behavioural outcomes of television food environment in specific samples and physiological states.

Investigating the efficacy of a potential intervention to mitigate advertising effects (Chapter 5)

Chapter 5 aimed to explore alternative policy routes to limit the impact of unhealthy television food adverts on children in Brazil; where statutory restriction does not appear to be imminent. It investigated the impact of two warning types (one relating to the unhealthiness of the food and the other relating to the persuasive nature of advertising) on children's *ad libitum* consumption of snack foods. No main effect of food advert exposure on intake was found, differing from previous research using samples of UK children (Boyland et al., 2013; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008). Contrary to previous research, control advert exposure led to an increased intake in all children. As such, warnings did not affect children's food intake. Although the hypotheses were not supported, discussion of this chapter will elucidate its contribution to knowledge in terms of the transference of established experimental paradigms into novel samples and a more in depth exploration of issues surrounding the notion of persuasiveness intent and its implications for health policy.

Alongside possible methodological explanations (as covered in section 5.4), it is worthwhile addressing the differences in findings between chapters Chapter 5 and 6. Both were conceptual replications of existing studies (Halford et al., 2008; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008) using paradigms that employed the same outcome variables (intake in kcal), similar but not the exact same manipulations and child samples from markedly distinct populations. To report a significant main effect of food advert condition in Chapter 6 but a significant increase in caloric intake in the control condition in Chapter 5 permits a discussion of factors that may be implicated in this difference.

Firstly, the findings in Chapter 5 may be explained in part by inherent differences in the population sampled. A plethora of socio-cultural factors shape food habits and eating behaviours. One of many aspects illustrating the sheer differences in food environment between the UK (a high-income country) and Brazil (a middle-income country) are the types of foods typically consumed, particularly related to the amounts of ready-to-consume products purchased and eaten. This is crucial to consider as these were the foods depicted within the television food advert exposure and offered within the *ad-libitum* food intake

task. As discussed within Chapter 5, the consumption of ultra-processed foods has increased in recent years in Brazil, in both upper and lower income groups (Carlos Augusto Monteiro et al., 2011a), where greater household availability of ultra-processed food products has been reported to be positively and independently associated with a higher prevalence of excess weight and obesity in all ages (Canella et al., 2014).

However, it could be that levels have not reached those comparative to the UK; where ultra-processed foods may be more entrenched as part of the food culture. A lack of familiarity with the study foods and food advertisements could explain, at least in part, why no significance was reported. A study using national food expenditure survey data from the UK (2008) and Brazil (2008-2009) found that in the UK, 63.4% of energy came from ready-to-consume products, more than twice that found in Brazil (27.7%; Moubarac et al., 2013). Differences were found in the amounts of food groups consumed including sweets, chocolates and ice creams (9.9% in the UK, 2.2% in Brazil), sugary-baked goods (7.7% in the UK, 3.2% in Brazil), breakfast cereals (3.8% in the UK, 0.7% in Brazil) and soft drinks and sweetened fruit juices (3.4% in the UK, 1.9% in Brazil). Data further illustrate that the vast majority of meals in Brazil are prepared and cooked at home, using mostly unprocessed or minimally processed foods, whereas ready meals and snacks prevail in the UK; highlighting further culturally-specific eating norms. Finally, the relative cost of ready-to-consume products was reported as 43% lower in the UK than in Brazil, emphasising the economic implications shaping the routine consumption of snack foods (Moubarac et al., 2013).

Considering that children sampled in Chapter 5 were from very low SES backgrounds, this comparative data may indicate reduced exposure to ready-to-consume food products compared to UK children, due to the snack foods being relatively novel and potential economic factors relating to this. Therefore, although television food adverts were checked for cultural appropriateness by local researchers; there may have been a level of unfamiliarity with the foods advertised in the television adverts and this may go some way in explaining the key differences reported.

The significant caloric increase in found in the control condition of Chapter 5 is arguably in itself a contribution to the knowledge base; as it raises an important point within the context of psychological science concerning the transfer of existing experimental

paradigms to novel populations and cultures. It highlights that more sensitivity in terms of materials and measures may be required to tap into the cultural nuances of the food environment and its impact on children's food intake. This may be achievable through the addition of pilot work proceeding the study design. Differences in results between Chapters 5 and 6 support the assertions of a recent meta-analysis of studies into the effects of acute exposure to unhealthy food and non-alcoholic beverage advertising on intake in children and adults (Boyland et al., 2016). This meta-analysis reported high heterogeneity across this literature with respect to effect size, with subgroup analyses indicating that study designs differences may have contributed to variability. Results from Chapter 5 imply that cultural differences may be yet another source of heterogeneity in this line of research.

Two further fundamental questions arose from Chapter 5 in relation to the embedded warnings; 1) did children understand the warnings? and; 2) if they were able to understand them, are they likely, based on theoretical understanding, to be able to act on them? In addressing this first question, our analysis showed that 60.5% of children in the health warning group and 37.5% of children in the persuasiveness warning group correctly interpreted the warning as it was meant. Both warnings have previously been discussed, however the persuasiveness warning warrants further scrutiny, as it relates to a debate at the root of food advertising policy and psychological theory. Existing research into children's cognitive capacity to process advertising has traditionally speculated that children over the ages of 7-8 years recognise that the purpose of advertising is to 'sell' the advertised product. This is endorsed by the APA, who recommend that no advertising should be directed towards children below the ages of 7-8 (John, 1999; Kunkel, Wilxoc, Cantor, Palmer, Linn, Dowrick, 2004). Older children however, aged 11-12 and above, are thought to have more sophisticated skills in recognising the selling intent of advertising (John, 1999).

From a theoretical perspective, the Persuasion Knowledge Model (Friestad & Wright, 1994) suggests that children interpret and respond to advertising attempts through a personal 'persuasion knowledge' based on life experiences which develop throughout childhood into adulthood. Aligning with this theory, other researchers puport that two facets of awareness develop over time; selling intent (the promotion of a product via presentation of its features and qualities in an essentially unbiased manner) and persuasive intent (whereby advertisers attempt to increase their product's desirability via appealing

techniques; Roberts, 2008). A key strength of Chapter 5 was that the persuasiveness warning aimed to generate awareness of persuasive intent of the television food adverts children were exposed to, not simply selling intent, which may not actually infer a lot about children's cognitive appreciation of the intent of advertising. That only 37.5% of children aged 7-11 in Chapter 5 incorrectly interpreted the warning but 62.5% of these children thought that they had understood the warning correctly confirms a broader issue underpinning food marketing regulation rhetoric. These data suggest a relatively unsophisticated appreciation of the intent of television food advertising in this sample and is supported by data in an American sample demonstrating children's awareness of selling intent by 11-12 years but lack of awareness of the persuasive intent (Carter et al., 2011). This may denote that an understanding of the more sophisticated concept of persuasive intent may emerge several years later than 8 years old.

Other authors propose that the traditional models used to explain advertising effects have overemphasized this importance of children's understanding of persuasive intent and cognitive ability to defend against direct marketing attempts (Harris, Brownell, et al., 2009). Psychologists now suggest that this emphasis may have limited researchers' ability to identify effective solutions to limit the unhealthy effects of food marketing. The food marketing defense model, proposed by Harris and colleagues (2009) builds on these two approaches but goes further to incorporate challenges that are unique to resisting the influence of food marketing. The model proposes four necessary conditions for individuals to effectively resist food marketing stimuli: 1) Awareness, defined as the conscious attention to individual marketing stimuli and comprehension of their persuasive intent; 2) Understanding of the effects resulting from exposure to marketing and how to effectively defend against those effects; 3) Ability, including cognitive capacity and available resources to effectively resist; and 4) Motivation, or the desire to resist. This model recognizes that the ability to resist marketing influence will differ not only for different forms of marketing, but also across different contexts, which highlights that the same findings in this chapter may not be replicated elsewhere. The authors posit that additional cognitive resources are required to inhibit desire for extremely tempting but unhealthy food products commonly presented in food marketing. Therefore applying textual and audio warnings may be too rudimentary to counter complex processes needed to combat food marketing like

motivation. Thus, future studies examining the establishment of persuasive intent alongside other future research directions relating to this chapter are discussed below.

Chapter 6 investigated the actual impact of food advertising on eating behaviours including individual differences in susceptibility. This built on findings within food advertising studies conducted previously and the wider appetite literature to logically further both literatures. Previously conducted food advertising studies reported weight status differences in response to food advertising, such that OW/OB children were more responsive to food promotion that their normal weight peers (Halford et al., 2008). Studies published in the appetite literature demonstrated that children who were more responsive to external food cues (e.g., the presence of food imagery) as opposed to internal cues (such as hunger or satiety) were more likely to display eating behaviours such as EAH (Carnell & Wardle, 2009; Jansen, Theunissen, Slechten, Nederkoorn, Boon, Mulkens, & Roefs, 2003; Nederkoorn, Dassen, Franken, Resch, & Houben, 2015). These findings together suggest a logical next step to address this gap in the literatures by manipulating hunger state into the experimental paradigm described in Chapter 6 to both remove hunger state as a potential confounder and investigate individual differences in response to food adverts in hungry and sated states; critical to our understanding of weight gain and obesity. From a policy perspective, the main effect found in this sample adds to the growing body of evidence that regulation of food promotion is necessary and justified. The present study demonstrates that all children increased their kcal intake in response to food adverts, however OW/OB responded to a greater extent in both advert conditions, demonstrating that OW/OB children are more prone to overeating snack foods than normal weight children in the absence of hunger.

8.7 Final summary

In summary, using a mixed-methods approach, this thesis has addressed weaknesses in the international television food advertising literature by illustrating food advertising prevalence on television and its impact on children's food intake in both developed and non-developed countries. For the first time, in a sample of Brazilian children, this thesis has shown that effects of food advertising may be more difficult to demonstrate, and that warnings embedded in television food adverts may have the potential to induce a negative response in children by increasing their likelihood of greater intake. Results point to the need for further experimental research of this nature in countries with developing economies, and imply that warnings may not be a useful and cost-effective alternative to statutory regulation alone. This thesis also further confirms that acute exposure to food advertising increases children's kcal intake, and makes an original contribution in that EAH behaviours may be heightened by television food advertising; especially in OW/OB children. A further novel finding from this thesis is that older children (9-11 years) were more influenced by the food adverts and increased their kcal intake in response; implying that older OW/OB children should be especially protected from the harms of food marketing exposure. Finally, a pilot study to examine the feasibility of creating a UK-specific food brand awareness measurement instrument demonstrated excellent reliability. This work warrants further data collection, with the aim of publication to aid future experimental work exploring exposure to food promotions and food-related attitudes, choice and intake in children.

Both the findings from the monitoring work and the experimental studies indictate together that television food marketing is powerful, pervasive and where both UK and non-UK children should be be protected. Ethically, restrictions should extend to children at least up to 12 years of age. If children do have less sophisticated appreciation of the intent of television food advertising than previously thought, this suggests that popular primetime entertainment shows watched by families (exempt from the rulings) should be subject to regulation. A pre-9pm ban in the UK would be more ethically appropriate and reduce the

amount of HFSS adverts seen by children by 82% (compared to 37% for the current regulations; Ofcom, 2006).

The impact of poor eating behaviours may prove to be one of the most difficult public health issues of our time to resolve. Once an individual becomes obese, most interventions, aside from surgery, are not effective (Heymsfield et al., 2007). Thus it is thought that preventing young people from becoming overweight or obese may be crucial in addressing the obesity crisis, and the only way to do so on a large scale is to intervene at the environmental level. Notably, there exists a dichotomy of individual versus environmental drivers of obesity permeating the literature, media and societal discourse. Although individuals bear some personal responsibility for their health, environmental factors can readily support or undermine the ability of people to act in their own self-interest (Corinna Hawkes et al., 2015). Today's food environments exploit people's biological, psychological, social, and economic vulnerabilities, making them more likely to consume unhealthy foods (Roberto et al., 2015). This environment reinforces individual preferences, choices and demands for HFSS foods, furthering unhealthy food environments. As such, obesogenic food environments are now thought to be a key driver of the obesity epidemic. Given that health behaviours are modifiable, environmental factors that promote unhealthy dietary habits and excess consumption are of public health concern.

An increased understanding of the environmental determinants of behaviours is essential in order to promote positive food preferences and healthy habits in childhood that are beneficial to health both in the short term and throughout the lifespan. Specifically, the role of food marketing to children should continue to be scrutinised. Research to date suggests that commercial activities should be subordinated to protect and promote children's health. Decreasing the promotion of HFSS food products will limit rapid weight gain in early childhood, helping to limit the risk factors for chronic disease in all children. Thus, regulatory actions from governments and increased efforts from industry and civil society are necessary. There is a clear commercial imperative for food manufacturers and marketers to put efforts in to reformulating and producing nutrient-rich food products which would not only help alter the food environment for the better but generate significant profit to consumers who in turn would make more purchases throughout their longer and heathier lives.

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