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Media Food Cues and their Influence on Children's Eating Behaviour

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Abstract

Previous research has shown that exposure to media food cues might encourage food consumption among children. According to food cue-reactivity theorists, images and cues that imply food intake might perform as conditioned stimuli that trigger cue-reactivity, resulting in food consumption. The primary aim of this thesis was to investigate the effects of media food cues on children's eating behaviour based on the Food Cue-Reactivity theory. To address this aim, content analyses of UK and Malaysian television were conducted to explore the extent of media food exposure on children's TV programmes. Following this study, experimental designs were utilized among children (aged 7 to 11 years old) and empirical research was conducted to explore the influence of media food promotion on children's actual eating (Study 2, Chapter 3). Finally, the current thesis explores the role of cue congruency in motivating food consumption among children (Study 3 in Chapter 4).

Results from the content analyses study indicate that children in both countries were frequently presented with non-core food cues in both advertisements and non-advertisements (Study 1, Chapter 2). The first empirical study found that older children (aged 10-11 years) who were exposed to embedded food cues during online gaming consumed higher amounts of food compared to those who did not see any food cues. There was no effect found among younger children (aged 7-9 years) in the same condition. The result from Study 3 suggests that congruent food cues do not influence children's immediate food intake.

In summary, children in both countries are still being exposed to non-core food cues within traditional media (i.e., television). Food cues depicted in integrated media have the potential to stimulate general food intake among children (aged 10-11 years), irrespective of the congruency of the food exposed. This thesis contributes to the present literature by enhancing our insight into the influence of food cues, particularly on children's eating behaviour in both advertising and non-advertising perspectives. There are a number of challenges that have been encountered by the present author in completing this research, primarily due to the experiments being conducted abroad (i.e., in Malaysia). Because of this circumstance, some of the initial plans had to be changed, and several tests were removed. It is recommended that future research should include several key assessments (i.e., hunger, BMI, food preferences etc) in order to examine the effect of food cues on children's eating behaviour.

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Glossary of terms

Core food

In the current thesis, the term "core food" is mainly used to refer to bread/grains, breakfast cereals, meats, dairy, fruit, vegetables, poultry, fish, sandwiches, eggs, and water.

Energy density

Energy density is "the amount of energy in a particular weight of food (calories per gram) and, depending upon the food's mix of nutrients, ranges from 0 to 9 kcal/g" (Rolls, 2017, p.247). According to British Nutrition Foundation (2016), the energy density in food can be estimated as follows;

Very low energy density foods = less than 0.6 kcal/g
Low energy density foods = 0.6 to 1.5 kcal/g
Medium energy density foods = 1.5 to 4 kcal/g
High energy density foods = more than 4 kcal/g

Healthy eating

According to Bisogni, Jastran, Seligson and Thompson (2012), the meaning of healthy eating can vary between individuals. Healthy food consumption is used in the context of eating the specified foods mentioned above (i.e., core foods) in an appropriate portion as recommended by the UK Eat Well Guide (see Figure 2.1).

HFSS food

This term is defined within the UK Government Department of Health and Social Care's nutrient profiling model (Department of Health, 2011), which is used to provide guidance regarding which foods can and cannot be advertised to children. The term high fat/salt/sugar (HFSS) foods is used to describe a selection of predominantly ultra-

processed snacks, such as chocolate, crisps, biscuits and sweets (or candy).

Palatability

According to Yeomans (1998), palatability can be defined as "the hedonic evaluation of orosensory food cues under standardized conditions" (p. 613). It is important to note that the palatability of the food is "jointly determined by the nature of the food (smell, taste, texture and state), the sensory capabilities and metabolic state of the subject, and the environment in which the food and subject interact" (Blundell & Stubbs, 1999, p.150). In the current thesis, palatability refers an enjoyment or pleasure obtained from the consumption of food.

Nutrients

Nutrients are described as the elements which humans acquire from food intake, and it is the source of nourishment which promotes the growth, maintenance, and repair of body cells and tissues (Hendrich et al. 1994). In the context of the current thesis, nutrients refer to health-promoting substances (i.e., protein, fibre, vitamins A, C and E, calcium, magnesium, iron and potassium), excluding the non-health promoting substances like saturated fat, sodium, and added sugar.

Nutrient-poor food

In the current thesis, the term nutrient-poor food refers to foods high in calories and low in nutrients (i.e., candy, chocolate, cake, biscuit, ice cream, crisps, dessert etc) and beverages with high and/or added sugar content (i.e., soft drinks, cordials, energy drinks etc).

Non-core food

In the current thesis, the term "non-core" refers to food that has been processed, and/or high in fat/salt/sugar. This includes foods such as fast food, convenience meals,

	desserts, pastries, snacks, crisps, confectionery, ice cream and candy.
Satiety	Satiety can be defined as an "internal state of energy depletion after a meal" (Drewnowski, 1998, p. 349).
Unhealthy eating	Unhealthy eating is regarded as excessive intakes of foods and drinks with high fat/salt/sugar content and a limited amount of micro- and macro-nutrients such as vitamins, minerals and fibre (National Health Services, 2019). In the current thesis, unhealthy food consumption is used in the context of eating the non-core or nutrient foods mentioned above (i.e., above suggested portion recommended in the UK Eat Well Guide illustrated in Figure 2.1).

CHAPTER ONE

1 Introduction

1.1 Aims of this literature review

The present thesis aims to investigate the prevalence of food cues depicted in the media and their influence on children's eating behaviour. This chapter aims to provide a narrative review of literature on children's eating behaviour and how exposure to media might play an important role in affecting children's eating behaviour. The review will also highlight the gaps in the literature that this thesis aims to address. The review will begin with the development of children's eating behaviour, where the current chapter will discuss the processes involved in shaping children's eating behaviour and the factors that influence children's eating (see section 1.1). Next, in section 1.2, the theories underpinning research on children's eating behaviour will be reviewed.

Section 1.3 will discuss how media exposure might influence children's daily routine, behaviour and consumer socialization. The current chapter will also discuss the medium of food advertising targeting children, particularly focusing on television and new media advertising (see section 1.4). Furthermore, the effects of food promotion on children, which is the key concept of the empirical chapters in this thesis, will be highlighted in section 1.5 of the review. Section 1.6 will provide a rationale for conducting the present research in Malaysia, discussing the current literature concerning food advertising targeting children in Malaysia. Finally, section 1.7 will provide the overall

thesis aims and specific objectives.

1.2 Children's eating behaviour

In this section, children's eating behaviour will be discussed, with a particular focus on the development of children's eating behaviour and how food promotions depicted within media technologies influence children's eating behaviour. Eating behaviour is "a broad term that encompasses food choice and motives, feeding practices, dieting, and eating-related problems such as obesity, eating disorders, and feeding disorders" (LaCaille, 2020, p. 641). According to scholars, eating behaviour is a dual process of biological and behavioural bases directed towards fulfilling the fundamental elements of growth and health (Savage, Fisher & Birch, 2007), and these processes evolve during the early years of life and progress through the years. Eating behaviour is a complex process that can be influenced by a mixture of personal, social, environmental, cultural, and economic factors (LaCaille, 2020).

The development of human eating behaviour involves an interplay of physiological (innate), behavioural (learned) and environmental (external) factors (Cooke, 2004; Farr, Chiang-shan & Mantzoros, 2016; Hopkins et al., 2016; Ventura & Worobey, 2013). Food consumption or eating is a process regulated by homeostatic and hedonic pathways, as well as cognitive feedback (Hall, Hammond, & Rahmandad, 2014; Nicola, 2016). The homeostatic control of feeding can be defined as a process of energy balance regulation modulated by neural and hormonal mechanisms, in which motivation to eat will be induced following a reduction or prolonged absence of energy. In other words, homeostatic eating is activated by energy depletion or hunger. Apart from these natural triggers, appetitive

stimulants (i.e., drugs) used in medication can also stimulate eating by increasing appetite (Desport et al., 2003). Supplementary to the regulation of food intake by homeostatic signals, drugs such as opiates also influence the hedonic aspects of eating and reward mechanisms, moderating both the palatability of flavoured fluids and food (Herz, 1998; Nogueiras, Romero-Picó, Vazquez, Novelle, López & Diéguez, 2012).

Contrary to the homeostatic pathway, hedonic control refers to reward-based pathways driven in response to pleasure, irrespective of energy level (Lowe & Butryn, 2007). Lowe and Butryn (2007) suggested that the difference between the two is that homeostatic eating is motivated by energy deficit, while hedonic eating is strongly influenced by the availability and palatability of food in the environment. However, the homeostatic pathway can be overridden by hedonic regulation during periods of energy excess by anticipating the desire to consume foods that are highly palatable (Lutter & Nestler, 2009). Indeed, some researchers have argued that homeostatic mechanisms of food intake can be governed by motivation and hedonic stimulation, in which any appearance of a food cue regardless of its hedonic value would be powerful enough to trigger "food wanting" or desire to eat (Zheng, Lenard, Shin, & Berthoud, 2009; Lutter & Nestler, 2009). This activation will simultaneously disregard any satiation signal by enhancing one's desire to eat highly palatable foods, ultimately increasing the consumption of such food.

According to Berridge (2007), distinguishing between "food liking" and "food wanting" is essential when assessing the role of food reward in eating behaviour. "Wanting" in the context of food reward denotes "the particular psychological process of incentive salience, which can occur either consciously or unconsciously, generated by

brain mesolimbic circuitry in the form of cue-triggered motivation", whereas "liking" implies "the hedonic impact of pleasant rewards" (Morales & Berridge, 2020, p.2). In other words, "food liking" can be referred to as palatability such as the pleasure sensation obtained from eating food, while "food wanting" refers to motivation of eating which is triggered by food-related cues the (i.e., the tendency to eat). The process of incentive salience involves in food wanting is associated with rewards and its cues. It facilitates in regulating the motivational value of rewards, which then develop triggers of "wanting" (Berridge, 2009). Consequently, just thinking about palatable foods (i.e., the sight, smell and taste of food) can trigger the desire for that food or "food wanting" (Pelchat, Johnson, Chan, Valdez & Ragland, 2004).

The third process involved in food consumption, which is a cognitive mechanism, consists of several distinct categories: self-regulation, social feedback, and environmental feedback (Hall, Hammond, & Rahmandad, 2014). Self-regulation involves individual conscious (i.e., physical activity in maintaining a healthy weight) and unconscious processes (i.e., stress, emotional eating, etc.) (Torres, Nowson 2007; Geliebter & Aversa, 2003). On the other hand, the social mechanism is a process where others play a role in influencing an individual's physical activity and eating behaviour, which are usually exhibited through social norms (Becker, Burwell, Herzog, Hamburg & Gilman, 2002; Font & Fabbri, 2010; Koehly & Loscalzo, 2009). The third category, environmental feedback, consists of the relationship between individuals and their environment (Hall et al., 2014).

According to Birch, Savage, and Ventura (2007), eating behaviour evolves during infancy, when children develop an understanding of food (i.e., what, when and how much to eat), as well as the development of food preferences. Children also learned to accept

food, reject food and formed a reaction (i.e., avoiding, dislike etc) towards non-edible or contaminated foods through disgust in the early years (Harris et al., 2019). According to Rozin and Fallon (1987), disgust is "that form of food rejection which is characterized by revulsion at the prospect of oral incorporation of an offensive and contaminating object" (p.24). Disgusting objects are likely to be considered distasteful (i.e., having a bad smell, taste or texture) (Rozin & Fallon, 1987). Disgust also plays an important role in determining what to eat, and what to avoid (Harris et al., 2019), as well as establishing preferences towards certain foods and food avoidance or rejection.

Furthermore, food preferences represent individuals' attitudes and liking for foods, while eating patterns or styles constitute how a person eats (Ventura & Birch, 2008). Contrary to hedonic food eating, children's acceptance of lower hedonic value foods is thought to be learned through experience with such food and eating. Children develop their food preferences by integrating food sensory cues with the context and consequence of eating certain foods (Birch, 1999; Birch & Fisher, 1998; Savage, Fisher & Birch, 2007; Wardle & Cooke, 2008).

Based on Zajonc's "mere exposure" theory (Zajonc,1968), children's acceptance of new foods requires repeated exposure to unfamiliar foods daily (Wardle, Herrera, Cooke & Gibson, 2003). The authors further noted that constant exposure to the taste of unfamiliar foods can promote liking of previously rejected foods among children, as repetition might be a vital aspect in the adaptation process of liking (Wardle et al., 2003). The mechanism by which repeated exposure increases liking is thought to be a "learned safety" behaviour (Kalat & Rozin, 1973). This hypothesis suggests that repeated consumption of unfamiliar food without negative outcomes leads to improved tolerance of that food.

Furthermore, Nicklaus, Boggio, Chabanet, and Issanchou, (2004) noted that children's development of food preferences is established during childhood and are expected to remain throughout children's lives until adulthood. Food marketing is one of the factors which are not only known to influence children's preferences and attitudes but also affect the intake of promoted products (Halford et al., 2007; 2008a; 2008b). Food promotions depicted within the media environment are believed to be portrayed as attractive and highly palatable, which stimulates children's hedonic hunger.

The concern regarding hedonic eating has been raised as a result of children's 'obesogenic' food-replete environment, which is highly associated with the current food marketing industry. This 'obesogenic' environment can be described as 'the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations' (Swinburn, Egger & Raza, 1999, p.564). Researchers believe that people living in this food environment eat as a result of anticipated pleasure drawn from palatable food rather than the presence of hunger (Pinel, Assanand, & Lehman, 2000) and that the attractive foods depicted through media environments have a particularly high influence on eating behaviour (Fedoroff, Polivy, & Herman, 1997; 2003; Harris, Bargh, & Brownell, 2009).

Past studies have suggested that "the sight and a brief taste of food actually 'primed' the appetite, regardless of energy state" (Lambert et al., 1991 p.298). This notion indicates that the visual stimulus is believed to be the most influential motivation toward hunger. Indeed, this priming concept was supported by Harris et al. (2009), who showed that unhealthy food advertisements shown on television can act as 'real-world' primes and result in increased snack consumption among children (see section 1.5.2). Moreover,

researchers have argued that television viewing may alter children's eating behaviour by disrupting the development of ingestive habituation (Epstein, Temple, Roemmich & Bouton, 2009). Ingestive behaviour, which is feeding and drinking, is a complex process encompassing a variety of neuronal mechanisms, metabolic processes, psychological features, and gastrointestinal mechanisms that convey neural and hormonal signals to the central nervous system (Plata-Salamán, 1993).

Habituation, on the other hand, refers to the modification in both behavioural and physiological reactions to eating which occur as eating progress (Epstein et al., 2009). In other words, according to Epstein, prolonged exposure to actual food would lead to habituation of the food consumed and consequently decreases response to such food. Epstein et al. also suggested that snacking or eating while watching television distorts children's habituation towards foods eaten by shifting attention from eating, leading to slower ingestive habituation (Epstein, Paluch, Smith, & Sayette, 1997). This means that when the process of habituation is slowed down, it may lead to a prolonged response toward food, which results in an increased intake of foods (Epstein, Paluch, Consalvi, Riordan, & Scholl, 2002) among children. For example, consider Ron who is eating a bowl of pasta. Ron took 10 minutes to eat the pasta and feels too full to eat any more pasta. However, he could still eat a slice of cake for dessert. This is because he has habituated to pasta. However, if Ron ate the pasta while watching television, it will transfer his attention to the television, resulting in slower habituation which ultimately increases the intake of that pasta. This process of habituation might explain how sensory cues might affect an individual's choice of food as well as the amount of food consumed.

To sum up, this section has discussed the development of eating behaviour and food preferences among children. As the development of eating behaviour involves a complex process, there are several elements contributing to the development of eating behaviour, specifically internal and external factors. Among other important factors, food depicted in the media environment plays a significant role in shaping children's eating behaviour. Therefore, to further understand children's eating behaviour, the following section will discuss the theoretical frameworks which are pertinent in explaining how exposure to media food cues influences children's eating behaviour.

1.3 Theoretical frameworks guiding research on the effects of food cues on eating behaviour

Eating behaviours consist of the selection, preferences and consumption of food and beverage in the context of the person's internal (individual) and external factors (Ventura & Birch, 2008). While internal factors include physiological aspects (i.e., satiety), external factors on the other hand are associated with the food itself and the environmental features that have a potential influence on an individual's eating behaviour (Connor & Armitage, 2002). Due to the extensive array of possible factors influencing eating behaviour, diverse models and frameworks have been applied to elucidate the underpinning components of food choice and eating habits. To address the main aim of the thesis, it is vital to understand the theoretical perspectives which can be applied to explain how food cue exposure influences children's eating behaviour. Therefore, this section will discuss the most pertinent theory used in research concerning eating behaviour - the Food Cue-Reactivity theory (FCR).

The section will begin with Pavlovian classical conditioning, which is fundamental to the Food Cue-Reactivity theory. The current section will further discuss the processes involved in FCR and the research supporting FCR. In the final part of this section, we will also include a brief discussion of the Reactivity to Embedded Food Cues in Advertising Model (REFCAM), the expanded model of FCR developed particularly for research concerning the effects of promotional food cues on eating behaviour.

1.3.1 Pavlovian classical conditioning in humans

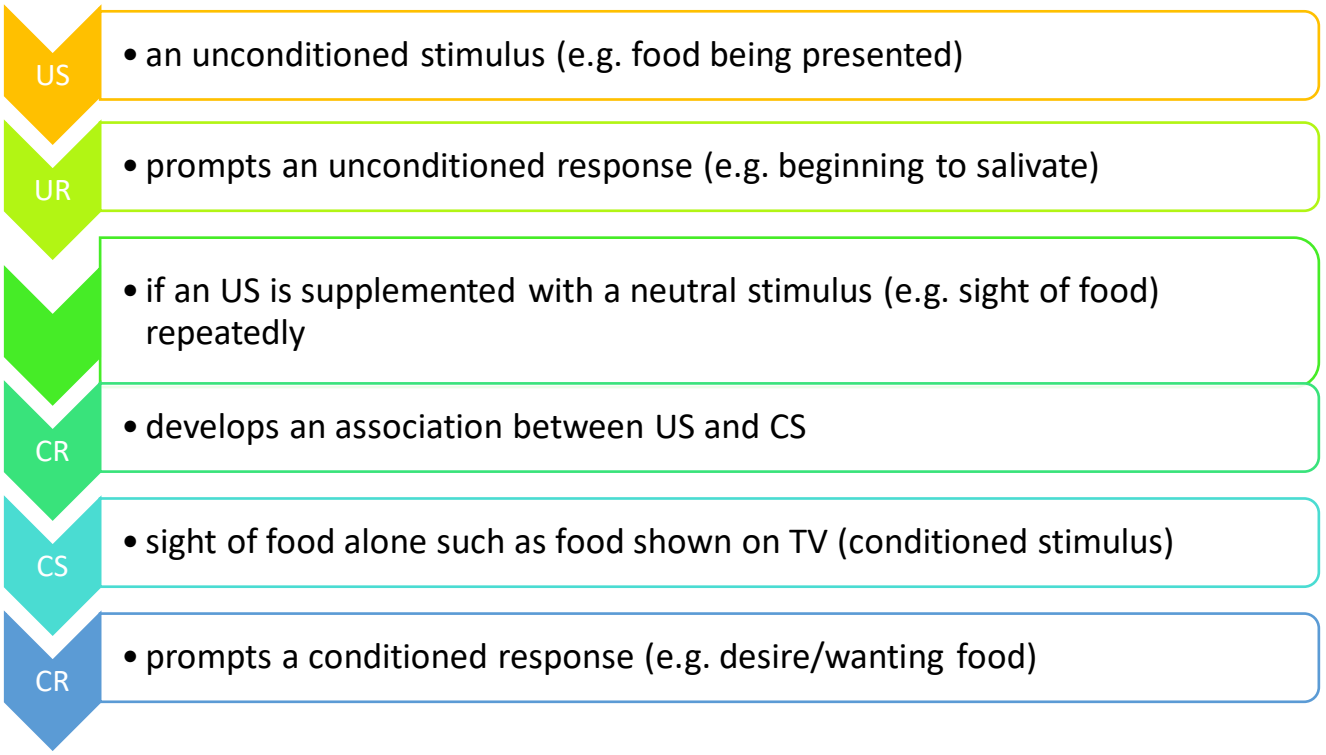
Research has suggested that food-associated cues play an important role in over-eating by inducing appetitive responses (e.g., food cravings), stimulating people to overconsume (van den Akker, Schyns & Jansen, 2018). Although scholars have highlighted the importance of human Pavlovian learning specifically in food cue-reactivity and its contribution to overeating studies, only a few studies have applied this to scientific research (Bouton, 2011; Jansen, Schyns, Bongers, & van den Akker, 2016). Pavlovian classical conditioning (Pavlov, 1927) refers to a learning theory that elucidates the manner in which creatures form associations between experiences to predict hazards or food (Andreatta & Pauli, 2019).

Classical conditioning signifies that relevant instinctive stimuli (unconditioned stimuli: US) can become associated with irrelevant or neutral stimuli if the stimuli have been repeatedly paired together. For example, when food is presented, it is an unconditioned stimulus (US) that will provoke an unconditioned response such as salivation (UCR). If the US is presented together with a neutral cue (i.e., sight, smell or taste of food) repeatedly, this cue (now becoming a conditioned stimulus: CS) will develop

an association with the US.

Consequently, this associated CS will incite appetitive responses (i.e., cravings for food as a conditioned response: CR) (Andreatta & Pauli, 2015; Myers, Martin & Apolzan, 2018; van den Akker, Nederkoorn, & Jansen, 2017) and ultimately stimulate food intake (Jansen, 1998; Pavlov, 1927). Refer to Figure 1 below for the illustrated example of the classical conditioning adapted from Collin, C. and DK Publishing, Inc. (2012).

Figure 1-1 Pavlovian classical conditioning on appetitive stimuli (adapted from Collin, C. & DK Publishing, Inc., 2012).



For instance, consider James who constantly eats crisps in the afternoon when watching his favourite TV programme (CS: watching his favourite TV programme in the afternoon). Eating crisps will prompt an unconditioned response (UCR: increased salivation). This context may develop an association with eating crisps (US), and if the CS has associated with the US, just watching James' favourite TV programme (CS) will

prompt desire for the crisps (CR) and motivate consumption of the crisps. In theory, any cue can develop an association with palatable food consumption, including emotions, cognitions, context, location, time, hunger, satiety, the sight, sound or smell of food (Jansen, 1998; van den Akker, Schyns & Jansen, 2018; Wardle, 1990).

Through Pavlovian conditioning, the unconditioned stimulus (i.e., US, such as palatable foods), develops connections with the internal and external inducements (i.e., the conditioned stimulus, CS) that are fundamental incentives due to their pleasing effect (Berridge, 2009). Because of this connection between external cues and food consumption, the central appetitive state is prompted to activate, resulting in a variety of physiologic and psychological responses (Fedoroff, Polivy, & Herman, 2003; Jansen, 1998). According to van den Akker, Stewart, Antoniou, Palmberg and Jansen (2014), this central appetitive state refers to responses to food cues following an association between palatable food (US) and food related cues (i.e., smells, images, food related cognition etc.)

The activation of this central appetitive state due to food reaction includes physiologic preparatory responses (i.e., cephalic phase, salivation), psychological responses (i.e., urge, desire to eat), and neurocognitive responses (i.e., brain activation patterns). Psychological responses include the incentive salience process which facilitate in governing the motivational triggers in the reward system (i.e., wanting or desire for food). The cephalic phase responses (i.e., physiologic responses) facilitate the body to better digest, absorb and process nutrients, and together, these responses stimulate the body to acquire and consume food (Jansen, 1998; van den Akker, Stewart, Antoniou, Palmberg, 2014; van den Akker, Schyns & Jansen, 2017).

1.3.2 Food Cue-Reactivity Theory

In this section, the Food Cue-Reactivity (FCR) theory, which is the core theory used to make predictions in the current thesis will be reviewed. The section will discuss the processes involved in FCR and the current literature supporting FCR. Studies on the effects of food cues on children's eating behaviour have often been based on the assumption of the Food Cue-Reactivity theory, in which initiation of craving for foods is triggered by the representation of food-related cues (Jansen, 1998, Nederkoorn & Jansen, 2002). The theory was first developed in the addiction field, when exposures to drug/alcohol cues prompted cravings and increased psychophysiological reactivity among substance abusers (Robbins, Ehrman, Childress, & O'Brien, 1997). Moreover, scholars have suggested that the craving following exposure to cues is a classically conditioned response (Drummond, Tiffany, Glautier, & Remington,1995).

Repeated experience of drug or alcohol consumption would result in an association between the cues that are related or present at the time of consumption and the rewarding effects of the experience (Pavlov, 2010). This association between drug/alcohol experience and the cue is generally based on the principle of classical conditioning. This occurs when originally neutral cues (i.e., bottles of alcohol or needles) that are recurrently paired with drug or alcohol (US: unconditioned stimulus) develop an inducement connection and become the conditioned stimulus. Thus, through this Pavlovian association that the environmental stimuli come to be a significant inducement of consequent drug/alcohol-seeking behaviour (Robinson & Berridge, 1993). For instance, when a person with a history of alcohol abuse sees alcohol-related stimuli or images, physiological reactions occur in the brain. This occurrence of reactions is known as cue-reactivity. This response

is due to the process of classical conditioning, in which certain cues (i.e., seeing a person drinking alcohol or images of alcohol bottles) develop a strong association with the alcohol consumption experience (Wiers et al., 2015).

Expanded from classical conditioning and drug cue-reactivity theories, the Food Cue-Reactivity theory emphasises on the conditioned responses (physiological and/or psychological) following the conditioned stimulus that was learned previously through the association of certain cues. This means that every time palatable food is eaten, it can develop an association with other internal or external environmental cues, and these associated cues subsequently stimulate cue-reactivity upon their next encounter (van den Akker, Schyns & Jansen, 2018). In other words, FCR occurs when the cues encountered have been learned or experienced previously through Pavlovian classical conditioning.

The Food Cue-Reactivity theory indicates that food cues that were associated with future consumption or motivation to eat, activate a sequence of physiological responses such as heightened salivation, heart rate and gastric activities (Nederkoorn, Smulders, & Jansen, 2000) as well as psychological responses including enhanced concentration for food-related cues (Nijs, Franken, & Muris, 2010; Nijs, Muris, Euser, & Franken, 2010; Folkvord et al., 2016), thoughts and urge towards food consumption (Carter & Tiffany 1999; Jansen, 1998; Herman & Polivy, 2008). Jansen's Food Cue-Reactivity model (Jansen, 1998) suggests that individuals with a history of overeating, such as binge eaters and overweight individuals, show heightened cue-reactivity in the presence of certain cues. Research on food cue-reactivity among these populations supports Jansen's proposition in which exposure to appetitive stimuli increased consumption (Jansen et al., 2003; Sobik, Hutchison, & Craighead, 2005; Temple, Giacomelli, Roemmich, & Epstein, 2007; Tetley,

Brunstrom, & Griffiths, 2009).

It has been suggested that the environment influences human eating behaviour through external sensory cues (e.g., the sight, taste or smell of food), emotional facets and cognitions (e.g., learning and thinking processes) by modifying the non-homeostatic control of eating behaviour (Berthoud, 2011; Cornier et al., 2009). Based on the learning theory (i.e., classical conditioning), the FCR proposed that food (unconditioned stimulus; US) when ingested, stimulates a metabolic response (unconditioned response; UCR), that will develop links with food-related cues (i.e., smell, sight or taste). These food-related cues are performed as conditioned stimuli (CS), and consecutively incite cue-reactivity (conditioned response; CR).

According to FCR, the activation of cue-reactivity will result in conditioned responses of both psychological (i.e., desire to eat or cravings) and physiological states (i.e., increased salivation, insulin release, cephalic phase response), sequentially enhancing consumption (Jansen, 1998). These responses will consequently increase the consumption of cued food. Based on this notion, the images and cues (those that imply food intake) exposed in the media (i.e., television and the internet) might perform as conditioned stimuli that trigger cue-reactivity and craving (Jansen, Havermans & Nederkoorn, 2011) which ultimately leads to food consumption. Refer to Figure 1.2 for the illustration of the FCR processes.

Figure 1-2 The illustrated process involved in the activation of cue-reactivity based on FCR (developed by the present author).

For example, consider Lily who eats a variety of foods every day. The food Lily consumed is considered as US which stimulates a metabolic response (UR). This response will develop links with food-related cues such as smell, taste and sight of food (CS) every time Lily eats. So for instance, if Lily had eaten ice cream before, she would know how it looks, smells, and tastes. Consequently, when Lily watches a cartoon that features an image of an ice cream (CS), this event will reactivate both psychological and physiological responses (CR). Lily will begin to yearn for an ice cream (i.e., psychological response) and salivates (i.e., physiological response). These responses, according to FCR, will lead to food consumption.

Additionally, learning theory also anticipates that conditioned FCR will be reduced after extinction, a process of repeated CS with no-US pairings (Jansen et al., 2011). The process of Pavlovian extinction has been explained by FCR theory which indicated that during "a most straightforward Pavlovian extinction procedure, the cue or context that once signalled intake remains systematically unreinforced" (Jansen, Schyns, Bongers & van den Akker, 2016, p. 175). This suggests that, for an instance, when an individual has developed a conditioned desire (i.e., food wanting or craving) for popcorn during TV watching, and s/he quits eating popcorn, this person is exercising extinction. Based on the

FCR paradigm, it is predicted that the process of extinction will eventually diminish the conditioned desire for popcorn, consequently ceasing food intake and reducing overeating (Jansen et al., 2011).

Grounded on the FCR paradigm, studies concerning the effect of food cue exposure have found that a series of physiological responses are increased following the exposure to food cues. Nederkoom, Smulders, and Jansen (2000) have reported that participants who were exposed to 16 minutes of their favourite foods through visual (i.e., looking at the foods), olfactory (i.e., smelling the foods), cognitive (i.e., envision the taste of the foods) and gustatory (i.e., tasting the foods) exposures, prompted increases in salivation, blood pressure, skin conductance, gastric activity and heart rate. Similarly, another study by Nederkoorn and Jansen (2002) has observed increases in salivation, gastric activity and heart rate in some of the participants. The authors also found that participants' cravings were greatly increased after the exposure to food cues, compared to the exposure to a neutral cue (i.e., a bar of soap) (Nederkoorn & Jansen, 2002). This effect on food cravings was also reported in other studies, where the authors found that exposure to the sight, smell and taste of participants' favourite foods can stimulate food cravings (Alsene, Li, Chaverneff, & de Wit, 2003; Nederkoorn, Smulders, Havermans & Jansen 2004; Sobik, Hutchison, & Craighead, 2005).

Apart from the physiological responses reported in the studies discussed above, several studies have also indicated that exposure to food cues can prompt consumption of cued food. For example, Fedoroff et al. (1997) conducted research on the effect of food cue exposure on food-deprived participants. In their study, participants were exposed to either no cue, olfactory food cue (i.e., the smell of pizza), cognitive food cue (i.e., thinking

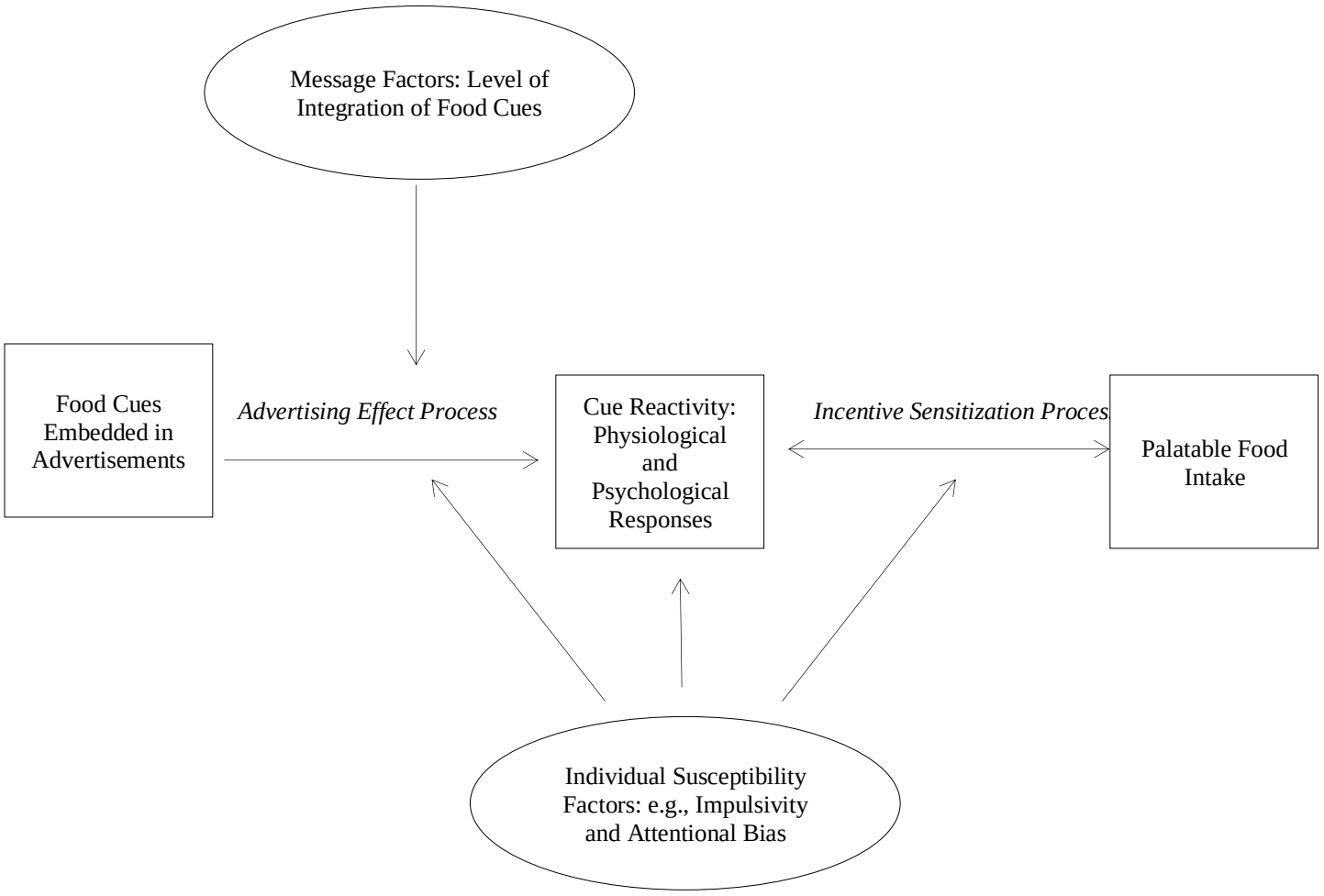
about pizza) or a combination of two types of food cues (i.e., smell and thinking of pizza) for ten minutes. The authors found an increase in appetitive responses among participants who were exposed to either the smell, the thought of food or the combination of these. The authors also reported that food cue exposures promoted greater food consumption compared to those with no exposure to any food cue.

1.3.3 The Reactivity to Embedded Food Cues in Advertising Model (REFCAM)

Research concerning the effects of food cues on dietary habits has been based primarily on the theory of FCR. However, the majority of the previous studies have particularly focused on adult populations, with only a handful of studies have examined the effect of food cues on children's eating behaviour. Expanded from the Food Cue-Reactivity theory, a recent model was developed by Folkvord et al. (2016) particularly aiming to understand the effect of food cue exposures in advertising. The authors further noted that the integrated model was developed in order to specifically evaluate children's responses to food marketing.

The Reactivity to Embedded Food Cues in Advertising Model (REFCAM) proposed that food cues depicted through advertising may result in psychological and physiological responses, which are influenced by a child's susceptibility toward the cue (see Figure 1.3 below for the illustration of REFCAM). According to this model, individual susceptibility factors toward food cues, such as impulsivity and attentional bias, play an important role in determining subsequent food consumption.

Figure 1-3 The Reactivity to Embedded Food Cues in Advertising Model (REFCAM).



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Food cues refer to any visual, auditory or mental signal that activates behavioural response toward eating. Importantly, the model proposed that food cues exposed in the food promotion context may result in greater consumption of highly palatable foods. REFCAM states that there are three foundational assumptions of the framework. First, there are the two-step processes of advertisement and eating behaviour. In other words,

food cues that are depicted within advertisements function as conditioned stimuli by stimulating children's responses towards the cued exposed. This process of advertising effect leads to the activation of Food Cue-Reactivity - physiological (i.e., increased salivation) and psychological (i.e., feelings about foods) responses towards the embedded food cues. When children's cue-reactivity is activated, motivation towards palatable foods is increased, resulting in greater consumption of foods.

The second assumption is that advertisement message factors determine the level of elaboration. Message factors such as the level of integration of food cues (i.e., interactive advertisement) can play an important role in facilitating the advertising effect process. Thirdly, individual dispositional factors such as impulsivity and attentional bias regulate children's susceptibility to the food cues exposed in advertisements. Individual differences in a context of appetite and eating behaviour have been mostly researched among adult population, thus the importance of these characteristics in understanding children's eating behaviour are limited. Therefore, Folkvord et al. (2016) suggested that the REFCAM model might be a useful guiding framework in investigating the relationship between food cues exposure in advertisements and children's food behaviour.

In summary, this section has synthesized the two pertinent theories guiding our research on the effect of food cues on children's eating behaviour. The Pavlovian associative learning and the Food Cue-Reactivity theory have provided a theoretical framework for perceiving individuals' responses toward food cues depicted in the environment. Although the REFCAM model has extended the FCR by supplementing the process of cue reactivation with cue message factor and individual susceptibility, the specific mechanism involved in the process of modification of children's eating behaviour

following cue exposures is still yet to be explained. Thus, based on the theoretical framework set out in the theory discussed above (i.e., the Food Cue-Reactivity theory), the present thesis aimed to explore the effect of media food cues on children's eating behaviour. To further comprehend how media influence behaviour, the following section will review the relevant works of literature concerning the development of consumer socialization among children.

1.4 Consumer socialization of children

According to Stupening (1982), the effects of media advertising can be distinguished into four dimensions; socialization, behavioural, perceptual and developmental. Socialization is believed to be the most important element in explaining other dimensions of advertising effects (Stupening, 1982). Therefore, to explore how media and advertising affect children's behaviour, this section will elaborate on the processes involved in consumer socialization among children, as well as discuss factors and agents which contribute to children's consumer socialization.

Consumer socialization can be defined as a process by 'which young people acquire skills, knowledge, and attitudes relevant to their functioning in the marketplace' (Ward, 1974, p.2). A key aspect of consumer socialization research is the identification of significant influences on that process (Ward, 1974). The majority of research concerning consumer socialization was carried out during the 1970s and early 1980s (Bandura, 1971; Bandura & Walters, 1977; Barenboim, 1981; Carlson & Grossbart, 1988; Moschis & Churchill, 1978; Moschis & Moore, 1979; Selman, 1980; Ward, 1974). Following these, John (1999) has provided an example of research on the consumer socialization process

by integrating theories of consumer socialization and developed a theoretical framework for understanding the socialization process among children.

In examining children's consumer behaviour, researchers have considered the issue from various perspectives pertaining to children's development towards becoming consumers including their marketplace knowledge, consumerism strategies, factors influencing socialization and their roles as consumers (John, 1999). Researchers have argued that the process of consumer socialization involves two developmental approaches which are related to Piaget's cognitive development and social development theory (Piaget, 1952; Piaget, 1964). The majority of studies (Chestnut, 1979; Calder, Robertson & Rossiter, 1975; Wackman & Ward, 1976) investigating children's consumer socialization have been based on these two frameworks.

Piaget's theory of cognitive development (1952) suggested four main stages; sensorimotor, preoperational, concrete operational and formal operational in which children's cognitive abilities are progressed through different stages of their childhood. Developmental psychologists interested in the potential impact of advertisements on children have adopted Piaget's theory in predicting children's development of advertising literacy. Although the Piagetian theory has been highly criticised (Lourenço & Machado, 1996), mostly regarding the concept of development observed in a sequence of stages, as well as the theory's underestimation of children's thought on abstract thinking and reasoning, it is nevertheless one of most influential theories in understanding children's development.

Based on Piaget's notion of cognitive development theory, Valkenburg and Cantor (2001) identified four stages involved in the process of consumer development among children. The first stage occurs during infancy (0-2 years) when children start to develop an interest in visual images and bright colours in television programmes, beginning to request the product advertised in the advertisements when they are 18 months old. The second phase, which is considered the most vulnerable stage, starts when children are in preschool (2-5 years). With their limited knowledge of television and advertisements and difficulties in differentiating between real and fantasy, children at this age find it hard to resist enticing products. This may result in tantrums when their request is being declined. Valkenburg and Cantor (2001) noted that two-thirds of the parents in their study reported such conflicts. The third stage (5-8 years) occurs when children start to become more competitive consumers by developing more subtle strategies and negotiation skills in making a purchase request to their parents. In the last stage (9-12 years), children are believed to exhibit sophisticated consumer behaviour, as they are able to use media critically and started to have preferences towards certain products' branding (Valkenburg & Cantor, 2001).

However, information processing theory proposed a different approach to explaining children's skills in acquiring and processing knowledge (Roedder, 1981). Instead of explaining in terms of Piaget's stages, children have been divided into three stages - strategic processor, cued processor and limited processor - depending on their ability to process information (Roedder, 1981). Children below the age of seven are categorized as limited processors because of their lack of utilizing information processing skills in learning. From the age of seven to eleven, children are considered as cued

processors due to their having enhanced skills and strategies in processing information but still needing to be aided by explicit cues. Children aged twelve and older are seen as strategic processors as they are able to fully utilize their skills in processing and retrieving information (John, 1999).

Social developmental theories focused on various topics including children's interpersonal and attachment relationships, and moral and prosocial development (Schaffer, 1996; John, 1999). The most pertinent literature is Selman's (1980) on social perspective-taking and Barenboim's (1981) on impression formation. Selman's view consists of several stages which begin from preschool years through adolescence. The first stage (3-6 years) or egocentric stage is when children's view is limited to their own perspectives. The second stage (6-8 years), also known as social informational role-taking, occurs when children are starting to have awareness of others' different views. However, according to Selman (1980), others' views are thought to arise as a result of different information, as children are still unable to understand that others might have different views on the same situation.

As children move to the next stage (8-10 years), the self-reflective role-taking phase, they are able to accommodate others' perspectives (Selman, 1980). Finally, Kuhlmann (1983) suggested that researchers seeking to understand the course of socialization formation should focus on several factors, which are; 1) the social learner, which includes their age and developmental stage, 2) the socializing agents, with whom the learner interacts, 3) the interaction settings in which learning occurs, 4) the process or methods of learning, and 5) the effects of learning in terms of inclination and behaviour.

To further explore how consumer behaviour developed among children, the next section will discuss relevant agents/factors influencing consumer socialization in children. We will also discuss children's perception and cognitive defence toward advertising as well as media literacy among children.

1.4.1 Agents contributing to consumer socialization in children

Consumer socialization theorists suggested that attitudes and behaviours related to consumerism are learned during childhood and adolescence through the medium of communication and interaction between a consumer and four main socialization agents: parents and relatives, peers, media (advertising), and schools (Moschis & Churchill, 1978; Ward, Klees, & Robertson, 1987). The majority of research has established that parents play the most important role in the consumer socialization process (Larson & Richards 1994; Campbell 1969; Neeley, 2005) and have a significant influence on children's consumer acquisition (Lum, 2006; Mittal & Royne, 2010; Moschis & Moore, 1979). As children begin to learn about being a consumer from an early age, parents are believed to have the most influential power in developing their children's market knowledge (Biddle, Bank & Marlin, 1980; Shim, 1996).

However, as children grow older and become more mature, attending schools and other social events, they start to shift towards other agents (Singh, Kwon & Pereira, 2003) such as media, siblings and peers which are also believed to perform an important function in shaping children's consumer knowledge (Churchill & Moschis 1979; Dotson & Hyatt, 2005; Kerrane, Bettany & Kerrane 2015; Moschis & Churchill 1978; Wang, Yu, & Wei 2012). Several researchers have considered the influence of socialization agents on

children and adolescents' market knowledge (Chan, 2006; John, 1999; Lueg & Finney, 2007). Children's attitudes and values towards functioning as independent consumers are shaped from birth until preteen age by the involvement of various forms of interaction with and observation of those agents (John, 1999; Epp & Price, 2008; Ward, 1974).

Family as the main agent. Family is one of the main agents contributing to the formation of children's consumer socialization and the development of scepticism towards advertising messages (Carlson, Grossbart & Stuenkel, 1992; Caruana & Vassallo, 2003). Baiocco, D'Alessio and Laghi (2009) suggested that parents play a role in shaping and developing children's attitudes, norms and values related to functioning as a consumer with both direct and indirect parental influences (Wackman, Wartella & Ward, 1977). Parents play an important role in establishing their children's consumer behaviour (Moschis, Moore & Smith, 1984; Nicklas et al., 2001; Wackman et al., 1977) through direct parenting styles, communication patterns and mediation strategies (Carlson et al., 1994; Fujioka & Austin, 2002; Kerrane & Hogg, 2013) and indirect modelling influences (Brown & Ogden, 2004; Contento et al., 1993; Nicklas et al., 2001). Both direct and indirect parenting influences play an important role in children's attitudes and behaviour towards their consumer socialization development.

According to several socialization theorists, direct parental influence includes family communication patterns (John, 1999; Kerrane & Hogg, 2013), in which can be seen two equivalent elements: 1) socio-oriented, including protective and laissez-faire, and 2) concept-oriented which consists of consensual and pluralistic approaches (Carlson et al., 1994; McLeod & Chaffee, 1972; Moschis & Mitchell, 1986). Clarke (2008) noted that parents implementing a concept-oriented style often encourage children to participate and

develop their own views. Whereas, in maintaining harmonious relations within the family, the socio-oriented parents are likely to control and monitor their children.

Another type of parental influence identified in the literature is the strategies that parents use in modifying the effects of advertisements. This is also called parental mediation, which refers to intervention strategies that parents used in order to provide guidance and control toward children's media usage (Warren, 2001). These strategies can be categorized into two mediations; active and restrictive (Carlson & Grossbart, 1988; Wiman, 1983). Active mediation involves engaging in discussion and comments about television advertising and actively clarifying the nature and intent of advertising messages to children. Parents who are practising active mediation guide their children through reasoning and discussion about media content with their children,

On the other hand, restrictive mediation includes control over children's exposure to television advertising (Buijzen & Valkenburg, 2005). This strategy involves limitation of children's media access. Buijzen and Valkenburg (2005) suggested that active mediation together with a concept-oriented communication pattern has been shown to have more effective results in reducing undesired advertising effects and shaping children's consumer behaviour. This is because strategies based on critical discussion and dialogue between parents and children can help children in nurturing their critical thinking skills and scepticism towards media (Fujioka & Austin, 2002).

Peers as consumer socialization agents. Apart from parents and family, peers are another socialization agent because as children move into Piaget's analytic stage, starting school and engaging in social activities (e.g., playgroup, breakfast club), peers can

influence children through both modelling and experience (D'Alessio, Laghi & Baiocco, 2009). Peers' perspectives and viewpoints as well as values and norms created within peer groups play a role in engaging children's attitudes towards advertising messages and brands (Valkenburg & Cantor, 2001).

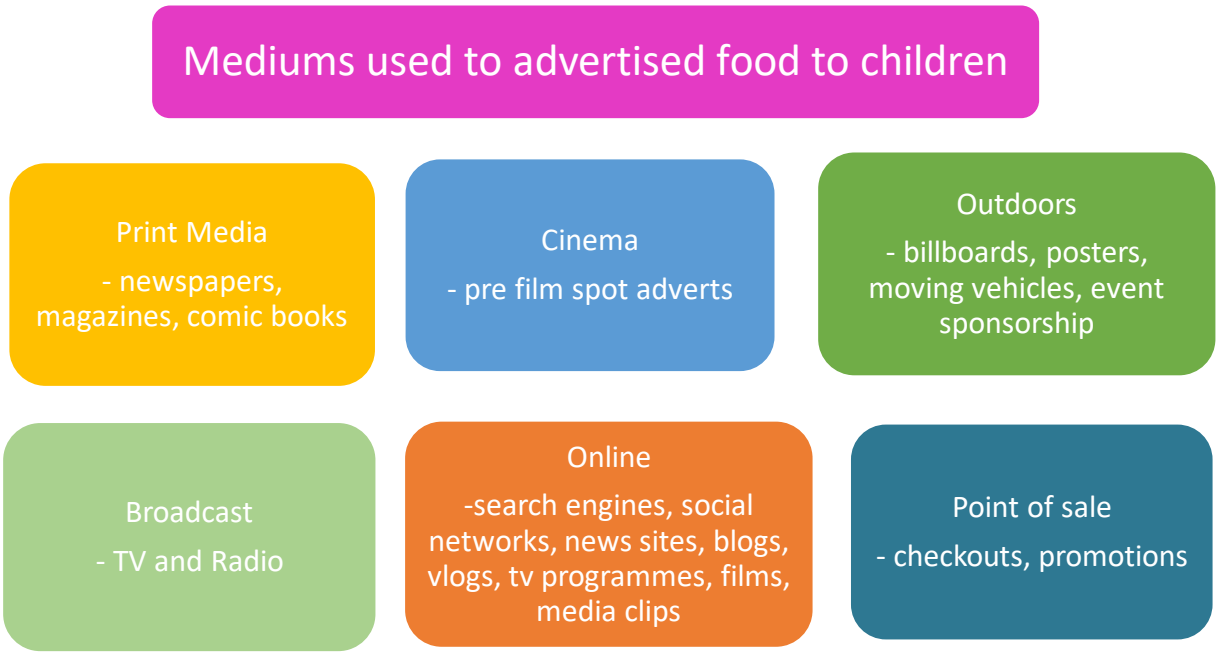
1.4.2 Media food exposure as an environmental agent toward consumer socialization

The food and beverage industry spends billions of dollars each year to market its products to children and young adults (Escalante de Cruz et al., 2004; Nestle & Jacobson, 2000; Powell, Harris & Fox, 2013), through multiple marketing media (see Figure 1.3 below) including television, magazines, event sponsorship, retail environments, viral marketing and advergames (Boyland & Whalen, 2015; Clark & Brownell, 2012; Chapman, Nicholas, & Supramaniam, 2006). Although television advertisements remain the most frequent medium of advertising in some countries, new media advertising such as the internet and viral marketing are becoming an important platform for marketing. Research on food advertising for children has been conducted around the world including in the UK (Boyland et al., 2011, Halford et al., 2007; Lewis & Hill, 1998), Australia (Kelly et al., 2011; Neville, Thomas & Bauman, 2005), the Netherlands (Buijzen, Schuuman & Bomhof, 2008), New Zealand (Jenkin, Wilson & Hermanson, 2009) and in the USA (Powell et al., 2011).

Research has shown that children are frequently being exposed to non-core food advertisements in the traditional media (i.e., television) (Boyland et al., 2011; Kelly et al., 2010). However, such research focuses mainly on television, with very few studies focusing the new media (Boyland & Whalen, 2015; Folkvord et al., 2014; 2016; 2017;

Norman et al., 2020), and the print media, such as comics and magazines (Cowburn & Boxer, 2007).

Figure 1-4 The advertising channels used in promoting foods to children (source: Boyland & Whalen, 2015)



Kelly et al. (2010) took a global perspective on the extent of television food advertisements to which children are exposed. Kelly et al., (2010) carried out research in thirteen countries covering Asia, Australia, Western Europe, America and Canada. The results revealed that unhealthy food advertisements were often broadcast during children's peak viewing times in all countries observed. Kelly et al.'s conclusions were supported by Boyland et al. (2011), who found a similar result in the UK. The authors claimed that an eighth of all advertisements were for food items, and mostly for unhealthy foods (Boyland et al., 2011). In addition to traditional media, exposure to non-core food advertising in the digital media (i.e., the internet and social media) has been shown to increase children's

consumption of energy-dense foods (Boyland & Whalen, 2015).

A more recent study by Norman et al. (2020) has demonstrated that brief exposure to unfamiliar, unhealthy food brands on TV and via online promotions increases children's brand recognition and stimulates positive attitudes towards the advertised brands. Another recent study conducted by Smith et al. (2020) investigated the persuasive influence of food marketing exposure via online gaming on children's food behaviours. The authors found that children's food choices of the exposed unfamiliar brand were influenced by a specific technique used in online video advertising (i.e., rewarded video advertising). Research on the prevalence and nature of food advertising targeted at children will be discussed further in Chapter 2.

1.4.3 Other factors influencing consumer behaviour

Apart from family, friends and media, there are several demographic factors that influence individuals and their behaviour. Factors such as socioeconomic status or culture might influence consumers in making their purchase decision. Haushofer and Fehr (2014) found that individuals living in a state of poverty made different economic choices from others. Another factor that acts as an influence on consumer decision making is advanced consumer age (Carpenter & Yoon, 2011; Carstensen et al, 2011; Moody, Sood, Drolet, Schwarz & Yoon, 2010). The brain circuitry involved in consumer decision making, and the mediation of the process by chemical substances such as dopamine and serotonin, are subject to biological maturation. This biological maturity is associated with changes in plasticity due to the accumulation of experience or changes in motivational goals (Samanez-Larkin, Li & Ridderinkhof, 2013).

Moreover, previous research has suggested that children's age and their cognitive development play important roles in shaping their advertising knowledge as well as defending themselves against the detrimental influence of advertising (Rozendaal, Buijzen & Valkenburg, 2009; Valkenburg & Cantor, 2001). Thus, having insights on how individual maturity shapes brain connection and the development of children's perception of persuasive intent, can provide a better understanding of the mental components related to consumer psychology across the life span.

1.4.4 Children's perceptions of advertising and persuasive intent

Researchers suggested that cognitive defences against advertising may help in reducing children's susceptibility to the impact of media promotion. (Rozendaal, Lapierre, Van Reijmersdal, & Buijzen, 2011). Cognitive defences can be referred to as children's perception of advertising knowledge and their ability to use that knowledge against the persuasiveness of advertising (Brucks, Armstrong & Goldberg, 1988; Gunter, Oates, & Blades, 2005; Kunkel et al, 2004; Livingstone & Helsper, 2006). Previous studies in the area of children's perception of advertising intent assumed that children develop cognitive defences against advertising using multiple skills throughout their childhood (Rozendaal, Lapierre, Van Reijmersdal & Buijzen, 2011; Carter et al., 2011). Researchers stated that the most fundamental skills in cognitive defences are; 1) the advertising recognition, which is children's capability to discriminate advertising from television programs based on perceptual structures (Bijmolt, Claassen & Brus, 1998; Kunkel et al, 2004) and 2) the understanding of advertising; children's ability to perceive both selling and persuasive intent of advertising (John, 1999).

In a study concerning children's advertising knowledge conducted by Mallalieu, Palan and Laczniak (2005), the authors found that older children, with a mean age of 11 years old, had a sophisticated understanding of persuasive intent compared to younger children (aged 5-7 years). Mallalieu et al. (2005) also examined children's scepticism regarding advertising claims and further reported that older children were more sceptical about the claims made and strategies used by advertisers. Indeed, Rose, Merchant and Bakir (2012) reported that although children (aged 8-10 years) may express a general knowledge of the persuasive message of advertising such as the selling intent, only a few children in their study could demonstrate scepticism towards specific advertising claims. The authors further suggest that children's application of persuasion knowledge and their abilities to interpret manipulative messages such as advertising intent or motivation behind persuasive messages are varied within the stages of their cognitive development (Rose, Merchant & Bakir, 2012)

In earlier research by Oates, Blades and Gunter (2002), children under the age of five years had difficulty recognizing the differences between advertisements and television programmes. However, later in their childhood, around the age of eight years, their cognitive defences have progressed so that most children at this age were able to distinguish advertisements from programmes, as well as develop an understanding of the advertising intent (Kunkel, 2004). In contrast, Rozendaal, Buijzen and Valkenburg (2009) investigated whether children's cognitive defences do help in reducing their susceptibility to the effects of advertising and how this varied across age groups (aged 8-12 years). Rozendaal et al. (2009) found a relationship between advertising exposure and children's desire for advertised products. Their results showed that although children (aged 8-9 years)

can recognize and understand the selling intent of advertising. Advertising knowledge did not mediate their susceptibility toward the persuasive intent of advertising. Understanding of advertising's persuasive intent is only effective among older children (aged ten years and above).

Indeed, John (1999) argues although children might be able to distinguish advertising content, they may not have the ability to retrieve and apply defence skills to fully understand advertisements until the age of twelve. In summary, children's perception of advertising knowledge varies with age. Even though some children may acquire advertising knowledge, and are able to understand the marketer's selling intent, they might not be able to apply that knowledge in defence against advertising. Therefore, it is important to provide children with media education to facilitate their understanding of media and advertising. The following section will further discuss media literacy among children.

1.4.5 Media literacy

Media literacy is the ability to access, comprehend and critically assess the contents of media as well as the creation of one's own media (Commission of the European Communities, 2006). Advertising literacy is the part of media literacy that focuses on the role of advertising influences in the media environment (The United Nations Educational, Scientific and Cultural Organization (UNESCO), 2011). Several modules of advertising literacy in UNESCO curricula include information about advertising placement and regulations, political advertising, advertising design, the evaluation of claims and the semiotics of advertising. Reynolds (2006) suggested the use of contemporary culture in

classrooms to create an integrated connection between various subjects and develop critical thinking in children.

An effective definition of advertising is that it is a "brand-initiated communication intent on impacting people" (Dahlen & Rosengren, 2016, p. 334). The authors also suggest the three aspects which are important in understanding the capability of advertising; specifically "the constant addition of new media and formats, the evolution of new consumer behaviours related to advertising, and growing acknowledgement of extended effects of advertising" (Dahlen & Rosengren, 2016). As argued in traditional literature, advertising exists to inform, persuade and sell (Blosser & Roberts, 1985; Macklin, 1985; 1987; Ward; 1972). However, concerning children's understanding of advertising intent, studies have suggested that in addition to the conventional intents of advertising (i.e., informative and persuade/selling), children might have a different perspective on what advertising is. Researchers have debated that children's perspectives on advertising intent includes social purposes and entertainment (Lawlor & Prothero, 2002; van Reijmersdal, Rozendaal & Buijzen, 2015).

Children who lack advertising literacy are more susceptible to the effect of advertising compared to adolescents, who are more media literate (Livingstone & Helsper, 2006). Researchers believe that children's knowledge of advertising works as a 'cognitive defence' against the influence of deceptive advertising (Gunter, 2015; Kunkel et al., 2004). According to Rozendaal et al. (2011), the most important element involved in the defence against advertising influences is the competencies in retrieving and applying the advertising knowledge following the exposure to those advertised products. Rozendaal et al. (2011) suggested that a negative attitude and scepticism towards advertising messages

can act as a protection against the influence of advertising.

They further suggested that for the children to utilize their cognitive abilities in processing the defence mechanism, they should have the ability to use their cognitive control to stop and think about the message being put forward. Young children who lack these cognitive abilities and understanding of the nature of advertising are likely to be persuaded by advertisements and make more purchase requests for the product advertised (Kelly et al., 2009). According to Buijzen and Valkenburg (2005). Parents play an important role in mediating the effects of advertising. Therefore, it is vital for parents as well as teachers to work together in providing essential education to children to support them in improving media literacy.

Throughout this section, we have explained the development of children's consumer socialization and how their consumer socialization was cultivated. Factors influencing children's consumer behaviours as well as children's understanding of persuasive intent have also been reviewed. In the next sections, we will provide a review of the media landscape that children are currently living in and how exposure to the media environment influences children's behaviour.

1.5 Current media food environment surrounding children

The 'post-Millennial' generation of children and adolescents are surrounded and consumed by technologies in an integrated media environment or the 'digital age' (Chaudron et al., 2015). "Post-Millennials" refers to those born after 1996; ages 6 to 21 in 2018 (Pew Research Centre, 2018). Piachaud (2008) elaborated on how childhood has changed over the past few decades in the UK, which leads to the commercialization of the

child. As family income has generally increased as a result of economic growth, levels of household expenditure have also increased, including spending on children (Piachaud, 2008). Children nowadays are living more solitary lives, in which they spend their past time alone with their own devices such as tablets or computers (Ofcom, 2019) compared to the generations before them (Piachaud, 2008). Apart from having social media networks to interact with their peers, children are spending more time with personal computers and tablets (Ofcom, 2019) in their bedrooms, which leads to sedentary behaviour. Furthermore, children's attitudes towards media have changed over time (Kostyrka-Allchorne, Cooper, & Simpson, 2017; Piachaud, 2008), alongside the development of new products in the market (Leiss, Kline, Jhally, Botterill, & Asquith, 2018), leading to a rapid rise in advertisement pressures towards children.

Traditional media such as television and radio have been extended with new media technologies such as smartphones, personal computers and tablets, which permit children instant access to entertainment, information, social engagement and marketing (Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). According to The Office of Communications (Ofcom, 2018), the majority of children aged between 3 and 15 years in the UK spend about 14 hours weekly watching television, 14 hours on the Internet and 10 hours playing digital/online games. As reported by Boyland et al. (2018), primary school children (aged 7 to 11) spent on average 38 hours weekly on both television and the Internet, with 28 hours exclusively on commercial media channels (television and Internet). The increased amounts of media usage among children are believed to be associated with more sedentary lifestyles and less outdoor activity (Matheson, Killen, Wang, Varady, & Robinson, 2004; Salvy & Bowker, 2014), which are among the factors

leading to childhood obesity.

However, Ofcom (2017) also noted that despite the rapid emergence of integrated media forms and the increased time spent online, television remained the main device for entertainment among children in the UK, and one that children used almost every day. Children in the US see up to 21 television advertisements per day (Kaiser Family Foundation, 2007), with non-core food advertisements being the most frequently shown. Harris et al. (2015) found that US children were exposed to sweets and candy advertisements in nearly 500 advertisements in 2011, and this number had increased by 75% from previous years. Boyland et al. (2011) found that in 2008, children were exposed to food and beverage items regularly and that these were the third most commonly advertised products in the UK. Boyland et al. also found that large numbers of unhealthy food and beverage advertisements were shown on children's channels and that such products were advertised more frequently during children's peak viewing hours.

Furthermore, children who spend more time engaging in media and new technologies are believed to be highly exposed to food marketing (Boyland & Whalen, 2015), as researchers have reported that excessive screen usage (i.e., television viewing, playing computer games, and engaging in new technologies such as tablet and smartphones) may be associated with adverse health outcomes such as children being overweight or obese (Bentham et al., 2017). Researchers have also suggested that exposure to food advertising during watching television or surfing the Internet might be linked to children's desire for High Fat, Salt and Sugar (HFSS) foods that they have seen advertised (Boyland et al., 2018; Chambers, Freeman, Anderson, Macgillivray, & Chambers, 2015; Tatlow-Golden et al., 2016).

Apart from traditional advertising, food companies are now utilising the new media advertising to market their products to children (Kelly, Vandevijvere, Freeman, & Jenkin, 2015), particularly promoting high-calorie and nutritionally deficient foods such as sweets and confectionary (Linn & Novosat, 2008). Multiple techniques and advertising appeals are being employed to persuade children to buy or request products (Nicholls & Cullen, 2004). The majority of media advertisements are being directed at children as marketers believe that children present a major market (Blades, Oates, Blumberg & Gunter, 2014) and that they play a role as market influencers with influence over family spending decisions (McNeal, 1992). With new technologies and the expansion of the Internet, advertisers are reaching children through different channels without any barriers (Pettigrew et al., 2013). Nonetheless, in spite of having a diverse exposure to multiple platforms of media, children are still considered as vulnerable consumer because they are incapable to recognize marketers' commercial interests (Mau, Schramm-Klein, & Reisch, 2014). Scholars believed that these marketing are directed at children to stimulate interest which leads to purchase demands on parents (Isler, Poppers & Ward, 1987).

Indeed, parents often serve as the gatekeepers of their children's media exposure as well as their purchase consumption (Holiday et al., 2018). Researchers have argued that parents' role as the ultimate gatekeepers is vital in mediating children's media consumption and purchase intents (Lou & Kim, 2019) . This is because parental mediation of children's media consumption has been found to alleviate some of the adverse effects of the media on them (Collier et al., 2016). However, as children are now accessing media through new technologies such as personal computers and tablets, they are often being exposed to a wide range of marketing which parents are not aware of.

Exposure to such marketing is believed to encourage children's desirability toward the advertised products, which eventually results in children demanding these products from their parents. Children influence family buying decisions through purchase requests from their parents (McDermott, Sullivan, Stead, & Hastings, 2006). This is often referred to as pester power, or "nag factor" (Bridges & Briesch, 2006). Pester power can be defined as the ability of children to influence (i.e., by nagging) their parents into buying the products they desire (Gunter & Furnham, 1998). Due to the impact pester power has on the family buying decision, children are viewed as the future market, and are being aimed by the marketers to induce brand loyalty at a young age (Moore, 2004).

In summary, children are frequently being exposed to non-core food environment through multiple media channels. Although television is considered the main media platform for promoting foods among children, digital media are becoming more prominent as children's knowledge of technology expanded. Thus, the next section will further review interactive media advertising, involving the internet and advergames.

1.5.1 Integrated media advertising – the Internet and Advergames

According to Ofcom (2017), the use of the internet among children and adolescents in the UK had risen rapidly in recent years, and online gaming is becoming more popular among children aged 5 to 15 years old (Ofcom, 2019). Although children spent most of their leisure time watching television in previous years (Ofcom, 2017), the time they spend on a TV set (broadcast channels) is currently decreasing with most children preferring to watch television on their own devices (Ofcom, 2019). This decline in television viewing is believed to be transcended by online activities among children, as Ofcom (2019)

reported that children's time online has increased, and children are now spending more time on the Internet than watching broadcast television (Ofcom, 2019). Because of the change in media consumption among children together with stringent regulations on television advertising, marketers have now shifted their marketing strategies towards the new media platforms.

An integrated media advertising format known as advergames includes messages, brand logos and characters in a game form (Mallinckrodt & Mizerski, 2007). Advergames typically contain computer game features such as the opportunity to generate personal avatars and play several stages, attempting to convince children to play multiple times and revisit the company or brand's website (Santos, Gonzalo, & Gisbert, 2007). Advergames are the online platform designed by marketers to deliver their messages to young consumers through interactive digital gaming which includes 'embedded advertisement messages within the content of retail - accessible video games and online electronic games' (Dahl, Eagle & Báez, 2009, p.47).

In the US, approximately 80% of the food and beverage websites that are advertised on children's television channels offer advergames as part of their online content (Culp, Bell, & Cassady, 2010; Henry & Story, 2009; Lee et al., 2009). As this type of advertising is prevalent among children and adolescents (Cheyne, Dorfman, Bukofzer & Harris, 2013; Moore & Rideout, 2007) brands such as Kelloggs, McDonald's, Coca-Cola, KFC and Nestle have used advergames as part of their marketing strategies (An & Stern, 2011; Clarke & Svanaes, 2012; Culp et al., 2010; Moore & Rideout, 2007). Advergames are more effective than other digital marketing techniques as they provide for longer engagement and interaction between children and the brands or products (Moore, 2004; Moore, 2006)

and so increase the time spent on the marketer's websites (Grigorovici & Constantin, 2004). Advergames that are amusing or entertaining affect children's attitude favourably towards the brands being advertised (Lee et al., 2009).

Previous research has suggested that food advertising influences children's preferences, attitudes, and behaviour toward food (see section 1.5). The use of advergames amongst other food marketing is a further way to promote non-core foods (Clarke & Svanaes, 2012). Food advergames have been revealed to impact children's purchase requests (Lee et al., 2014; Van Reijmersdal et al., 2010), brand recognition (Van Reijmersdal et al., 2012), brand recall (Hernandez and Chapa, 2010; Van Reijmersdal et al., 2012) as well as their attitude towards the products being advertised (Hernandez et al., 2004; Hernandez & Chapa, 2010; Van Reijmersdal et al., 2010; 2012).

Most importantly, advergames have affected children's behaviour in terms of brand or product preferences (Dias & Agante, 2011; Mallinckrodt & Mizerski, 2007), choice (Hernandez & Chapa, 2010; Pempek & Calvert, 2009) and ultimately increase consumption of the food advertised (Folkvord et al., 2013; Harris et al., 2012; Pempek & Calvert, 2009). However, research concerning the impact of digital media on children's eating behaviour is limited. Thus, to further understand how digital and integrated media influence children's eating behaviour, the effects of food cues presented on integrated media (i.e online games) will be discussed further in the experimental chapters (Chapters 3 and 4).

Throughout this section, we have discussed and illustrated the significance of research concerning food promotions among children and the current media environment

surrounding children. In summary, children in this era are being overexposed to food promotion from all sorts of media outlets (Boyland & Whalen, 2015). With the expanded and integrated version of food marketing, it is becoming more difficult to protect children against the influence of food advertising. To further understand how food promotions affect children, the next section will provide a comprehensive review of the consequences of food promotion intended for children.

1.6 The effects of media food promotions on children

Non-core food depicted during television watching in childhood might have an impact on eating behaviour among children and adolescents (aged 7 to 11 years) (Birch, 1999; Harris, Bargh & Brownell, 2009). Scholars in a food advertising domain have suggested that excessive exposure to non-core food promotion is a dominant factor in children's unhealthy eating habits (Brownell & Horgen, 2004; Sahoo et. al., 2015; Stroebele & Castro, 2004). As discussed previously (see section 1.2.3), children's responses to food cues in advertisements are mediated by their physiological and psychological processes (Folkvord et. al., 2016). Exposure to intrinsically rewarding foods may prompt children's intake of such food or similar highly palatable foods.

Advertising directed at children is designed to influence children and persuade them to buy products or make purchase requests to their parents (McDermott, O'Sullivan, Stead, & Hastings, 2006; Story & French, 2004). Marketers have used various techniques in an attempt to attract children and promote positive responses from them (Calvert, 2008; Powell, Langlands, & Dodd, 2011). Most research has considered several categories of effects; cognitive, affective, and behavioural effects (Buijzen & Valkenburg, 2000;

Rossiter, 1979), as well as health effects (Lobstein & Dibb, 2005; Strasburger, Jordan, & Donnerstein, 2010). To further understand how children are influenced by media promotions, this section will discuss the effects of food promotions in the media. The discussion will consider all areas; cognitive, affective, behavioural and health effects. However, since the purpose of this thesis was to investigate the effects of food exposure on children's eating behaviour, we will focus particularly on the behavioural effects of food promotions.

1.6.1 Cognitive and affective effects

Cognitive effects are associated with children's perception, recognition and recall of the promoted brands (Van Reijmersdal, Rozendaal, & Buijzen, 2012). Vollmers (1995) found an increased level of knowledge about brands promoted on television. Vollmers' sample consists of children aged seven to eleven years old but no differences in age were reported. Hudson and Elliott (2013) showed a spontaneous recall for a product advertised among the children exposed to brand placements in their study. Consistent with Uribe and Feuntes-Garcia (2015), they demonstrate an effect of increased brand awareness among children who viewed fast food advertisements, and an even higher effect when the advertisements were shown together with brand placements.

Moreover, most child-directed food promotions used a 'branding' tactic as this has been evidenced to have a prospective influence on children's food preferences and consumption behaviour (Connor, 2006; Kelly, King, Chapman, Boyland, Bauman, Baur, 2015). As children become more brand aware, it will create a positive attitude towards the brand, leading to purchase intention. Researchers have found that children's food

preferences and eating behaviour (i.e., food intake and food choice) are modified by exposure to food promotions and branding (Boyland & Halford, 2012). Children's enhanced attitude and preferences towards the promoted food and brands will consequently result in higher food consumption (Smith, Kelly, Yeatman & Boyland, 2019).

However, studies on individual differences have suggested that children's attitude towards food such as food selectivity, food approach traits as well as children's impulsivity might also play an important role in influencing their food consumption. Folkvord et. al. (2016) suggested that targeting implicit reactions to snack foods is effective in moderating children's snack intake. Studies on individual differences have also shown that impulsivity and attentional bias may alter the direction and potency of advertising effect on children (Folkvord et al., 2014; 2015). Impulsivity is a complex, multifaceted concept and can be defined as "a predisposition toward rapid, unplanned reactions to internal and external stimuli without regard to negative consequences of these reactions to the impulsive individuals or others" (Moeller, Barratt, Dougherty, Schmitz, & Swann, 2001, p.1784). Folkvord et al. (2014) demonstrated that attentional bias for advertising food cues resulted in an increased intake of snacks among children. The study also found that children who are impulsive were more influenced by advergames that promote unhealthy snacks (Folkvord et al., 2014).

Other cognitive studies have examined children's ability to discriminate advertisements from television programmes (Stephens, Stutts, & Burdick, 1982) or in web page design (Ali, Blades, Oates, & Blumberg, 2009). Several researchers have considered how children understand the persuasive and selling intent of advertisements (Oates, Blades, & Gunter, 2002). The cognitive effects studies have demonstrated that children

under the age of seven years have less understanding of the advertising nature compared to those who are above seven (Ali, Blades, Oates, & Blumberg, 2009; Stephens, Stutts, & Burdick, 1982). Younger children also respond to advertisements differently from older children (Oates, Blades, & Gunter, 2002).

In investigating children's perception of persuasive knowledge, researchers usually use age as an approximate way of predicting their level of understanding. However, recent studies have suggested that children's social-cognitive development and their theory of mind may contribute to their comprehension of persuasive communication (McAlister & Cornwell, 2009; Moses & Baldwin, 2005). As discussed previously (see section 1.3.4), it has been suggested that even though children might be able to discriminate advertising content based on superficial concepts such as characterising features, they might not yet perceive the true purpose of advertisements and persuasive intent (Moses & Baldwin, 2005).

Moreover, Ghani & Zain (2004) suggested that children's awareness of TV advertising and their influence over parental purchases were predictors of their attitudes towards television advertising. However, children's understanding of the persuasive nature of advertising is more complex than just being aware of the advertising (Oates, Blades & Gunter, 2002; Rozendaal, Buijzen, & Valkenburg, 2011). Researchers have suggested that even when children can discriminate between advertising and non-advertising programmes, some of them still are very much susceptible towards those advertised products (Buijzen, 2007; Rozendaal, Buijzen, & Valkenburg, 2012). Studies investigating the affective influence of advertising often emphasise children's positive feelings towards advertisements and trusts that advertising is somewhat true (Chan & McNeal, 2004;

D'Alessio, Laghi, & Baiocco, 2009). Children's acceptance and trust in advertisements may be the outcome of being exposed to repetition of advertising brands and messages, which eventually leads to increase in brand attitude (i.e., liking of the advertised brands) and buying intention (Ray, Sawyer & Strong, 1971). Although some research has been conducted to examine the association between advertising exposure and brand loyalty (Arredondo, Castaneda, Elder, Slymen, & Dozier, 2009; Pecheux & Derbaix, 1999), little is known about how such loyalty might affect judgement and decision making in purchasing or whether loyalty beliefs result in biases towards product evaluation in the future (Connell, Brucks & Nielsen, 2014).

Connell et al. (2014) found that adults who were exposed to product advertising during their childhood (below the age of 13) had shown a positive biased product evaluation towards those products compared to products shown during their adulthood. This finding suggests that exposure to advertisements may lead to positive affection and biased product judgement towards the products and brands which persist until adulthood. This is due to the "affective nature of child-oriented advertising and developmental constraints on processing" (Connell et al., 2014, pg., 131). Connell et al. (2014) argued that these biased evaluations can be difficult to correct as they are not limited to the original advertised products but can be applied to line extensions even if the extensions were exposed to the person as an adult. Moreover, Connell et al. (2014) suggest that the biased evaluation begins when children were firstly exposed to such advertising during childhood, the time in which the consumer is still vulnerable and unable to effectively utilize their cognitive skills in defence against advertising messages. Connell et al.'s study supported previous research by Robinson, Wysocka, and Hand (2007), which suggested children's

taste preferences can be influenced by brand identity, not just within the advertised product category, but extends beyond the type of food being advertised.

1.6.2 Behavioural effects

Behavioural effects studies are usually conducted in a laboratory setting where children are shown an advertisement for a product embedded in or between the programmes (French, Story & Jeffery, 2001; Halford et al, 2004, 2007, 2008; Robinson et al, 2007). Children are then given a choice from a range of products that include the advertised product. If children choose the advertised product, this shows the effect of the advertisement on the children's preferences. Children's attitudes and preferences toward the advertised products are important aspects because it showed how the advertisements exposed to them have influenced their choice and perspectives regarding the products.

A few studies have evaluated the immediate effect of food advertisements depicted on television by evaluating children's disposition toward the product and brand following the exposure (Dijkstra, Buijtels & van Raaij, 2005; Uribe and Fuentes-Garcia, 2015). These studies have found increased behavioural choices of the advertised product. Other research investigating children's purchase requests associated with advertising exposure have shown a relationship between advertised products and children's requests (Arluk, Branch, Swain & Dowling, 2003; Batada & Borzekowski, 2008; Bolton, 1983; Buijzen, Schuuman & Bomhof, 2008; Dickinson, 1997; Dixon et al, 2007; Harrison & Marske, 2005).

Borzekowski and Robinson (2001) stated that regardless of the child's weight status, any exposure to food-related advertisements increases eating in children. However,

research has contradicted this claim, showing that overweight children have higher immediate responsiveness to food advertising than children at a normal weight (Halford et al., 2008). As discussed previously (see page 56), this might be due to individual dispositional factors (i.e., impulsivity and attentional bias) that play an important role in the processing of food cues in advertisements (Folkvord et al., 2016).

Studies on behavioural effects of advertising suggest that exposure to food advertising is a major factor in promoting changes of consumption pattern, food preferences (Carter, 2006; Halford et al, 2008) and purchase behaviour (Bridges & Briesch, 2006). It is also have been evidenced that this exposure can lead to increased consumption of food products in both advertised brand and non-advertised product categories (Boyland & Halford, 2013; Halford et al, 2007). Research into the effects of television and food advertisements have consistently found evidence that food marketing exposure leads to increased food consumption, product preference and purchase requests among children (Andreyeva, Kelly & Harris, 2011, Gorn & Goldberg, 1982; Halford et al, 2004) in short-term (Epstein et al, 2008; Harris et al, 2009) as well as long-term effects (Barr-Anderson et al., 2009).

Children exposed to food cues in advertisements show increased preference for the advertised foods and actual intake of advertised foods, especially for snacks and energy-dense foods (Boyland et al., 2013; Buijzen et al., 2008; Folkvord et al., 2013; Giese et al., 2015; Halford et al., 2008). Additionally, Cairns et al. (2013) suggested that advertising attracts children's attention and enhances their preferences, acceptance and demands of the advertised products. Furthermore, exposure to television advertisements increases children's attempts to influence their parents' purchases. particularly towards choosing the

products being advertised (Buijzen & Valkenburg, 2003; Galcheva, Iotova, & Stratev, 2008; Halford et al., 2004).

Dixon et al. (2007) explored the relationship between children's television viewing habits and their attitudes and behaviour towards food-related products. Dixon et al. showed that children who were highly exposed towards food advertisements and heavier television viewers had a greater positive attitude toward junk food, as well as increased consumption of those food categories. This finding was supported by Boyland et al. (2015), who reported that exposure towards healthier food items in fast food advertisements did not have a significant effect on children's healthier food selections but did increase preferences for fast food.

Exposure to unhealthy food advertising not only influences children's preferences and food choices but may also result in greater consumption of nutrient-poor and HFSS foods among children (Boyland & Whalen, 2015; Boyland et al., 2016). A meta-analysis revealed that exposure towards food advertising for 4.4 minutes on average increased children's food intake by 60.0 kcal compared to those who were exposed to non-food advertising (Russell, Croker & Viner, 2018). In spite of that, only limited experimental studies have been published regarding the effects of food advertising on children's actual consumption. In experiments focusing on children's food intake, Halford et al. (2004; 2007; 2008) demonstrated that children's food intake increased following exposure to television food advertising. Children were shown television programmes with embedded advertisements, food or non-food.

Halford et al. (2007) found that children on average eat 16% more calories when

exposed to food advertising compared to children who were shown toy advertising. Halford et al. (2007) found that food advertisements encouraged children's food consumption of high calorie snacks when being exposed to food advertisements, with greater impact on overweight and obese children. Halford et al. also found that exposure to TV food advertisements increased the amount of overall food intake irrespective of the advertised products. Consistently, a relevant amount of research has shown a spill over effect of food advertising extending to other food products within the same category of depicted items advertised (Ambler, 2006; Bandura, 1994; Halford et al., 2004; Young, 2003).

Dovey et al. (2011) expanded the findings of Halford et al.'s studies by examining the influence of healthy and unhealthy food advertising on the amount of snack consumption among children. Dovey et al.'s study focused on the role of food neophobia and weight status in response to food advertisements among children aged five to seven. The study employed a repeated measure design with one month intervals between conditions; unhealthy food advertisement, healthy food advertisement and toy advertisement. Children were shown a cartoon with embedded advertisements, and were offered a choice of snacks (chocolate, sweets, potato crisps, Snack-a-Jacks, grapes and carrot sticks) after watching the cartoon. Dovey et al. found that exposure towards food advertising, regardless of its content (healthy or unhealthy), increased food intake by over 10% in both low and high food-neophobic children.

A similar study by Boyland et al. (2013) investigated the immediate effect of television food advertising on children (aged 8-11 years), focusing on the influence of celebrity endorsers in a food and non-food context. Boyland et al.'s study examined

children's consumption of potato crisps in four conditions embedded within a cartoon; 1) a Walker's crisps advertisement with a presence of celebrity endorser, 2) another savoury food advertisement, 3) television footage of the same celebrity endorser in a non-food context, or 4) a non-food advertisement. Children were shown a video of a cartoon with an embedded clip and were presented with two bowls of Walker's potato crisps immediately after the viewing; one bowl labelled as Walker's and one bowl labelled as a supermarket brand. Boyland et al. (2013) found an increased intake of advertised crisps among children who watched the branded crisps advertisement compared to the other food advertisement and to the non-food advertisement. Boyland et al. also found increased consumption of the branded crisps among children who watched the television footage featuring the celebrity endorser of the branded crisps. These findings showed that children's actual food intake and brand preference were heavily influenced by food advertising, and that the impact of that advertising goes beyond the advertisement itself.

Harris, Bargh, & Brownell (2009) in the US found similar results. Harris et al. examined the immediate effects of television food advertising on children's eating behaviour. Children (aged 7-11 years) were presented with snack food while viewing television, rather than afterwards. There were two conditions; four unhealthy food advertisements and four non-food advertisements embedded in a children's cartoon. The unhealthy food advertisements were for potato crisps, waffle sticks, high-sugar cereal and fruit rolls. Children in both conditions were shown the cartoon with the embedded advertisements and were given a bowl of cheese crackers during the session. The children who were exposed to unhealthy food advertisements during television watching ate more cheese crackers than those who watched television with the non-food advertisements

(Harris et al., 2009). Although the studies mentioned above have provided evidence as to the detrimental effects of food advertising on children's behaviour, yet the direct factor contributing to such an effect is still uncertain. Thus, the direct behavioural effect of food promotions will be discussed in further detail in Chapter 3.

1.6.3 Effects on physical health and diet

Health scientists suggest that eating behaviour that has been established during childhood might track into adulthood and contribute to long-term health (Perry, Story & Lytle, 2010). Thus, it is important to ensure that children develop a healthy eating lifestyle. Healthy eating can be defined as "eating practices and behaviours that are consistent with improving, maintaining and/or enhancing health" (Taylor, Evers & McKenna, 2005, p.20). Healthy eating practices refer to the intake of a diverse types of foods, eating at least five portions of a variety of vegetables and fruits every day, together with intake of high fibre foods, protein, dairy and plenty of fluids (Public Health England, 2020; NHS, 2019). The UK Government guideline on the recommended sugar intake suggests that free sugar (i.e., foods and drinks with added sugar and natural sugar such as fruit juices, honey, smoothies etc.) should not make up more than 5% of the total energy intake each day (NHS, 2020). This indicates that sugar intake for; adults, should not be more than 30g each day, children (aged 7 to 10) should exceed 24g a day, and children (aged 4 to 6) should not be more than 19g a day (NHS, 2020).

According to health scientists, poor dietary habits or unhealthy eating, among other factors, might gradually leads to overweight or obesity (Mesas et al., 2012). Scholars indicated that obesity is caused by an excess of calorie intake relative to calorie output

(Ambler, 2006; Kremers et al., 2006). It has been found that the prevalence of obesity among children and adolescents worldwide has increased over the past few decades, with one in five people (aged 5 to 19 years) being overweight or obese in 2016 (Abarca-Gómez et al., 2017). Abarca-Gómez et al. (2017) also noted that although the overall growing shifts in children's and adolescents' body mass index (BMI) in many high-income countries have levelled, notwithstanding at high levels, rates have been elevated in low- and middle-income countries such as in Asia.

Scholars state that the current food environment is highly obesogenic and has been described as 'toxic' due to the omnipresent nature of palatable, energy-dense foods and the deficiency of physical effort required to access these foods. It has also been suggested that food advertising is amongst the important factor contributing to this environment (Keller et al., 2012). With advances in technology and integrated media, children today spend less time playing outdoors and engage in more sedentary activities, which can also contribute to childhood obesity (Epstein & Roemmich, 2001; Epstein et al., 2002; Matheson et al., 2004; Procter, Clarke, Ransley, & Cade, 2008; Saelens & Epstein, 1999; Salvy & Bowker, 2014).

Television food marketing has also been criticized for its influence in aggravating the prevalence of obesity by promoting unhealthy eating (Lobsten & Dibb, 2005; Lobstein et al., 2015). Indeed, Lobstein and Dibbs (2005) reported a relationship between the amounts of HFSS advertisements shown on television and the national levels of overweight and obese in the US. According to the American Academy of Paediatrics (AAP) scientists, hours spent watching television are linked to increased risk of obesity in children (Robinson et. al., 2017). This obesity crisis may be the result of energy imbalance

between overconsumption of foods high in fat, salt and sugar (HFSS) and decreased physical activities among children.

Furthermore, previous studies have demonstrated that exposure towards distracting stimuli such as television can increase energy intake in children (Epstein et al, 2002; Matheson et al, 2004; Robinson et. al., 2017; Temple et al., 2007). It is debated that excessive exposures towards food advertising during television viewing could lead to overconsumption among children. In a study conducted by Andreyeva et al. (2011), the authors investigated the direct effects of food advertisements on children's diet outside the experimental setting. Similar to the previous studies (Halford et al., 2004; 2008), Andreyeva et al. found an association between advertising exposure and children's intake of the advertised products. Higher consumption of fast food and soft drinks was exhibited by children with greater advertising exposure towards those products. Andreyeva et al. (2011) indicated that exposure to energy-dense and poor-nutrient food advertising may contribute to increased overall consumption of non-core food categories in children which may possibly lead to short term poor diet and long-term effects on children's health.

While the research highlighted above have evaluated the effects of food marketing among children, the outcome of underlying cues beyond advertising is still vague. The beyond advertising food cues in the context of this thesis are referred to as any presentment of visual food cues depicted within media (traditional and integrated), which does not contain any persuasive or advertising intent (See Chapter 2). On that account, this thesis aims to explore the impact of such cues, supplementary to food cues in advertisements on children's eating behaviour. Therefore, in the next section, the rationale of conducting the research in this thesis will be elaborated.

1.7 Malaysia in context – advertising to children

As reviewed previously, current literatures have provided evidence that food advertisements may influence children's attitude, food choices and eating (see section 1.5) in the developed countries. However, research relating to food promotions towards children in the middle income or developing countries like Malaysia is scarce. Since the present author has access to conduct the research in Malaysia, the data for both experimental studies were collected in Malaysia. Apart from the convenience of sampling, the research in this thesis will provide an empirical overview of media food promotions targeting children in the developing countries. Therefore, this section will provide a contextual background of Malaysia and the current food advertising environment targeting at children in Malaysia.

Background of Malaysia. Ever since the country's liberation in August 1957, Malaysia has experienced rapid industrialisation and urbanisation in both economic growth as well as in social reforms. The stabilization of economic development and political progress has led to improved mortality and morbidity in Malaysia. According to the report of Population and Housing Census of Malaysia 2020, the total population of Malaysia in 2020 is 32.4 million compared to 27.5 million in 2010, with an annual population growth rate of 1.7 per cent (Department of Statistics Malaysia, 2022). The population consists of the ethnic groups Malays (69%), Chinese (23%), Indians (7%) and others (1%). Parallel with the increased in population growth, Malaysian household spending consumption has also risen. The Malaysia Household Expenditure Survey (2016) showed that the average monthly budget expenditure for Malaysia has increased from RM3,578 (£664) in 2014 to

RM4,033 (£748) in 2016, growing at 6.0 per cent per annum. The mean of monthly household expenditure in urban areas showed an increment of 5.8 per cent yearly from RM3,921 (£727) to RM4,402 (£816). Meanwhile in rural area, it is also increased at 5.7 per cent annually from RM2,431 (£450) to RM2,725 (£505) during the period of 2014 to 2016.

Economic development leads to lifestyle change. Kuala Lumpur is the capital and the largest city in Malaysia with a population of 1.7 million (The Population and Housing Census of Malaysia, 2010). Kuala Lumpur and the adjacent urban areas are the fastest-growing economic region in Malaysia, with complete suburbanization. Researcher believed that the economic change and population growth combined with lifestyle changes to urbanization have led to significant changes in the diet and physical activity of Malaysians and the "Westernization" of lifestyles (Li, Liu, Gibson, & Zhu, 2012; Sherina & Ahmad, 2004). The rapid social and economic development of recent decades in Malaysia has brought about changes, starting with the demographic conversion to urbanisation and shifting professions from being physically active to sedentary occupations (Kamaruzzaman, 2019; Li et al., 2012).

Researchers have suggested that Malaysia is now undergoing a nutrition transition (Micha et al., 2014; Noor, 2002). Reduced consumption of fruits and vegetables together with increased consumption of high in fats and energy and added salt and sugar foods have been observed among Malaysians (Tee, 1999). The author further stated that the changes in lifestyle and eating habits have been associated with an increase rate in obesity and non-communicable disease and illnesses in Malaysia (Tee, 1999).

Moreover, Malaysia is also among the countries that faces the tenacity of the double burden of malnutrition (DBM), which is a combination of undernutrition (i.e., underweight, wasting and stunting) and overnutrition (i.e., overweight and obesity). The DBM phenomenon is due to several reasons, mainly the stage of nutrition transition related to food patterns, lifestyle, reduced physical activities as well as interaction of demographic and socio-economic status (Ng & Popkin, 2012: Popkin, 1994; Popkin, Corvalan & Grummer-Strawn, 2020). It is a problem faced by many countries, including Asian and South East Asian regions (Rachmi, Li & Baur, 2018). Studies have indicated that the DBM is more dominant in urban than rural areas of developing countries, specifically among the low income households (Doak, Adair, Bentley, Monteiro & Popkin, 2005; Jehn & Brewis, 2009).

However, research concerning the double burden of nutrition in Malaysia showed an increased prevalence of overweight and a decrease of underweight between 2000 and 2010 (Lim, 2000; Moore, Hall, Harper & Lynch, 2010). Consistently, Poh et al. (2013) reported that overnutrition was more prevalent than undernutrition among children (aged 6 months to 12 years) in Malaysia. According to World Population Review Data (2019), the prevalence of obese adults in Malaysia is the highest in Southeast Asian countries at 15.6 percent followed by Brunei (14.1%), Thailand (10.0%) and Indonesia (6.9%). The results of the National Health and Morbidity Survey (NHMS) in 2019 found that 50.1 % of adults in Malaysia are either overweight or obese; 30.4 % are overweight while 19.7 % are obese.

Childhood obesity among Malaysian children. According to an analysis of Global Burden of Disease Study in 2013, the pervasiveness of obesity and overweight

among children and adolescents in developing countries are increasing in the last three decades from 8.1% in 1980 to 12.9% (boys) and 8.4% to 13.4% for girls (Ng et al, 2013). Importantly, as pointed out in sections 1.6.3, the prevalence of childhood obesity is increasing globally, especially among children in low- and middle-income countries. In Malaysia Poh et al., (2013) found that the percentage of obese or overweight children in Malaysia increased from 21% in 2002 to 26% in 2008. A more recent report by NHMS (2019) survey found that 29.8 per cent of children between the age of 5 to 17 years were overweight including obese, with 14.8 % children found to be obese while the rest are overweight. This finding is worrying as it shows an upward trend of more than three -fold in less than a decade.

Advertising towards children in Malaysia. Children in developing countries are believed to be more at jeopardy of being targeted by marketers, as there is a massive prospective for market growth of the non-core foods in countries with a poor advertising regulation (Ng et al., 2014). Despite this knowledge, limited studies have been conducted in regard to advertising towards children in Malaysia. To date, only a few studies have been published on the nature and extent of television in promoting non-core foods to Malaysian children. Previous research has suggested that children in Malaysia were exposed to approximately five food advertisements per hour with four of those being unhealthy food products (Kelly et al., 2014). Furthermore, according to a content analysis of 54,000 advertisements on six free to air channels in Malaysia, approximately a quarter of these were found to be food advertisements (Karupaiah et al., 2008). The study also revealed that snack foods were frequently marketed (34%), followed by dairy products (20%), confectionary (13%) biscuits (11%), fast food (6%), breakfast cereals (6%),

beverages (4%) and less than 1% each for supplements, rice, instant noodles, oils and fats (Karupaiah et al., 2008). The authors also noted that the frequency of food advertisements aired during children's prime time viewing increased during weekends, school holidays and seasonal celebrations (Karupaiah et al., 2008). Additionally, Chong et al., (2016) disclosed that snacking was a relatively common eating behaviour among Malaysian children, with one-fifth of the population snacking three times a day in between main meal.

Despite the Malaysian government banned of fast-food advertisements and sponsorship during children's programmes, these types of food advertisements were among the most advertised non-core foods, with increased frequencies aired during children's prime viewing time (Ng et al., 2014). It was found that children in Malaysia were exposed to an average of one non-core food or beverage advertisement every 16 minutes (Kelly et al., 2014). Similar findings have also been reported in the neighbouring countries such as Singapore (Huang, Mehta & Wong, 2012) and Thailand (Jaichuen, Vandevijvere, Kelly, Vongmongkol, Phulkerd & Tangcharoensathien, 2018), as well as other developing countries; Colombia (Velasquez, Mora-Plazas, Gómez, Taillie, & Carpentier, 2021), Turkey (Guran et al., 2010) and Korea (Kim & Han, 2012). Furthermore, a comprehensive study by Kelly et al. (2016) investigated the prevalence of food advertising targeting children in the Asia Pacific regions, including China, Indonesia, Malaysia and South Korea. The authors reported that food advertisements aired in the above-mentioned countries promoted predominantly non-core foods, with a rate of six foods per hour. The study also found that the most advertised product across all sites was sugar-sweetened drinks, followed by low fat dairy, high fat dairy, baby formula milk and ice-cream (Kelly et al., 2016).

As discussed previously, human eating behaviour is complex, and can be influenced by various factors including the media environment. With evidence showing that children are frequently exposed to non-core food promotions in the media, it is crucial to explore the extent of food advertising currently surrounding children, as well as how media food depictions might influence children's eating behaviour. Therefore, to explore the influence of food cues on children's eating, the next chapter will initially investigate the prevalence of television food promotions targeting children in the UK and Malaysia (Chapter 2). In summary, this section has provided a background setting towards the market growth, and studies on the prevalence of food promotions targeting children in Malaysia. However, since there is a limited literature concerning this issue in Malaysia, it is uncertain to determine the effect of food promotion among Malaysian children. Therefore, this thesis aims to investigate such effects by conducting experimental studies among Malaysian children. The next section will specify the research objectives and aims of the current thesis.

1.8 Research aims and objectives

As discussed previously, it has been suggested that media food promotion is one of the important environmental factors influencing children's eating behaviour (section 1.5). With the growing concern over food exposure towards children in the media and the increasing rate of children gaining access to digital media platforms, it has been shown that food and beverage promotions might have negative implications on children's food awareness, preferences, consumption, health and dietary habits. Contemporary children are believed to be at an increased risk of developing serious health problems, with

childhood obesity being a critical global epidemic (World Health Organization, 2016). Obesity among children persist to be high in many countries globally, with an estimated of 124 million children and adolescence being obese, and 216 million being overweight (World Health Organisation, 2016). It has been suggested that childhood obesity is linked with children who come from a low socioeconomic status as well as living in countries with poverty (Loring & Robertson, 2014). Research has found that the levels of childhood obesity and overweight around the world have increased dramatically over the past four years (NCD Risk Factor Collaboration, 2017). Middle- and low-income countries in East Asia, North Africa and the Middle East were found to have the major rise in number of children with obesity, with the most rapid increase in Asia (NCD Risk Factor Collaboration, 2017).

Based on the Foresight System Map of Obesity (Government Office for Science, 2007), food advertising falls under societal cluster which was highly influenced by economic growth at the population level; and media engagement (i.e., TV watching) at the individual level. Although genetics play a significant role in the susceptibility to obesity (Golden & Kessler, 2020), other complex behavioural and societal factors such as changes in lifestyle, physical activity, socioeconomic development as well as food advertising, among others may contribute towards the causes of obesity. Furthermore, due to the globalisation of the food system (i.e., global food trade by multinational food and beverages companies that primarily produce and market unhealthy food and beverage products), children particularly in developing countries such as Malaysia are being highly exposed to food marketing. This type of food promotion eventually increases appeal and normality in consuming these types of food products (Hawkes, 2006).

Previous research concerning the effects of food promotion on eating behaviour has focused primarily on the food shown within the marketing context, without taking the issues beyond the advertising atmosphere. Hence the effects of food exposures in a non-advertising context among children are undiscovered. Drawing from the Food Cue-Reactivity (FCR) theory, exposure to food images or cues that imply consumption can stimulate reactivation of FCR, which leads to food intake. Thus, to establish our understanding of how media food promotions influence children's eating behaviour, the overall aim of the thesis is to test the effect of media food cue exposure on children's eating behaviour based on the Food Cue-Reactivity theory. To achieve our aim, we have set several specific objectives within every study and addressed these by utilizing content analyses and experimental approaches:

1. To explore the extent to which children are being promoted with food cues on television in the UK and Malaysia.
2. To examine the effects of food cues depicted in digital media (computer games) on children's immediate food consumption.
3. To investigate the role of cue congruency in motivating children's food consumption.

We first provide a comparative analysis between the extent and nature of food promotions on television in the developed and the developing countries (UK and Malaysia) in the next chapter (see Chapter 2). The second aim was to investigate the effects of food cues depicted in the digital media context on children's actual food intake, so the influence of food cues embedded in computer games will be explored in Chapter 3. The thesis will further investigate the role of cue congruency in motivating children's food consumption (see Chapter 4). The final chapter will provide a general discussion on the results of the studies and will also discuss the significant implications of the thesis.

CHAPTER TWO

Study 1: Content analyses of British and Malaysian children's television programmes

2 Introduction

At present, non-core food and beverage promotions are rapidly increasing (Chan, Harris, Schwartz, & Brownell, 2010; Tse, Tam, & Huang, 2016). Despite concern over childhood obesity, the non-core food industry and marketers have exploited many channels to promote their products. These types of foods are considered as affordable, accessible and convenient choices for most families, and are widely consumed in every country (Drewnowski & Darmon, 2005; Swinburn et. al., 2011). To market such food, children are exposed to non-core food promotions and advertisements through traditional and digital media (Kelly et al., 2010; Shifrin et al, 2006). Health advocates have suggested that food and beverage advertisements targeted at children have a negative influence on children's diet and food consumption (Dixon et al., 2007; Sadeghirad et al., 2016), and such advertisements have been directly linked to childhood obesity (Andreyeva et al., 2011; Borzekowski & Robinson, 2001; Livingstone, 2005; Lobstein & Dibb, 2005; Veerman et al., 2009).

2.1 The prevalence of childhood obesity

According to The Global Burden of Disease 2015 Obesity Collaborators (2017), in 2015, a total of 107.7 million children across 195 countries were categorized as obese. The global public health problem is caused by many factors (Goldblatt, Moore, & Stunkard, 1965; Wright & Aronne, 2012), with diversification of the food environment and food systems as an important contributor (Hall, 2018; Swinburn et al., 2011; Wright, & Aronne, 2012). Concurrently, increased sedentary activity (Robinson, 2001; Rey-Lopez, Vicente-Rodríguez, Biosca, & Moreno, 2008) and poorer dietary patterns (Poti, Duffey & Popkin, 2013; Drewnowski, 2009) have resulted in energy imbalance among younger populations. Health scientists indicate that among the reasons for over-energy consumption and overweight problems, important factors include the excessive marketing of energy-dense foods (Drewnowski, 2004), the convenience of such foods, their affordability (French, 2003; Powell, & Chaloupka, 2009), and the easy availability of these kinds of foods (Davey, 2004; Harris, Pomeranz, Lobstein, & Brownell, 2009).

2.1.1 Food promotion toward children

Despite new media and digital platforms, television remains the main venue where children spend most of their time on media consumption (Gunter, Oates & Blades, 2004; Moses, 2014). As mentioned in Chapter 1, Ofcom (2017) has reported that children aged 3-15 years old spend on average 14 hours per week (or 2 hours a day) watching television. Although new media technology's popularity (i.e., the internet, computer games etc.) has recently increased among children, television is still an important medium in children's lives, especially among preschoolers and younger children (Ofcom, 2017). To better

understand the extent of food advertising targeting children, some researchers have conducted analyses of television, to examine non-core food and beverages presented during children's programming (Boyland et al., 2011; Kelly et al., 2010; Zimmerman & Bell, 2010). By utilizing content analysis studies, these researchers have examined the content of advertisements, focusing on the nature of advertised products and the persuasion techniques used by the marketers. Previous content analyses of children's television programmes have shown that children are heavily exposed to non-core foods (unhealthy), which also known as energy-dense/ low nutrient foods or High Fat/Salt/Sugar (HFSS) products such as snacks, fast-food, sugared cereal, sweets and confectionary (Boyland et al., 2011; Radnitz et al., 2009).

2.1.2 Non-core food promotion toward children in the UK

In the UK, the regulation regarding HFSS products was initially introduced in 2007 by the Office of Communications (Ofcom), which is the UK broadcast regulator. This was implemented in phases intended to restrict foods with HFSS advertisements targeting children. From January 2009, the final phase was enforced when all HFSS product advertisements were banned from children's channels (Ofcom, 2010). Other countries like France, Sweden, Norway and Canada have also banned some advertising aimed at children (Hawkes, Lobstein, & Polmark Consortium, 2011). Although these food advertising restrictions have been implemented in some countries, non-core food products are still being depicted in children's television programmes (Boyland & Halford, 2013; Radnitz et al., 2009; Scully et al., 2014). Research concerning the extent of food advertising toward children has found that in 2010, children in the UK were exposed to an average of 3.5 food advertisements per hour (Whalen et al., 2017), with non-core food advertisements being

frequently shown on UK television. Similarly, a previous study by Boyland et al., (2011) in 2008 also found that food items were the third more commonly advertised product, with non-core foods being the most dominant (Boyland et al., 2011).

2.1.3 Non-core food promotion toward children in Malaysia

Malaysia introduced a public policy restriction on fast food advertisements during children's shows on television in March 2007. Fast food advertisements were banned on children's television programmes, and fast food advertisers are not allowed to sponsor children's programmes (Singh, 2007). However, as discussed in Chapter 1 (section 1.6), advertising policy in Malaysia is self-regulated, and there is no specific governing body to monitor advertisements in Malaysia (Mirandah, 2006). In 2013, further actions were taken by The Consumers' Association of Penang in collaboration with 10 major food and beverage companies through the 'Responsible Advertising to Children Pledge' (Mohamed Idris, 2013). The pledge included a restriction of non-core food and beverage advertising in both print and broadcast media.

As opposed to the Western literature on non-core food promotion, only one study has been published on the content analysis of food advertising targeted at children in Malaysia (Karupaiah et al., 2008). Karupaiah et al. analysed broadcast advertisements on six Malaysian free-to-air channels for their content and frequency over a period of six months. Karupaiah et al. (2008) found that, contrary to the regulation banning of fast-food advertisement in Malaysia, children were heavily exposed to food advertising, particularly snack foods. Karupaiah also reported that food advertisements were broadcast more frequently during children's prime time viewing than during adults' prime time.

To the author's knowledge at the point of writing this thesis, no further research has been conducted investigating the depiction of food embedded in children's programmes in Malaysia. Thus, the extent of food and beverage exposure during children's television programmes in Malaysia is yet uncertain. Hence, in this chapter, analyses of children's television programmes and advertisements were conducted in the two countries - the UK and Malaysia. Despite the awareness of the negative influence of television advertising on children's food choices/preferences (Borzekowski & Robinson, 2001; Goldberg et al., 1978; Halford et al., 2007), diet/consumption (Halford et al., 2004; 2007), and attitudes/beliefs towards food and beverages (Dixon et al., 2007), there still exists a gap in our knowledge regarding the food references or cues in television programmes.

2.1.4 Effects of exposure to food promotion on television

According to previous studies concerning food marketing toward children, non-core food and beverage promotion may affect children in various ways - cognitive, behavioural, emotional, and physical health and wellbeing. One of the most important aspects affected by food promotions is children's eating and dietary habits (Boyland & Halford, 2013; Halford et al., 2004; 2007; 2008; Harris et al., 2009). In a meta-analysis, Boyland et al. (2016) found that children's consumption of non-core food items increased after being exposed to non-core food advertisements. Researchers have demonstrated the negative influences of television food advertisements on children concerning children's preferences, product choices and purchasing requests (Chernin, 2008; Sadeghirad, Duhaney, Motaghipisheh, Campbell, & Johnston, 2016). With the rapid growth of technology and media usage by children and adolescents (Brandtzaeg et al., 2004; Livingstone & Bovill, 2001; Wright et al., 2001), it has never been easier for junk food

advertisers to reach young consumers.

Previous research has focused mainly on the content of advertising during children's television prime time viewing (Adams et al., 2009; Boyland et al., 2011; Halford et al., 2004; Kelly et al., 2010; Prell et al., 2011; Radnitz et al., 2009; Stitt & Kunkel, 2008; Zimmerman & Bell, 2010). However, it has generally not considered any food references in the programmes themselves. A few recent studies have considered the appearance of food and beverages during children's television programmes, in Ireland and the United Kingdom (Scully et al., 2014), in Iceland (Olafsdottir & Berg, 2017), in Sweden (Olafsdottir & Berg, 2016), and in the United States (Eisenberg, Larson, Gollust & Neumark-Sztainer, 2016; Radnitz et al., 2009).

In most of these studies, researchers found non-core food and beverage items were depicted more frequently than healthy food items (Boyland et al., 2011; Halford et al., 2004; Kelly et al., 2010; Radnitz et al., 2009; Scully et al., 2014). The only exception was in the Swedish study (Olafsdottir & Berg, 2016), in which healthy foods (fruits and vegetables) were presented more frequently. Apart from the findings from the above studies, research regarding television food references in an editorial context (within programmes) is scarce. Therefore, it is not clear whether children are being exposed to non-core foods within programme content during television viewing in the UK and Malaysia. Hence, Study 1 was designed to examine the degree of food and beverage cues depicted within children's television programming in both advertising and in non-advertising contexts. Advertising context was defined as products advertised by profit-based companies using specific marketing techniques (i.e., persuasive appeal). The non-advertising context was distinguished as a context within the programme itself, without

any specific remarks towards branding or company, and does not include any marketing technique (i.e., advertising/persuasive appeal).

2.2 Aims of the study

The primary purpose of the current study is to explore the extent of traditional media (television) portrayal of food cues during editorial content of children's programming, as well as to explore the omnipresence of food advertising targeted at children in the UK and Malaysia. To achieve this aim, a few objectives have been set out – firstly, this study will investigate the level of food and beverage cues depicted in children's television programmes in the UK and Malaysia. Secondly, this study aims to investigate which type of food cues (i.e., core, and non-core) were commonly exposed on children's TV. The current study also intends to explore the type of food advertisements aired during children's television programmes in the UK and Malaysia. Finally, the study aims to investigate the type of persuasive appeals frequently used in food advertising in the UK and Malaysia.

2.3 Methodology

The current study consists of content analyses of food cues on television programmes in eight free-to-air children's channels in the UK and Malaysia, with four channels in each country. The current study also analysed food advertising aired during children's television programmes in the UK and Malaysia, as well as the persuasive appeals used in food advertisements.

2.3.1 Ethical permission

Ethical approval was not required since the current study comprised content analyses and does not involve any human participants.

2.3.2 Design

The study utilized a simple descriptive content analysis method, with a recording sample consisting of children's and family television programmes across 180 hours. The sample of programmes taken for this study was coded for the classification of food items into core (healthy) or non-core (unhealthy) cues (Gantz et al., 2007; Kelly et al., 2010). The current study focuses on the prevalence of food cues on television programmes (editorial content) and investigates the pervasiveness of food advertisements targeted at children in the UK and Malaysia. Based on Kelly et al. (2010) and Boyland et al. (2013), the current study was designed to replicate the findings in Malaysia, as well as to explore the extent of food cues beyond advertising content.

2.3.3 UK television sampling

The four children's channels selected for television recording in the UK were CBBC (Children's British Broadcasting Corporation), CBeebies, CITV (Children's Independent Television) and POP. These channels were selected as they are the most popular children's television channels in the UK (Ofcom, 2017). CBBC and CBeebies are both owned by the British Broadcasting Corporation (BBC), and do not contain any advertisements during their broadcasting hours. CITV and POP are both commercial channels owned by private companies (ITV Digital Channels Ltd and Sony Pictures Television Networks, respectively), and both broadcast advertisements between

programmes (not included in the sampling).

The BBC target audience for CBeebies is children aged 0-6 years, and for CBBC it is 6-12 years (Ofcom, 2018; Livingstone & Local, 2016). CITV programmes are aimed at children up until the age of 12 years and POP is aimed at children aged 6-9 years (Ofcom, 2018). These commercial channels (i.e., CITV and POP) were chosen deliberately because of their target audiences' age. As discussed in Section 1.4.4, very young children (i.e., aged below 5) might have a difficulty in recognizing the advertisements aired on television. Moreover, these channels were selected in order to fit into our empirical studies (refer to Chapters 3 and 4) which aimed at primary-school aged children (aged 7 to 11).

Table 2-1 Recording schedule and the amount of recorded hours in United Kingdom

Day Channels	Monday (3-7pm)	Tuesday (3-7pm)	Wednesday (3-7pm)	Thursday (3-7pm)	Friday (3-7pm)	Saturday (11am-1pm) & (4-7pm)	Sunday (11am-1pm) & (4-7pm)	Total recording hours
CBBC	4	4	4	4	4	5	5	30
CBeebies	4	4	4	4	4	5	5	30
CITV	4	4	4	4	4	5	5	30
POP	4	4	4	4	4	5	5	30
Total	16	16	16	16	16	20	20	**120**

*CITV was recorded from 2 pm - 6 pm on Monday to Friday, and from 11 am - 1 pm and 3 pm - 6 pm on Saturday and Sunday.

Recorded samples in the UK included popular children's programmes such as:

- The Next Step
- The Dumping Ground
- Our School
- Zig and Zag
- Danger Mouse
- ROY
- Gigglebiz
- Super 4
- Peter Rabbit
- Horrid Henry
- Alvin and the Chipmunks
- Totally Spies
- Transformers

A total of 120 hours of children's television programmes broadcast on the four British children's channels was recorded in April 2016 to June 2016 (i.e., 60 hours of non-advertising channels and 60 hours of advertising channels) . The recorded hours came from five weekdays after school hours and two weekend days per channel. Refer to Table 2.1 for the schedule of recording hours in each channel. This sample consisted of 30 hours on each channel. The recorded hours include advertisement time in the two advertising channels (CITV and POP). CITV was recorded from 2pm - 6pm on five weekdays (four hours per day), 11am - 1pm and 3pm - 6pm on Saturday and Sunday (five hours per day) due to its broadcasting hours ending at 6pm. As we did not observe the length of advertisements in advertising channels (duration of advertisements aired within the 60 hours), we did not have the corrected full time frame for the in-programme only duration.

2.3.4 Malaysian television sampling

The four leading free-to-air channels in Malaysia (TV3, TV2, NTV7 and TV9) were selected for sampling. These four channels are not specifically dedicated to children (in Malaysia, children's channels are not available for free), and contain commercials. These channels were chosen because they are public service channels, which are available for everyone to view. Pay-per-view channels were not included in the sample as an attempt to capture programmes viewed by broader demographic audience. Samples of broadcast material (programmes and advertisements) were taken during children's prime-time hours, which was after school time during weekdays, and morning and afternoon hours on weekends.

Table 2.2 shows the schedule of recording hours across all channels. The recorded hours were chosen based on the broadcast programmes, which targeted children's and

family viewing. In order to match the recording samples of UK advertising channels, a total of 60 hours were recorded during March 2016 to April 2016, consisting of 15 hours on each channel. Similar to the UK samples, the recording hours include the duration of advertisements aired within the time frame and the length of advertisments aired were not observed. The time frame shown below includes both programmes and advertisements.

Table 2-2 Recording schedule and the amount of recorded hours in Malaysia.

Day Channels	Monday (5-6pm) (7.30-8pm)	Tuesday (5-6pm) (7.30-8pm)	Wednesday (5-6pm) (7.30-8pm)	Thursday (5-6pm) (7.30-8pm)	Friday (9.30-11.30am) (5-6pm)	Saturday (9.30-11.30am) (5-6pm)	Sunday (9.30-11.30am) (5-6pm)	Total recording hours
TV3	1.5	1.5	1.5	1.5	3	3	3	15
TV2	1.5	1.5	1.5	1.5	3	3	3	15
NTV7	1.5	1.5	1.5	1.5	3	3	3	15
TV9	1.5	1.5	1.5	1.5	3	3	3	15
Total	6	6	6	6	12	12	12	**60**

Malaysian samples involved both children-specific and family programmes such as:

- Upin & Ipin
- Crayon Sinchan
- Adi genius
- Boboi boy
- Spongebob Squarepants
- Rimba Racer
- Super Squad
- Pororo

2.3.5 Data coding and inter-coder reliability checks

Prior to the coding of the recorded data, a sample of three hours of programmes were coded by the researcher and another coder to assess the reliability of coding. The second coder is a PhD researcher in Malaysian university, and is fluent in both English and Bahasa. To avoid any bias towards the results, the second was given the same coding form and instructions to code the sample of three hours of recorded programmes. To

assess reliability, Cohen's kappa was used for the categorical variables. Agreement between coders on the specific food categories was 96% (κ = .82). Recorded data were then viewed individually by the primary investigator and were coded based on a scheme adapted from the coding schemes developed by Waren et al. (2008) and Boyland et al. (2011). Refer to Table 2.3 for a full coding scheme used. Programmes were coded for any presence of food and beverages shown during the recorded hours.

Table 2-3 Core, non-core and unclassified food and beverage coding system (adapted from the original schemes developed by Waren et al. (2008) and Boyland et al. (2011)

	Core food categories
1	Breads (include high fibre, low fat crackers), rice, pasta and noodles
2	Low sugar and high fibre breakfast cereals (<20 g/100 g sugar and >5 g/100 g dietary fibre)
3	Fruits and fruit products without added sugar
4	Vegetables and vegetable products without added sugar
5	Low fat/reduced fat milk, yoghurt, custard (<3 g/100 g fat) and cheese (<15 g/100 g fat; includes 50% reduced fat cheddar, ricotta and cottage) and their alternatives (e.g., soy) (including probiotic drinks)
6	Meat and meat alternatives (not crumbed or battered) (includes fish, legumes, and nuts and nut products, including peanut butter and excluding sugar coated or salted nuts)
7	Eggs (including cooked in full form e.g; scrambled, poached, boiled)
8	Core foods combined (including frozen meals (<10 g/serve fat), soups (<2 g/100 g fat, excludes dehydrated), sandwiches, mixed salads and low fat savoury sauces (<10 g/100 g fat; includes pasta simmer sauces)
9	Baby foods (excluding milk formula)
10	Bottled water (including mineral and unsweetened soda water)
	Non-core food categories
11	Full cream milk, yoghurt, custard, dairy desserts (>3 g/100 g fat) and cheese (25% reduced fat and full fat varieties, and high salt cheese, including haloumi and feta) and their alternatives
12	Crumbed or battered meat and meat alternatives (e.g., fish fingers) and high fat frozen meals (>10 g/serve fat)
13	Dessert, cakes, muffins, sweet biscuits, high fat savoury biscuits, pies and pastries
14	Snack foods, including chips, savoury crisps, extruded snacks, popcorn, snack bars, muesli bars, sugar sweetened fruit and vegetable products (such as jelly fruit cups, fruit straps) and sugar-coated nuts
15	Fruit juice., fruit drinks and sugar sweetened drinks (including soft drinks, cordials, electrolyte drinks and flavour additions e.g., Milo)
16	Frozen/fried potato products (excluding packet crisps)
17	Ice cream and iced confection

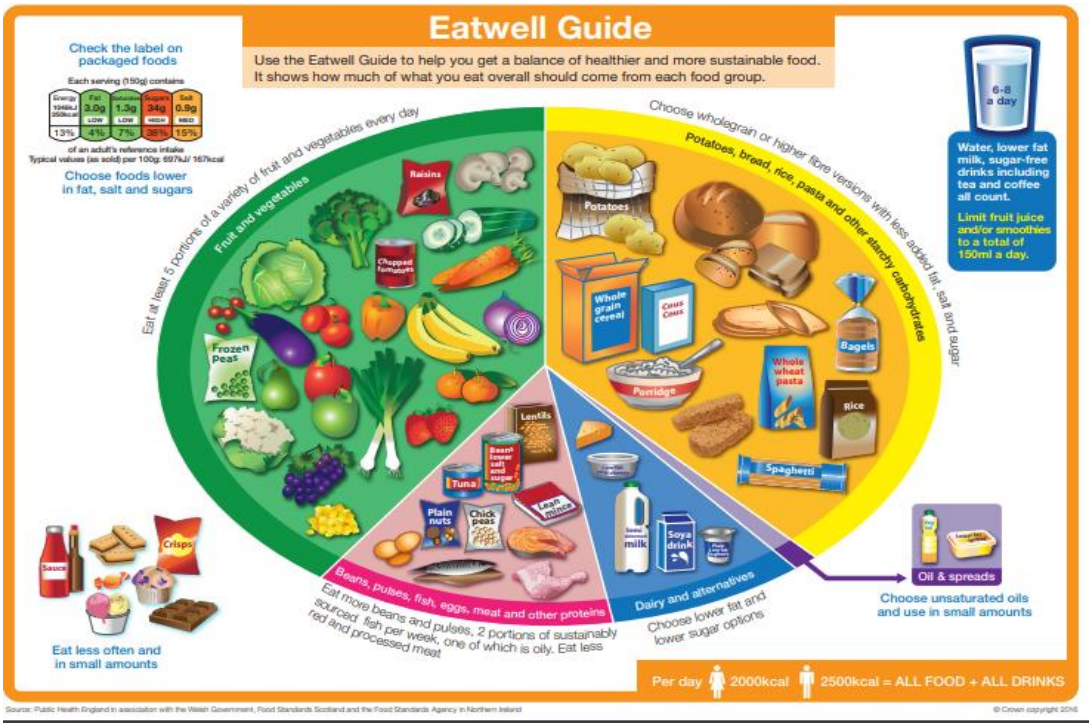
18	Chocolate and confectionery (including regular and sugar-free chewing gum and sugar)
19	Fast food/ restaurants/ convenient meals (include general pizza, burgers, 'healthy' alternatives from fast food restaurants, canned food)
20	High sugar and/or low fibre breakfast cereals (>20 g/100 g or <5 g/100 g dietary fibre), high fat/sugar/salt spreads (includes yeast extracts, excludes peanut butter), oils, high fat savoury sauces (>10 g/100 fat), meal helpers (including stocks, tomato paste) and soups (>2 g/100 g fat tinned and all dehydrated)
21	**Unclassified/ miscellaneous food and beverage** Includes vitamin and mineral supplements, tea and coffee, supermarkets; advertising mostly non-core foods or mostly core foods or non-specified generic supermarket ads or not clearly for core or non-core, baby and toddler milk formula, honey, spices and specialty food.

A food or beverage cue was defined as a product being displayed within a food-specific context (i.e., a context in which the food or beverage was consumed, could have been consumed or was considered for consumption). Food and beverage cues were not coded if they were portrayed in a non-food context. For example, a character named as 'Waffle' was not coded for food, and any verbal notions of foods or beverage portrayed in a figure of speech such as 'cute as a muffin' were not coded as food. Multiple cue types within a scene were each individually recorded (e.g., in a mealtime scene, if different types of foods and beverage were displayed, each type was coded individually). However, repeated presentation of the same cues in the same scene within 30 seconds (of previous sample) were recorded as one instance of a cue.

Cues were coded by types of product. They were also coded as core food (healthy), non-core food (non-healthy) or unclassified food type based on the coding scheme above (see Table 2.3) and the UK Eat Well Guide (refer to Figure 2.0 below). Core food types included breads/grains, breakfast cereals, meats, dairy, fruit, vegetables, poultry, fish, sandwiches, eggs, and water. Non-core food types included HFSS (high fat/salt/sugar) dairy, fast food/convenience meals, desserts, processed food, pastries, snacks,

confectionary, ice cream and candy. Unclassified/miscellaneous food types included tea/coffee, honey, spices and specialty food. Cues were coded in all presentations, visual, verbal or both. Background cues were coded if the food could be potentially consumed (e.g., fruits in a fruit bowl, cereal boxes, milk in a milk carton). However, background cues (e.g., paintings, posters or decorations of foods) were not coded.

Figure 2-1 UK Eatwell Guide



The Eatwell Guide is "a pictorial representation of government healthy eating advice showing the proportions in which different types of foods are needed to have a well-balanced and healthy diet. The proportions shown are representative of your food consumption over the period of a day or even a week, not necessarily each mealtime" (Public Health England, 2018, p. 5).

2.3.6 Advertisement sampling

Advertisement samples in the UK and Malaysia

In the UK, two Freeview channels CITV and POP were recorded and viewed for any advertisements aired. The other two channels, CBBC and CBeebies were non-commercial channels in the UK and did not include advertisements. All recorded channels in Malaysia (TV3, TV2, NTV7 and TV9) broadcast advertisements. Because Malaysia did not have any dedicated children's channel, advertisements recorded in the current study contained several persuasive appeals that were not present in the coding used in the UK. The additional persuasive appeals identified in Malaysia television were added to the persuasive coding tool in Table 2.4 and were defined by the present author.

2.3.7 Coding for advertisements and persuasive appeals

Advertisements on the UK (CITV and POP) and Malaysia (TV3, TV2, NTV7 and TV9) channels were first classified into two categories; food and other products, and then they were further categorized according to food product type (core and non-core food). The number of advertisements broadcast in each category was recorded during the broadcast hours. If the same advertisement was repeated more than once, the type and category of the advertised item still counted for the times it was aired. For example, if an advertisement for Kelloggs Coco Pops was repeated four times, it was counted as 4 in the category of advertisements for "food products".

In examining persuasive appeals used during recorded children's programmes, each advertisement was coded based on six persuasive techniques used in advertising toward children (Jenkin, Madhvani, Signal, & Bowers, 2014), which were defined in

Hebden's taxonomy of persuasion (Hebden, King & Kelly, 2011). The coding tool was revised and a few other persuasive techniques (i.e., price, programme/movie sponsorship and special tagline) were added in the tool, as shown in Table 2.4. The added persuasive appeals (i.e., price, programme/movie sponsorship and special tagline) were defined by the present author as they were identified in the advertisement samples (see Table 2.4). If more than one appeal was used in an advertisement, every type of appeal was coded individually. For example, if a McDonald's advertisement featured four appeals, all four types of appeals were each coded.

Prior to coding for persuasive appeal content, 20 random food advertisement samples were coded by two coders (primary and second coders), and reliability was assessed using Cohen's κ. The second coder (i.e., the same coder mentioned in section 2.3.5) was given the same coding tool (see Table 2.4) and instructions to code the persuasive content. The agreement between coders was 98%, with almost perfect agreement ($\kappa = 0.9$). The data were then viewed and coded individually by the primary investigator.

Table 2-4 Coding tool for measuring marketing techniques used in food and beverage advertisements with definitions

Types of appeal	Definition
1. Premium offers • Contest / giveways • Freebies / toys	Food advertisement that depicts a premium offer with purchase of the food product, for example, competition, giveaway (such as a toy or tickets to a venue or show), rebate or voucher.
2. Emotional appeal (fun/happiness)	Non-verbal or verbal display of happiness (e.g. smiling or playing) or uses words 'fun', 'happiness' or similar expressions.
3. Characters • Child characters • Celebrity endorsement • Licensed characters	Cartoon characters, children, celebrity/popular personalities (including sportspersons), health professionals/scientists, charity/organizations.
4. Programme/movie sponsorship *	Acknowledgement of sponsorship within the advertising, featuring characters from programmes/movies.
5. Palatability of taste and smell	Food product that was described/depicted as tasting or smelling good.
6. Nutritional values/health claim	A statement regarding the presence or absence of a nutrient, energy or a biologically active substance in the food and, in some cases, the amount of the component, for example, a good source of dietary fibre.
7. Price *	Affordability statement of the product's cost or price mentioned in the advertisement.
8. Special meaningful tagline *	Meaningful words/expression toward the products or description of the product which was used as part of the product branding.

Description of premium offers, emotional appeal, characters, palatability and nutritional values were based on Hebden's taxonomy of persuasion (Hebden, King, & Kelly 2011). Other types of appeals (*) were defined by the present author as they were featured in the advertising samples recorded in the study.

2.4 Analysis

Analysis was performed using SPSS v26. Descriptive statistics were performed to measure the prevalence of food cues on television programmes and food advertisements aired within the recorded hours in both countries. Further analyses were conducted using chi- squared ($\chi 2$) testing. In all chi-squared analyses of food cues, channel category is the independent variable and food category is the dependent variable. Chi-squared analysis of persuasive appeals utilised advertising channel as the independent variable and types of appeal as the dependent variable. Statistical significance was set at $p < .05$.

2.5 Results

2.5.1 Food cues depicted on UK and Malaysian television

The total of 180 hours of programme recordings (editorial contents) across the UK and Malaysia were analysed for the proportion of food and beverage cues. Table 2.5 shows the food cue proportions of all eight channels across the two countries. Overall percentage of core foods accounted for 48.7% of specific cue type and non-core foods accounted for 43.2% of specific food cues, and unclassified/miscellaneous foods for 8.1% (see Table 2.5).

Table 2-5 Proportions of food type across all channels in the UK and Malaysia (in %)

Country	Channels	Food Cue Category		
		Core food	*Non-core food*	*Unclassified food*
UK	*CBBC*	65.6%	25.6%	8.8%
	CBeebies	68.5%	26.7%	4.8%
	CITV	35.8%	54.3%	9.9%
	POP	34.9%	62.2%	2.9%
Malaysia	*TV2*	40.5%	45.8%	13.7%
	TV3	42.2%	45.6%	12.1%
	NTV7	42.9%	47.8%	9.3%
	TV9	49.4%	43.5%	7.1%
Grand Total		48.7%	43.2%	8.1%

In the UK, the proportion of core foods was higher in the non-advertising channels (CBBC and Cbeebies), with more than double the proportion of the non-core food (unhealthy) cues. The proportion of non-core food cues was higher in the advertising channels (CITV and POP). On the other hand, in Malaysia, the proportion of both non-core and core food cues was approximately even across the four channels (TV2, TV3, NTV7 and TV9). Refer to Figure 2.1 and 2.2 below for the illustrated proportion of each food cue type shown on the UK and Malaysian television.

Figure 2-2 Percentages of food cues shown during children's programmes in each UK channel.

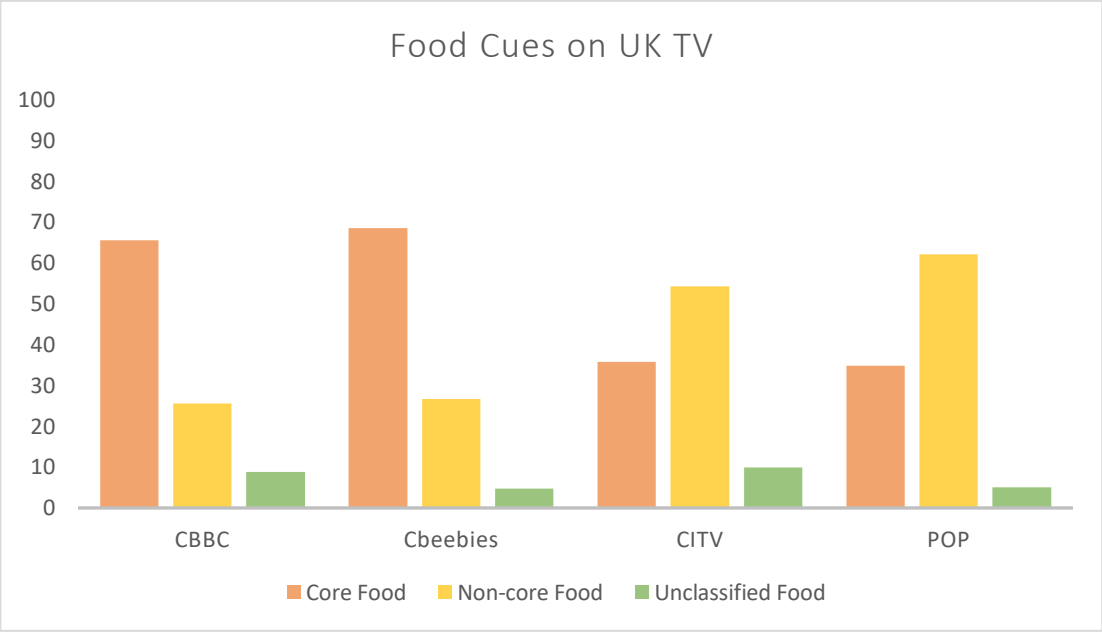
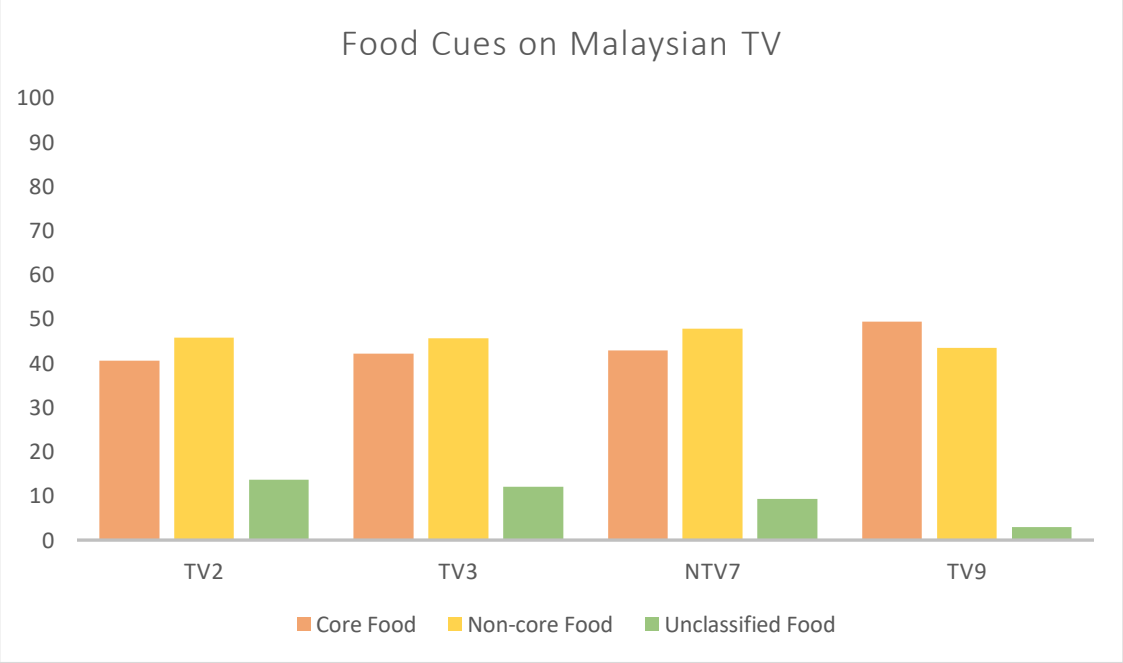


Figure 2-3 Percentages of food cues shown during children's programmes in each Malaysian channel.



2.5.2 Specific food cue subtype shown in the UK and Malaysian television

Twenty specific food types were identified (see Table 2.6) in all channels within the two countries. The most common specific food subtypes shown across both countries were desserts/cookies/cake/biscuits, which were categorised as non-core food cues, followed by fruits, vegetables and breads/rice/pasta/grains/wheat, which were all classified as core food cues. The lowest proportion of food types found was for baby foods, which only accounted for 0.7% of overall food cues presented. Furthermore, in the UK, the proportions of fruits were found higher on CBBC and CBeebies, whereas sugary desserts, cakes, muffins, biscuits, cookies, pies were featured most on CBeebies, CITV and POP. In Malaysia, the proportions of these food subtypes were almost equal across the four channels.

Table 2-6 Proportion of specific food and beverage cue category across all channels in the UK and Malaysia (in %)

Country	**UK**				**Malaysia**				
Channel	CBBC	Cbeebies	CITV	POP	TV2	TV3	NTV7	TV9	Overall total
Food category									
Core food type									
Breads, rice, pasta, grains, wheat	9.3	9.0	4.2	6.3	6.9	6.8	6.3	7.8	**7.0**
Breakfast cereals	4.0	3.4	2.6	5.9	6.1	5.3	3.4	5.8	**4.3**
Fruits	18.1	19.1	6.1	5.0	8.4	7.3	6.3	5.2	**10.2**
Vegetables	8.8	17.4	8.0	5.5	4.6	4.4	5.4	10.4	**8.9**
Low fat dairy, milk, cheese, yogurt	6.6	5.1	2.9	4.6	1.5	1.9	2.4	1.9	**3.7**
Meat, fish, poultry	2.6	3.1	4.8	1.7	2.3	2.9	5.9	3.2	**3.4**
Eggs	3.1	2.8	2.2	1.7	2.3	3.9	5.4	5.8	**3.2**
Soup, sandwiches, salads, low fat/SS spread, sauces	6.2	5.1	3.5	2.5	1.5	2.9	2.0	1.9	**3.5**
Baby foods	0.0	0.6	0.0	0.0	0.8	1.5	2.4	1.3	**0.7**
Water	7.0	3.1	1.6	1.7	6.1	5.3	3.4	5.8	**3.9**
Total core food	**65.6**	**68.5**	**35.8**	**34.9**	**40.5**	**42.2**	**42.9**	**49.4**	**48.7**
Non core food type									
Full fat/flavoured/ sweetened dairy, milk, cheese, yogurt	1.8	2.0	3.5	3.4	6.1	2.9	4.4	2.6	**3.1**
Ice cream, lollies, popsicle	1.8	2.8	6.7	6.7	2.3	4.4	3.4	3.9	**4.2**
Chocolate and confectionary	0.9	0.0	3.5	3.8	2.3	3.4	4.4	3.2	**2.5**
Sweets, gums, jelly	0.9	1.7	2.9	6.3	3.8	1.5	3.4	2.6	**2.8**
Fast food /canned food/restaurant/takeaway	4.4	0.8	4.2	8.8	6.9	8.3	5.4	9.7	**5.4**
HFSS spreads, jam, cereals	0.9	1.7	5.8	4.6	0.8	1.9	3.4	3.9	**3.0**
High fat/processed/ frozen/ crumbled/ battered meat/fish	0.4	0.0	3.8	3.8	3.8	3.9	4.9	4.5	**2.8**
Desserts, cake, muffin, biscuit, cookies, pies	6.6	15.2	14.7	15.5	9.2	8.3	10.7	7.1	**11.7**
Snacks, chips, crisps, popcorn, bars, nuts	2.2	0.6	4.5	3.4	4.6	5.8	4.4	3.2	**3.3**
Fruit juice, fruit drinks	5.7	2.0	4.8	5.9	6.1	5.3	3.4	2.6	**4.3**
Total non core food	**25.6**	**26.7**	**54.3**	**62.2**	**45.8**	**45.6**	**47.8**	**43.5**	**43.2**
Unclassified food/beverage	**8.8**	**4.8**	**9.9**	**2.9**	**13.7**	**12.1**	**9.3**	**7.1**	**8.1**

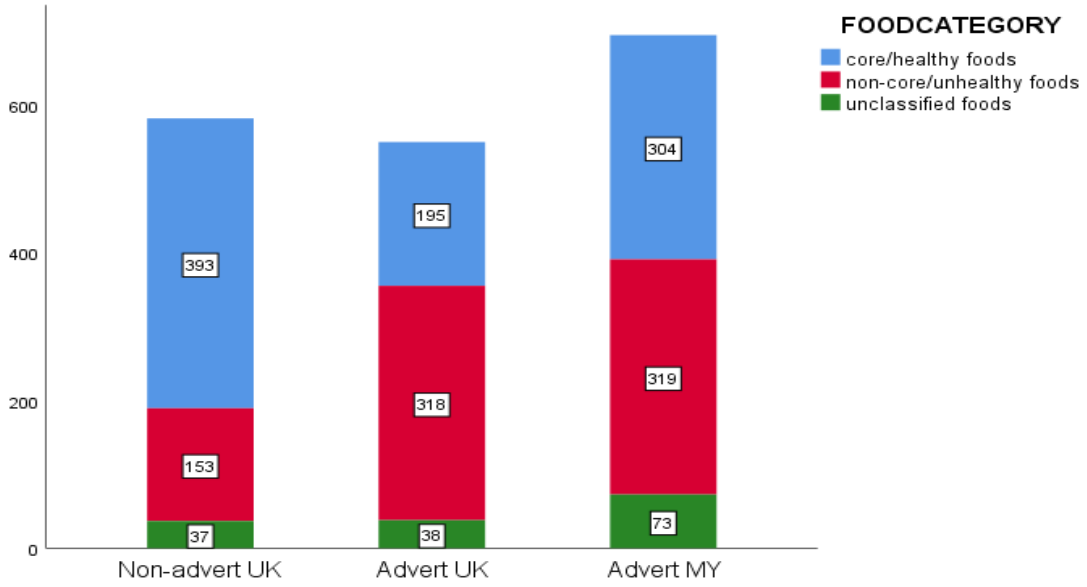
2.5.3 Types of food cues depicted in advertising channels in the UK and Malaysia

In order to analyse the food content by channel type, channels were grouped into three categories; 1) Non-advert UK (CBeebies and CBBC), 2) Advert UK (CITV and POP) and 3) Advert Malaysia (all four channels; TV3, TV2, NTV7 and TV9). A chi-squared test of independence was performed to examine the association between the category of channels (1: Non-advert channels UK; 2: Advert channels UK and 3: Advert channels Malaysia) and the type of food cue (core, non-core and unclassified) as shown during children's programmes. The independent variable is the category of channels and the dependent variable is the type of food cue. Refer to Table 2.7 as below for frequencies and percentages of each food cue type shown within each channel category, and Figure 2.3 for a representation of the frequencies illustrated in a chart.

Table 2-7 Contingency table of channels x types of food cue across 180 hours of programming

Category of Channels	**Types of Food Cue**							
	Core food		Non-core food		Unclassified food		Total food cue	
	n	%	n	%	n	%	n	%
Non-advert UK	393	44.1%	153	19.4%	37	25%	583	31.9%
Advert UK	195	21.9%	318	40.3%	38	25.7%	551	30.1%
Advert MY	304	34.1%	319	40.4%	73	49.3%	696	38%
Total	892	100%	790	100%	148	100%	1830	100%

Figure 2-4 Types of food cue shown in each channel category across 180 hours programmes (frequency shown is out of the total food cues).

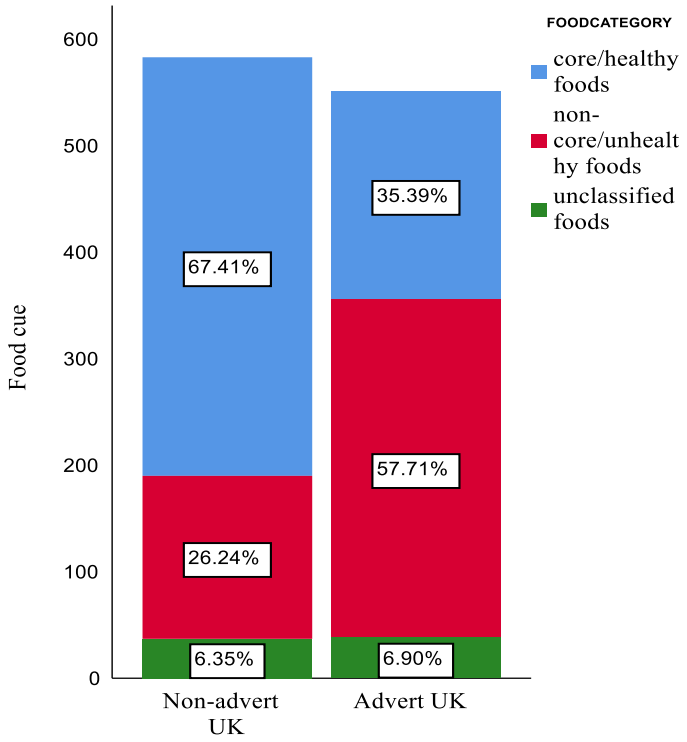


The association between channel category and the type of food cue was significant, X^2 (4, N = 1830) = 140.44, p < .001. This result shows that food cue exposure is associated with the channel category. The Non-advert UK channels had a higher proportion of core foods (44.1%) than the other two channel categories; Advert UK (21.9%) and Advert Malaysia (34.1%). The highest proportion of non-core foods was found in Advert Malaysia (40.4%) and Advert UK (40.3%) channels, and a low percentage was present in the Non-advert UK channel (19.4%).

Contrast between Non-advert UK and Advert UK channels

Figure 2.5 shows the proportions across all three food cue categories in the Non-advert and Advert UK channels. The chi-squared test was conducted with the channel category (Non-advert UK and Advert UK) as independent variable and the food category as the dependent variable. The chi-squared analysis revealed a significant association, X^2 (2, N = 1134) = 123.68, p < .001. A higher proportion of non-core food cues was observed in the Advert UK channels (57.7%) than in the Non-advert UK channels (26.2%). Core food cues were depicted more frequently in the Non-advert channels (67.4%) than the Advert channels (35.4%) in the UK.

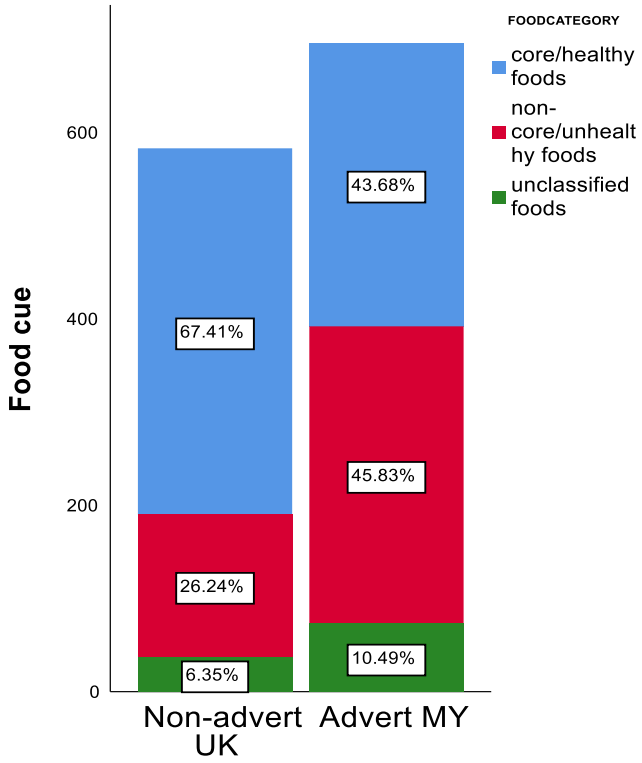
Figure 2-5 Food and beverage cues shown (in %) between Non-advert and Advert channels in the UK.



Contrast between Non-advert UK and Advert Malaysia channels

The comparison between Non-advert UK and Advert Malaysia channels also revealed a significant association , X^2 (2, N = 1279) = 72.10, p < .001. Core food cues were more frequently shown in the Non-advert UK channels (67.4%) than the Advert Malaysian channels (43.7%). The proportion of non-core food cues was higher in Advert Malaysia channels (45.8%) than in Non-advert UK channels (25.2%). The proportions of all three food cue categories in the Non-advert UK and Advert Malaysia channels are illustrated as in Figure 2.6 below.

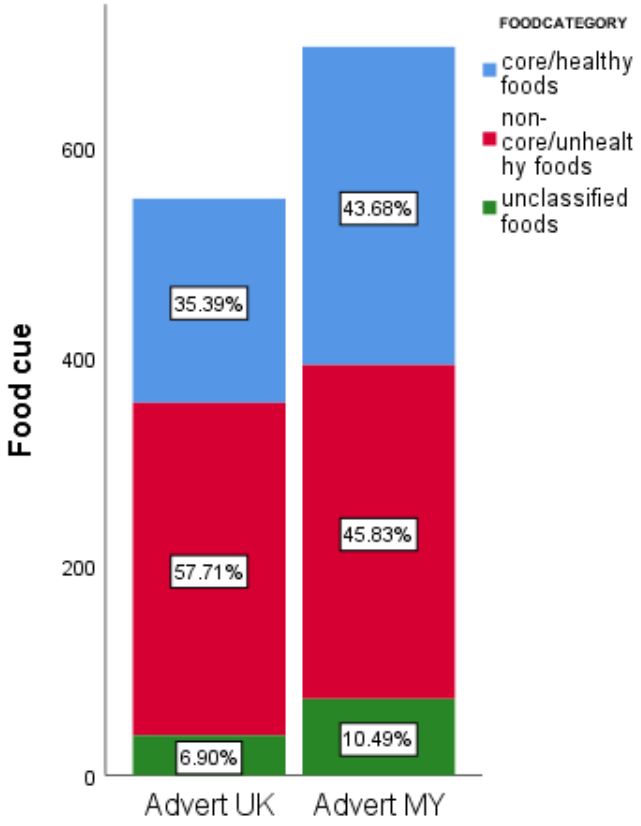
Figure 2-6 Food and beverage cues shown (in %) between Non-advert UK and Advert Malaysia channels.



Contrast between Advert UK and Advert Malaysia channels

The comparison between the two advert channel categories (UK and Malaysia) revealed a significant result, X^2 (2, N = 1247) = 18.23, p < .001. Core food cues were depicted less frequently in the advert UK channels (35.4%) than the advert Malaysian channels (43.7%). The total of non-core food cues was proportionally higher in advert UK channels (57.7%) than in advert Malaysian channels (45.8%). Refer to Figure 2.7 below for proportions of all three food cue categories in the advert UK and Malaysian channels.

Figure 2-7 Food and beverage cues shown (in %) between Advert UK and Advert Malaysia channels.



In summary, similar patterns were observed across both advertising channel categories (UK and Malaysia), with non-core food cues presented more frequently than core food item, and with a higher proportion of core food cues in non-advert UK channels. Furthermore, food cues depicted were significantly associated with channel categories, indicating that non-advert channels (CBBC and CBeebies) have depicted proportionally more core food cues than advertising channels in both countries (UK and Malaysia).

2.5.4 Food advertisements targeted at children across UK and Malaysian television

Food advertisements in UK television

A total of 1403 advertisements were identified, broadcast over 60 hours of programming in the two children's free-to-air channels (CITV and POP), with a mean of 23 advertisements per hour (see Table 2.8). Of these advertisements, 125 (8.9%) were for food and beverage items, with a mean of approximately two food advertisements per hour. The majority of advertisements aired were for other product categories (i.e., toys, baby diapers, home/cleaning products, websites, services, electronics, clothing, travel, etc.), with 790 advertisements depicted across the two channels.

Among all food advertisements aired in the UK channels, non-core foods (i.e., sugared cereals, fast food meal, high sugar yogurt) were found to be most prevalence. These non-core foods accounted for 89% of total food advertisements within these two channels, with the same brands being aired repeatedly throughout the recorded hours (see Table 2.9). Furthermore, across the 60 hours of programming, only 14 advertisements were for core food item (See Table 2.7). Seven specific food brands were identified, with cereals as the most commonly advertised. There were no advertisements for fruit juice, candy, ice

cream, crisps, water or vegetables found in the recorded data of the current study.. Some brands promoted more than one product in an advertisement, while others include other food items together with their selling products. For example, in promoting cereals, some brands presented milk and fruits to eat with the cereals. Refer to Appendix A for the sample of food advertisements shown in the UK.

Food advertisements broadcast on both channels (CITV and POP) include:

- McDonalds Happy Meal
- Kelloggs Coco Pops cereal
- Nestle Munch Bunch yogurt
- Nestle Frubes fromage frais
- BEAR Alphabites cereal
- Weetabix breakfast cereal (core food)
- Nestle squashums yogurt

Table 2-8 Frequency of advertisement across all channels in the UK and Malaysia (total core food advertisements are shown in parentheses)

Country	**UK Channels**		**Malaysian Channels**				
Type of Ads	**CiTV**	**POP**	**Tv2**	**Tv3**	**NTV7**	**Tv9**	**Total**
Food Adverts	89 (6)	36 (8)	15	54	31	63	288
Non-food Adverts	413	865	7	55	16	49	1405
Total	**502**	**901**	**22**	**109**	**47**	**112**	**1693**
Grand total	**1403**		**290**				

Table 2-9 Proportion of food advertisement category across all channels in the UK and Malaysia (in %)

Country	UK Channels		Malaysian Channels			
Types of food advert	**CiTV**	**POP**	**Tv2**	**Tv3**	**NTV7**	**Tv9**
Core Food	6.7 %	22.2%	0	0	0	0
Non-core Food	93.3%	77.8%	100%	100%	100%	100%

Food advertisements on Malaysian television

There were a total of 290 advertisements and promotions depicted, in the 60 hours of children's prime time programming, across the four free-to-air channels with a mean of five advertisements per hour (see Table 2.8). Out of these, 163 (56%) were for food and beverage items, with a mean of 2.7 advertisements per hour. Other product advertisements (e.g., home cleaning, services, body products) accounted for 110 (38%) of the advertisements, followed by toy advertisements 17(6%) across all four channels (see Table 2.9)

All of the food advertisements were for non-core foods (cereals, fast-food meal, candy, snacks, cookies, etc). There were no core food products identified in the 60 hours. Sixteen specific food brands were depicted, with snacks and high sugar beverage as the most common products promoted. Refer to Appendix B for the examples of food advertisements depicted in Malaysian television.

Food and beverage brand advertisements broadcast on all four channels include:

- Apollo snacks
- Mamee monster snacks
- Nini chocolate sticks
- Nestle Koko Krunch breakfast cereal
- Nestle calciyum yogurt drink
- Calpis yogurt drink
- Marrybrown fast food
- KFC fast food
- Nestle Milo chocolate drink
- Cadbury chocolate bar
- 100 plus energy drink
- Nestle Maggi instant noodle
- Chipsmore cookies
- Tropicana juice
- Shapes crisps
- Formula milk

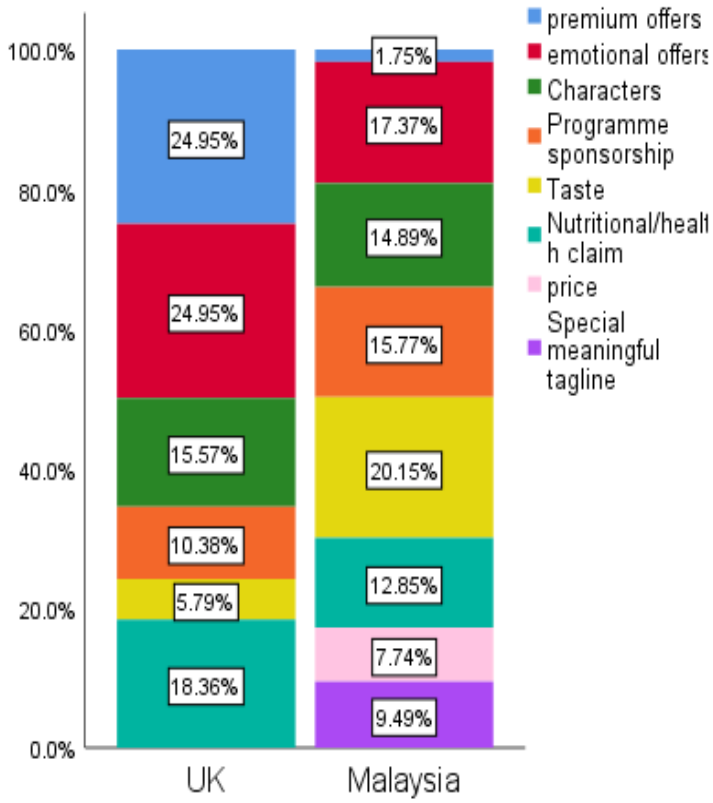
2.5.5 The persuasive appeals used in food advertisements across the two countries

A chi-squared test of independence was performed to examine the relation between channels (UK and Malaysia) and the type of persuasive appeals used in food advertising. Refer to Table 2.10 below for frequencies and percentages of each type of appeal used in food advertisements within the two countries, and Figure 2.8 for a representation of the frequencies illustrated in a chart. The proportion of persuasive appeal used in food advertising differed significantly across the two countries, X^2 (7, N = 1186) = 283.66, p < .001.

Table 2-10 Appeals x Channels cross tabulation table across UK and Malaysian TV

Types of Appeal	Advertising Channels				Total	
	UK		Malaysia			
	N	%	N	%	N	%
Premium offers	125	25%	12	1.8%	137	11.6%
Emotional offers	125	25%	119	17.4%	244	20.6%
Characters	78	15.6%	102	14.9%	180	15.2%
Program sponsorship	52	10.4%	108	15.8%	160	13.5%
Palatability of taste/smell	29	5.8%	138	20.1%	167	14.1%
Nutritional/health claim	92	18.4%	88	12.8%	180	15.2%
Price	0	0%	53	7.7%	53	4.5%
Special meaningful tagline	0	0%	65	9.5%	65	5.5%
Total appeal used	**501**	**100%**	**685**	**100%**	**1186**	**100%**

Figure 2-8 Persuasive appeal used (shown in %) in food advertisements the UK and Malaysia.



Advertising appeals used in food advertisements in the UK

The data included a total of 125 food and beverage advertisements, with 111 (89%) for non-core food items, and 14 (11%) for the core food product. Types of advertising appeals used in all food advertisements (core and non-core) were noted. The mean number of appeals used in non-core food advertisements was five, and two for core food advertisements. Non-core food advertisements broadcasted on CITV and POP used emotional appeals of fun, toy premiums, giveaways/contests, licensed characters, and health claims more frequently than other appeals. In all non-core food advertisements, at least four advertising techniques were used in a single advertisement.

Only one brand was found in the core-food advertising, which is Weetabix. This advertising used a fun appeal and contest as part of its advertising techniques. Refer to Table 2.10 for the proportion of each persuasive appeal category used. Overall, a total of 501 persuasive appeals were identified within the 125 of food advertisements. The most frequently used persuasive techniques were emotional appeals of fun/happiness and premium offers, with each of these two appeals accounting for 25% in all food advertisements (core and non-core foods). The third most commonly used appeal was nutritional value/health claims, followed by characters and movie/programme sponsorship. The least appeal identified was for the palatability (i.e., taste and/or smell). No appeal of price and special tagline were found in all food advertisements in the UK.

Advertising appeals used in food advertisements in Malaysia

In Malaysia, there were a total of 685 persuasive appeals in the 163 food and beverage advertisements. Non-core food items were presented in every advertisement and no core food products were advertised at all. Each food advertisement used a mean of four appeals of various categories. As presented in Table 2.10, the most frequently used persuasive appeals in food advertisements were appeals of palatability (i.e., taste and/or smell), followed by emotional appeals of fun/happiness or humour, programme/movie sponsorship, characters including celebrity, children and cartoon/animated, nutritional values/ health claims, special taglines and price. The least used appeal was premium offers. Refer to Figure 2.8 for the illustrated proportions of persuasive appeals used in both the UK and Malaysian food advertising.

2.6 Discussion

2.6.1 Food cues depicted on children's programmes in the UK and Malaysia

The primary objective of this study was to investigate the prevalence of food cue exposure on children's television programmes across the UK and Malaysia. The findings from the present study suggested that food items are frequently appeared during children's programmes in both countries, supporting findings from previous studies conducted in the UK (Boyland et al., 2016; Scully et al 2014; Whalen et al., 2017;) and Malaysia (Karupaiah et al., 2008; Kelly et al., 2010). During the recorded hours in the two countries, overall food and beverage items appeared in a non-advertising context for an average of 10 food items every hour. Of these total food appearances, half were for non-core foods and unclassified foods, and almost half were for core-foods. This result suggests that children

were still frequently exposed to non-core foods despite both the UK and Malaysian governments' initiatives to promote healthy eating.

Although in the UK, core foods were shown more frequently than the non-core foods, children were still being presented with numerous amounts of non-core foods and beverages. Our result was different to what has been observed previously in the UK (Scully et al., 2014), where non-core food items were found more frequently shown during children's television programmes. This discrepancy of findings might be due to a couple of reasons; firstly, different broadcasting days observed between our study and Scully's. Scully et al. (2014) comprises of programmes during weekdays whereas our study included both weekdays and weekend days (i.e., Saturday and Sunday).

Secondly, the dissimilarities between recording time between Scully's and our study might explain the inconsistent findings. Our study consists of recording time between 11 am – 1pm (i.e., observed in weekends) and 3 pm – 7 pm (i.e., observed in weekdays and weekends), while Scully's study analysed programmes broadcasted between 6 am – 11.30 am. Due to these differences in the time and day observed, there might be different variations of broadcasted TV programmes, hence the conflicting results between ours and Scully's. Nevertheless, our result was consistent with a Swedish study (Olafsdottir & Berg, 2016), which also found that core food items appeared more frequently in their study.

Importantly, the most common specific food type appearing on both countries' television programme was desserts/cookies/cakes/biscuits. This showed that food with high sugar content was prominently shown during children's programmes in the two countries. The result from this study was parallel to Scully et al. (2014), who also found

that sweets, snacks and candy were shown more frequently than other types of food. The findings also consistent with Radnitz et al. (2009). In Radnitz et al,'s study, they found that American children were frequently exposed to non-core food references. They also found that non-core foods were depicted as valuable by television characters and were consumed in higher amounts. The current study also identified a difference in the proportion of baby food depicted in the UK and Malaysian television. The disparity could be due to programmes' genres and the targeted audience. As the programmes recorded in the UK were specifically directed at children (i.e., cartoons, animated programmes etc), whereas in Malaysia, programmes were recorded from channels that were not specifically designed for children (i.e., includes drama, soaps for family viewings etc).

The current study also found that advertising channels in both the UK and Malaysia have shown proportionally more non-core food cues compared to non-advertising channels (UK). This suggests that non-advertising channels in the UK are more likely to depict core food cues during children's programmes compared to channels containing advertisements. As noted previously, the similar pattern observed in advertising channels in UK and Malaysia have provided an important perspective on the presentation of editorial food cues within this medium.

Nevertheless, it is important to note that the differences observed between non-advertising channels in the UK and advertising channels in the UK and Malaysia could be due to the disparate length of programming between the channel categories. As mentioned earlier, the current study did not observe the precise length of each advertisement aired, hence the correct time frame for the in-programme only duration was unspecified. However, as the non-advertising channels in the UK (i.e., CBBC and CBeebies) contain

self-promoting breaks (i.e., a short break between programmes, promoting future programmes), these lengths of breaks may be compatible to the duration of advertisement aired in the commercial channels.

Notwithstanding, whether children watched television in a developed or in a developing country, and whether the channels watched were broadcasting advertising or not, children were still being exposed to similar food environments that include the depiction of non-core foods. As discussed previously, much research has concluded that television food promotion affects children's food choices, preferences, and consumption behaviour (Radnitz et al., 2009). By being exposed to high amounts of non-core foods found in the current study, children could be at risk of developing unhealthy eating behaviour which is also one of the main factors leading to childhood obesity. The findings from the current study suggested that irrespective of sociocultural variance, children are simultaneously being exposed to an extensive amount of non-core foods during television watching. Since the current study was the first to explore the difference between the non-advertising channels and advertising channels in the UK, future research is needed in order to scrutinise the direct implication of these exposures to children's behaviour.

2.6.2 Food advertisement in the UK and Malaysia

A total of 125 food and beverage advertisements were shown during 60 hours of television programming in the UK (on CITV and POP). Of all these, only 14 advertisements were for a core food item, which was for Weetabix breakfast cereal. Our results showed that children were exposed to the non-core food commercials even after the implementation of Ofcom regulations on banning the HFSS advertisements in 2009.

Although much research has suggested that excessive exposure towards non-core food advertising may contribute to higher consumption of such foods, and that the effects of this influence goes beyond the advertised brands alone (Dovey et al., 2011; Halford et al., 2004; Harris et al., 2009), children were still being exposed to messages promoting non-core foods. The depiction of such commercials might be due to marketers or food companies trying to circumvent the restriction on HFSS food advertising by promoting healthier products in order to obtain broadcasting time for their brands during children's programming. As found in our study, children are still being exposed to "McDonalds" advertisements on television. According to a study by Boyland, Kavanagh-Safran and Halford (2015), the exposure to McDonalds "healthy" food meal bundle advertisements (i.e., fish fingers, a pack of fruits and a bottle of water) increases children's liking for fast food, but did not enhance their preferences for healthier options.

Furthermore, the current study also found that all food advertisements shown in Malaysia were for non-core food items. The channel with highest recorded food advertisements was TV9, and the one with the lowest food advertisements was TV2. This may have been because TV3, NTV7 and TV9 were all owned by an integrated profit-making media company, called Media Prima, with a range of media-relevant businesses including advertising and digital media. In contrast, TV2 was owned by Radio Television Malaysia, an organisation part of the Malaysian Government division, in which it is not for profit making purposes like the other three channels. Although Malaysia has pledged against fast food advertising in 2007, the results of the current study showed that Malaysian children were still being exposed to such advertising.

Additionally, the result also revealed that there is a substantial difference of advertising density between Malaysia and the UK television. This might be due to fewer advertising aired during certain time of the day (i.e., during children programmes) in Malaysia. Majority of the advertisements found in the recorded sample of Malaysian television were depicted during family viewing time. Moreover, the most common advertisements observed in both countries were for non-food items (refer to Section 2.6.4). For this reason, the current study did not assess the prevalence of specific products within this type of advertisements, thus unable to explicate the reason of such disparity.

2.6.3 Advertising appeals used in food advertisement

In examining the persuasive appeals used in food advertisement, the findings revealed that non-core food advertisements used more persuasive appeals compared to core food advertisement, with average of five appeals in each non-core food advertisement. Consistent with the previous studies (Batada et al., 2008; Boyland et al., 2011), we found that the most frequently used appeal in food advertising in the UK was the emotional appeal of fun/happiness, which was found in all the advertisements broadcast. The current study also found that in all food advertisements (both core and non-core foods), premium offers were utilized in combination with emotional appeals of fun/happiness as part of their persuasive techniques.

The findings from the present study also revealed that food advertisements in Malaysia used an average of four persuasive appeals in each advertisement, with appeals to taste being used most frequently, followed by appeals emphasizing the fun nature of a product. Previous studies in Western countries also found that the primary appeal used in

food advertising to children was for taste (Gantz et al., 2007; Wicks, Warren, Fosu & Wicks, 2009) and the main emotional appeal was for fun (Boyland et al., 2011; Folta et al., 2006). Premium offers were the least used appeals in Malaysia. This was different from advertising in the West where premium offers such as giveaways and toys/freebies are commonly used in food advertising (Batada et al., 2008; Boyland et al., 2011; Kelly et al., 2010). Wicks et al. (2009) found that taste/flavour was the most commonly used appeal and that some advertisements used nutritional claims as well.

A total of 288 food and beverage advertisements were identified during 120 hours of television programming in both countries (excluding CBBC and Cbeebies). Of all these, only 14 were for core food items – these were recorded in the UK. The results of our study implied that children were still being exposed towards HFSS food commercials even after the implementation of Ofcom's regulations on banning the HFSS advertisements in 2009. Excessive exposure towards non-core food advertising may contribute to higher consumption of such foods, and this influence goes beyond the advertised brands alone (Dovey et al., 2011; Halford et al., 2004; Harris et al., 2009).

The results from this study were consistent with previous studies (Batada et al., 2008; Boyland et al., 2011) in which the most common persuasive appeal used in food advertising towards children was an emotional appeal of fun/happiness. In all of the food advertisements recorded, fun appeal was used as the main technique in combination with other advertising techniques. Consistent with previous studies, our study has found that the emotional appeal of fun/happiness often featured animation/cartoon or human characters engaging in a fun activity or using humour as part of the appeal to alter children's mood (Boyland et al., 2012; Folta et al., 2006; Hasting et al., 2003). Fun appeal was found to be

the second most frequently used in Malaysia, following the appeal of taste, which was utilized most frequently in Malaysia's food advertising.

All of the food advertisements recorded in the present study used at least four appeals in each advertisement. Other frequently used appeals found in the UK television were premium offers, nutritional/health claims and characters. This was similar to the previous study by Batada et al. (2008), which found that animation, movie or cartoon characters were used frequently in food advertising. In Malaysian television, palatability appeal of taste was the most common appeal used in food advertisement. This result is consistent to Gantz et al. (2007) who also found that the most common primary appeal used in all advertisements targeted at children and teens was taste, whereas claims about health or nutrition were rare. Apart from taste appeal, emotional fun appeal, programme sponsorship and health claims were also frequently utilized in Malaysian food advertisements. Similar to Wicks et al. (2009), results from the current study have shown that nutrition/healthy claim was regularly utilized in children's food advertisements, nonetheless only a few percentages are for taste/flavour appeal in Wicks' study.

2.6.4 Non-food advertisements in the UK and Malaysia

Apart from food advertisements, the findings in the current study have revealed that children in both countries have been exposed to a total of 1405 non-food advertisements within the 120 recorded hours. This is 83% of the total advertisements aired during the recording period. As discussed in Chapter 1 earlier (see Section 1.6), previous research has shown that exposure to television advertisements (especially toy advertising) might influence children's perspectives and affection towards the advertised products and

brands (Buijzen & Valkenburg, 2000; Goldberg, Gorn, Peracchio, & Bamossy, 2003), which consequently leading to purchase requests as well as materialism (Opree, Buijzen, & Valkenburg, 2012; Lenka, 2014). As the current study only aim to explore the food content within children's television programmes and advertising, the content of non-food advertisements were not analysed. Future studies should consider investigating such advertisements in order to examine whether these commercials were intended for children, and how they might affect children.

2.6.5 Limitations of the study

The current study was the first to analyse the prevalence of food cues on editorial content in Malaysia, and to directly compare the nature of media food exposure towards children in the UK and Malaysia. However, there are some limitations of this study. Firstly, the data analysed were randomly selected during children's prime time television viewing at the specific periods over a specific duration. Thus, they might not reflect the overall food cues depiction on all children's television programmes in the two countries. The current study only included public broadcast channels in Malaysia, thus food cues exposed on children's specific channels in pay-per-view or subscription television were not explored. Future studies should consider including programmes in subscription TV such as Netflix and Disney channels to further examine the extent of media food cue exposure.

Moreover, due to the different sample size in the UK and Malaysia (120 hours and 60 hours) and the lack of advertisement length observed, comparisons between the two countries can only be made proportionately rather than the amount of cue occurrence. As the current study was conducted based on the relevant previous research (i.e., Boyland et

al., 2013 and Kelly et al., 2010), which did not include the lengths of advertisement, this was not observed in the current study. Thus, it is recommended for future studies to observe the advertisement lengths so that accurate evaluation can be made. Furthermore, as the nature of this study (content analysis) is non-experimental, it does not allow us to assess whether children notice the food cues and commercial content exposed. Nor does it allow us to measure whether different types of food cues influence children's direct eating behaviour differently. Therefore, the effects of these cues will be further explored in the following chapters (Chapters 3 and 4).

2.6.6 Research implication

The findings from the present study have revealed that children may be exposed to a substantial amount of non-core food cues during television viewing regardless of their demographic region. As noted earlier in this chapter, excessive exposure towards non-core food cues might influence children's preferences and attitude towards the food, which could have an effect on their eating behaviour. The findings from this study have provided substantial evidence of the current prevalence of media food cues depicted on children's television programmes. However, further research is needed in order to investigate the immediate effect of television food exposure towards children's actual eating behaviour.

2.7 Conclusion

This chapter provides analyses of the extent of food and beverage cues depicted during children's programming in both UK and Malaysia in both advertising and editorial contents. Similar to previous research discussed in the beginning of this chapter, the findings from our study have provided evidence that children are still being exposed to

non-core foods during television viewing whether they are in a developed or developing country. This means that the UK policy regulations of advertising towards children (i.e., Ofcom's regulation of HFSS food advertising, 2010) have had little impact in protecting children from the harm of unhealthy food environments, as children are still presented regularly with non-core foods within children's programmes. To our knowledge, the present study was the first study to directly compare food cues within children's television programmes (non-advertising context) in the UK and Malaysia.

Studies have shown that television food advertising may influence children's food choices, purchase requests and eating behaviour (See Chapter 1, section 1.5). The high proportion of non-core foods exposed during television viewing found in the current study might be one of the determinants of children's unhealthy eating habits. Prolonged and excessive exposure to non-core foods might influence children's preferences to these type of foods. The finding from our study has provided evidence that children are still being consistently exposed to non-core foods during television viewing. Although there are emerging research concerning the effect of food exposure on the digital media, to the author's knowledge, such research among children from developing countries are scarce. Therefore, this will be the next focus in Chapter 3, where the immediate direct effects of food cues embedded on computer games on children's eating behaviour will be investigated.

CHAPTER THREE

3 The effects of healthy food cues during computer gaming on children's immediate snack intake

3.1 Introduction

The results in Chapter 2 have provided insight regarding the media food environment of children in the UK and Malaysia. The previous study (see Study 1 in Chapter 2) has also stressed the importance of research concerning the visual food cues portrayed in the current media environment. This evidence gave a substantial basis to our research in understanding the extent of food cues portrayed in the media. As discussed earlier, exposure to non-core food cues in traditional media (i.e., television) can influence children's eating behaviour (see Chapter 1, section 1.4). Children who watch television with embedded food cues consume a greater amount of food compared to those who weren't exposed to any food cues (Boyland et al., 2016, Harris et al., 2009). Although the findings of these studies have shown that food cues on television are powerful enough to stimulate children's immediate food consumption, the evidence of such an effect in other media contexts is limited.

To develop a further understanding of the impact of visual food cue exposures on children's eating habits, it is crucial to examine such effects in a different type of media exposure, such as the digital media. Therefore, in this and the next chapter (Chapter 4), the present thesis will focus on the effects of media food cue exposures during computer

gaming on children's immediate snack intake. Children's actual consumption following exposure to food cues will be the emphasis of these studies. The current chapter will highlight children's susceptibility toward visual food cue exposure during computer gaming in a non-advertising context. The current chapter will also explore the role of children's age in moderating the effects of media food cue exposures.

3.1.1 The effect of food cues exposed in digital media on children's eating behaviour

As discussed earlier, research has concluded that excessive exposure to non-core food or beverage stimuli might be one of the factors leading to overconsumption among children (see Chapter 1, section 1.5.2). Apart from traditional media marketing, children in this era are increasingly targeted by food marketers through new media platforms (Buijzen, Owen & Van Reijmersdal, 2010; Folkvord et, al., 2016; Rifon et al., 2014). As children are becoming more literate in conventional technologies such as digital media (i.e., computers and the Internet), online marketing and interactive digital marketing are becoming more prominent in promoting foods.

As far as the effects of computer games on children's eating behaviour are concerned, research focusing on this particular domain is sparse, with only a small number of studies including actual food intake as a measure. Research concerning digital media has mainly focused on the marketing technique called 'advergames', which has been designed especially for the purpose of marketing to children. Advergames are online platforms designed by marketers to deliver their messages to young consumers through interactive digital gaming, which includes 'embedded advertisement messages within the content of retail; accessible video games and online electronic games' (Dahl, Eagle &

Báez, 2009, p.47).

One of the pioneer studies concerning the digital media effect was an early study of children's advergames by Harris et. al. (2012), in which children (n=152) aged between 7 and 12 were exposed to existing online advergames with unhealthy food cues, healthy food cues or a non-food game, and then the children were offered selections of fruits and snack foods immediate after playing games. Harris et al. (2012) reported that children who played unhealthy food advergames consumed more unhealthy snacks than those who played healthy food advergames or non-food games. They also found that children who played advergames with healthy foods ate significantly more healthy foods (fruits and vegetables) compared to children who played advergames with unhealthy snacks or controls. These findings suggest that there exist direct relations between the priming foods exposed and children's immediate food consumption.

Following the study by Harris et al. (2012), Folkvord et al. (2013) extended the research by utilizing a large sample with a total of 270 children aged from 8 to 10 years old. Children were randomly assigned to four conditions; an advergame that promoted energy-dense snacks (a popular candy brand featuring 8 different gummy and jelly sweets of the same brand), a fruit advergame (a popular fruit brand featuring 8 different fruits, fruit drinks, or cups with the fruit of the same brand), a non-food advergame, or a control with no game. Unlike Harris et al. (2012), the advergames used in Folkvord et al. (2013) were memory card games that were specifically designed for the purpose of their research. Children were then offered selections of two types of snacks and two types of fruits presented in four different bowls. One of each type of snack or fruit was identical to the type of food shown in the advergames.

Folkvord et al. (2013) found that children who played the advergame with food cues, whether for healthy or unhealthy foods, ate more snack food compared to children who did not see any food. Folkvord et al. (2013) also reported that children who played the advergame with fruits did not eat more fruits than children in other conditions. These findings provide evidence that food advertising in computer games, whether healthy or not, has an impact on children's immediate snack consumption.

Although the current literature has provided evidence of the effects of food cues exposed within traditional media (Andreyeva, Kelly & Harris, 2011, Boyland et al., 2013; Epstein et al, 2008; Gorn & Goldberg, 1982; Halford et al, 2004; Harris et al, 2009), studies of such effects in integrated media (i.e., computer games) are still scarce. Importantly, most of the studies concerning digital media have focused primarily on the influence of advertising (Folkvord et al., 2013; Harris et al., 2012), without considering such effects in a non-advertising context. As found in the previous study (see Chapter 2), children are being exposed to non-core foods in both advertising and non-advertising contexts. Therefore, the current study was designed to address the gap in the literature by exploring children's susceptibility toward embedded food cues within digital media. The current study will explore the effects of food cue exposure on computer games in a non-advertising context.

3.1.2 Priming effect of food cues embedded in computer games – theoretical perspective (Food Cue-Reactivity theory)

Research concerning the effects of food cues on eating behaviour is often based on the theoretical framework provided by the Food Cue-Reactivity (FCR) theory (Jansen, 1998). As discussed in Chapter 1 (see Chapter 1, section 1.2.2), FCR states that the

activation of cue-reactivity is triggered by the representation of food-related cues. The theory proposes that when food (unconditioned stimulus) is consumed, it will stimulate a metabolic response (unconditioned response), that develops links with food-related cues (i.e., smell, sight or taste). These food-related cues perform as conditioned stimuli, sequentially inciting cue-reactivity (conditioned response).

According to FCR, the activation of cue-reactivity will result in conditioned responses of both psychological (i.e., desire to eat or cravings) and physiological states (i.e., increased salivation, insulin release, cephalic phase response). These responses will consequently increase the consumption of cued food. Based on this notion, the images and cues (implying food intake) exposed during computer gaming might perform as conditioned stimuli that trigger cue-reactivity and craving (Jansen et al, 2011) which ultimately leads to food consumption. Therefore, based on the Food Cue-Reactivity theory (FCR), the current study predicts that food cues embedded in computer games will perform as conditioned stimuli, which will reactivate conditioned responses and significantly prime food consumption among children, thus increasing food intake.

As mentioned earlier, exposure to visual food cues in media can motivate food consumption among children by stimulating cue-reactivity towards food cues (see Chapter 1, section 1.2.2). Nevertheless, since the stimuli exposures used in the previous studies mostly utilised traditional media (i.e., television) exclusively (Boyland et al, 2013; Dovey et al, 2011; Halford et al., 2004, 2007, 2008; Harris, Bargh & Brownell, 2009;), the mechanisms involved in priming children's instantaneous food consumption are still undetermined. Therefore, the current study aimed to investigate the effects of food cues on children's eating behaviour by utilising digital media (i.e., computer games) as a method

of exposure.

To the author's knowledge at the point of writing this chapter, there are no studies that have directly tested the effects of food placement in children's media without any reference to branding or advertising. As stated previously (see Chapter 2, section 2.1), food advertisements include promotional features to persuade consumers to buy a product. Also, promotional brands and logos are sometimes used in product placement in tv shows and films. However, in contrast to advertising and product placement contents, food cues exposed in a non-advertising context do not contain any specific marketing or persuasive messages. Therefore, the present study considered the effects of a visual food cue on children's immediate snack consumption when that cue was not associated with any advertising or branding. Specifically, this study investigated whether food cues embedded in computer games would motivate children's immediate snack intake. Based on the assumptions of the Food Cue-Reactivity theory (Jansen, 1998), the current study predicted that exposure to food cues in computer games would stimulate children's immediate food consumption.

3.1.3 Children's cognitive development of advertising literacy

As reviewed in Chapter 1 (see section 1.3.4), research has established substantial evidence regarding children's cognitive development of advertising knowledge. For instance, Wright, Friestad and Boush (2005) noted that children's advertising literacy developed as they mature. The recognition of advertising was observed to develop before children progressively acquire an understanding of advertising intent (Gunter, Oates & Blades, 2005). Furthermore, research has suggested children aged 8 to 12 years old have a

better understanding of the persuasive intent of advertising than younger children (below the age of 8 years) since they are able to distinguish and detect bias, especially when the advertising is misleading (Valkenburg & Cantor, 2001). A cross-sectional study by Hudders and Cauberghe (2017) has found that older children (aged 10 -11 years) have a better ability to identify advertising intent and the source of brand placement compared to younger children (aged 7-8 years).

Although these studies have shown the importance of age in the development of children's advertising knowledge, research on older children's susceptibility to digital media is very limited. Since most of the research has centred exclusively on such effects in advertising and marketing contexts, the potential impacts of media food exposures outside an advertising point of view are still inconclusive. Thus, the current study will investigate the effect of non-advertising media food cues on children's eating behaviour, as well as explore children's susceptibility towards such exposures by examining the role of age in moderating the effects of food cues exposed. Therefore, the current study compared children aged 7-9 years and children aged 10-11 years.

3.2 Objectives of the study

Several studies have considered the effect of advertising on children's preferences, recognition and purchase intention (Halford et al., 2004; 2007; 2008) but little is known about the direct causal effect of food promotion on children's consumption, especially among children in the developing countries. With the current concerns about children's eating behaviour following exposure to food cues, there is a need for more research into food cues on digital media. Thus, the primary objective of this study is to investigate

whether food presentation in the digital media (i.e., computer games) can motivate children's immediate food consumption.

Based on the existing literature in the digital media domain (Folkvord et al., 2013; 2017; Harris et al., 2012), the present study predicts that children who are exposed to food cues during computer gaming will consume more food than those who do not see any food. Importantly, since most of the previous studies concerning media food cues have only measured the effects of non-core food cues, the present study is also interested to discover whether the same effect would be observed if the cues are for healthy ones. Therefore, to address the gap in the literature, the present study will utilise healthy food cues (i.e., fruits) as the food stimulus and will use non-advertising computer games as a method of exposure.

Secondly, the study aimed to examine the role of children's age in moderating the effects of food cue exposures. As children's energy needs varies according to their age, gender and physical activity, older children require higher amounts of calories to maintain the body and growth (American Paediatric Association, 2014). Thus, it is predicted that food consumption will be higher among older children compared to younger children, due to a bigger appetite and greater body surface (i.e., higher energy and caloric requirements) in older children. Nonetheless, as discussed earlier, children's cognitive development plays an important role in mediating their susceptibility toward advertising effects. Therefore, the current study predicts an interaction between children's age and cue exposure in which older children will consume less food than younger children when exposed to food cues during computer gaming.

3.2.1 Hypotheses

H1 Children who play computer games featuring food cues will eat more than those who do not see any food.

H2 Older children will eat more than younger children in the same condition, as they need a greater food intake to be satiated.

H3 There will be an interaction between children's age (younger and older) and type of cue exposures (food and non-food). Children's age will moderate the effect of cue exposures, where the effect will be stronger among younger children who were exposed to food cues.

3.3 Methodology

3.3.1 Ethical approval

Ethical approval was given by the University of Sheffield Ethics Committee to conduct the experiment. See Appendix E1.

3.3.2 Design

The current study utilized a two-way factorial ANOVA; 2 Age groups (younger children and older children) X 3 Conditions (Food game, non-food game and control). To address the hypotheses, the present study utilized a between-subject design, in which children were assigned to one of the three conditions (1- Food Game; 2- Non-food Game; 3- Control non-game). The amount of cereals consumed immediately following each condition was the dependent variable, being the behavioural response towards the cue

exposed.

3.3.3 Data collection and participant recruitment

Data collection was conducted in May 2018, from two elementary schools in Alor Setar, Kedah, Malaysia. The state of Kedah is located in the northwest coast of Peninsula Malaysia, at the border of Malaysia and Thailand. Participating schools are located in Alor Setar, a peri- urban area which is the capital city of Kedah. According to the Global Food Security Index (2021), Malaysia is ranked at 39th in 2021, up nine places from the previous year. However, data on the food security within this specific region (i.e., Kedah) is unknown neither does the prevalence of obesity among its population. Prior to the start of data collection, invitation letters were sent to schools inviting them to participate in the study. Headteachers from interested schools were then provided with detailed experimental procedures and study objectives, together with a consent letter. Schools and parents were made aware that the research was carried out and approved by a UK-based university. Parents with children in participating schools were given an invitation letter and information sheet (see Appendix F) detailing the purpose of the study. Parents who requested more information were informed that the study was intended to measure the effects of food references during computer gaming on children's eating behaviour but was asked not to share the true purpose of the study with their children before the experiment.

All parents provided written informed consent before the start of the experiment. Children were told that they would participate in gaming sessions/television screening, and would be given snacks following the session. The consent letter includes questions regarding food allergies and intolerances (i.e., nuts, dairy and gluten) (refer to Appendix

G). Children with food allergies or intolerances related to the food used in the study were excluded. Prior to the start of the experiment, children with parental consent were asked whether they would like to participate in the study. All participating children provided verbal assent to the primary investigator. Upon completion of the experiment, participating children were given a debrief explaining the purpose of the study (see Appendix H1).

An opportunity sample of 180 children aged between 7 and 11 years from elementary schools in Malaysia participated in the current study (see Table 3.1). The sample size used in the current study was based on similar studies concerning the effect of food cues on children's immediate food intake (Folkvord et al., 2016 (N=133); Folkvord et al., 2017 (N=127); Harris et al., 2012 (N=152); Normal et al., 2018 (N=160)). All the children were recruited from two elementary schools in Kedah, a Northern district in Malaysia. Before the experiment, participants answered questions regarding their age and gender.

Table 3-1 Total number of children in each age group and gender

Age group	N	No. of male	No. of female
Younger children			
7 year-olds	30	15	15
8 year-olds	30	15	15
9 year-olds	30	15	15
Older children			
10 year-olds	45	22	23
11 year-olds	45	23	22
Total	**180**	**90**	**90**

3.3.4 Procedure

Parents were given an invitation letter inviting their children to voluntarily participate in the experiment. Parents were informed that the study was about the effects of computer games on children's eating habits. Parents along with their children who agreed to participate were asked to complete a written consent form. Children who had parental consent were asked whether they would like to participate in the study. All participants provided verbal assent before the experiment. The children were assigned to one of the three conditions; (1) Food computer game; (2) Non-food computer game; (3) Control television programme.

Conditions

- **Condition 1** – Food Game: A five-minute computer game featuring characters jumping and running while collecting fruits was the stimulus for the food cue game. Condition 1 contained embedded food cues without food consumption.
- **Condition 2** - Non-Food Game: A five-minutes computer game featuring characters jumping and running was the stimulus for the non-food cue game. Condition 2 did not contain any food depiction or food consumption.
- **Condition 3** - Control: A five-minutes Mr Bean cartoon programme was the stimulus for the control condition**.** Condition 3 did not contain any food depiction or food consumption.

All experiments were conducted in a computer lab for the computer game or the television watching sessions, and in an empty classroom for the eating session at their school. All experimental sessions were conducted between 9am - 11am (after breakfast)

and 1pm - 2pm (after lunch). The school's morning/snack break is from 9.45 am to 10.45 am and the afternoon/lunch break is from 12 to 1 pm. Children were asked if they had eaten breakfast or lunch before the experimental session. All participants reported that they have eaten prior to the experiment. However, the time since the last meal was not recorded. To control for the variability of testing times, each experimental condition group was allocated into scheduled sessions shown in Table 3.2 below. Testing times were included in the preliminary analyses to determine whether these have an influence over children's intake. As applied in the previous research (Dovey et al., 2011; Harris et al., 2009), in order to minimize the initial differences of hunger, the experiment was conducted at the same time of day (between 9-11am and 1-2pm) for each condition. Further tests on children's hunger, BMI, and attitude towards the game and food cues were not measured.

Table 3-2 Schedule of experimental sessions

Sessions	Day 1	Day 2	Day 3	Day 4	Day 5	D/ay 6
9 am	Younger Condition 1	Older Condition 1	Younger Condition 2	Older Condition 2	Younger Control	Older Control
9.30 am	Younger Condition 1	Older Condition 1	Younger Condition 2	Older Condition 2	Younger Control	Older Control
10 am	Younger Condition 1	Older Condition 1	Younger Condition 2	Older Condition 2	Younger Control	Older Control
10.30 am	Younger Condition 1	Older Condition 1	Younger Condition 2	Older Condition 2	Younger Control	Older Control
1 pm	Younger Condition 1	Older Condition 1	Younger Condition 2	Older Condition 2	Younger Control	Older Control
1.30 pm	Younger Condition 1	Older Condition 1	Younger Condition 2	Older Condition 2	Younger Control	Older Control

On the day of the experiment, the experimenter asked the permission of the headteacher and teachers before the start of the first session to call the children from their

classroom. Initially, children were assigned to the conditions. Children followed the experimenter in groups of five to ten to the computer lab. Before the experiment, the experimenter gave the children brief information about the study and what it would involve. Children were told that the experimenter was interested in understanding children's media preferences and interest in computer games. Children who were selected for Conditions 1 or 2 (computer games) were instructed to take a seat in front of a computer screen and make themselves comfortable before starting the experiment. Each child was assigned to sit individually in front of the computer.

Children were told that they were expected to remain quiet and to not speak with one another to avoid interrupting other children. They were told that if they had any problems during the session, they should raise their hand and the experimenter would come and help them. All computers were already set up and running with specific games before the children entered the lab. Children were given instructions on how to play the game and were told that they could play for five minutes and that they would have to stop when the bell rang. Children who were selected for the control condition were instructed to take a seat in a group of five to ten facing the LCD screen at the back of the computer lab. In the control condition, children were told that they would see a clip of a cartoon (i.e., Mr Bean) for five minutes. They were instructed to remain silent during the viewing and were told that the experimenter was interested in the children's attitudes and behaviour during television watching.

Immediately after playing the game or watching the television programme, children were thanked and were asked to follow the experimenter to another room (an empty classroom) which was located next to the computer lab. Children were instructed to

take a seat and were given a 20-grams bag of Kellogg's Froot Loops. To avoid peer influence on the amount of cereal eaten, children were seated separately from each other. The eating sessions took place immediately after gaming/watching television, and experimental sessions were conducted at various times of the day depending on the allocated group (refer to Table 3.2).

Children were informed that the cereals were given to compensate for their time and participation in the experiment. They were also told that they could eat as much, as little as they liked or none if they don't want them. They were also told that they could ask for more cereal if they had finished the first bag. Children were advised that they could eat the cereal in the experimental room only and that they were not allowed to take any cereal outside the experimental room. Children who finished the first bag of cereal were asked if they would like to have more. Children who asked for more cereal were given another bag with the same weight (20 grams). Each bag of cereal given was labelled with a participant ID for post-experiment weighing purposes. Bottled water was provided during the snack intake as required by ethical approval. The amount of water drunk was not measured as part of the study. Children were told that they could leave the experimental room anytime they liked.

Before leaving the experimental room, children were asked not to reveal what they had done during the experiment to their friends who had not yet done the study. An experimental session lasted for no more than 20 minutes including briefing, doing the task and eating the food. After the experiment, the experimenter collected all bags of eaten cereals and weighed the remaining balance of cereal left in each bag. The total amount of cereal consumed by each participant was recorded. Children's cereal consumption in each

condition was determined by weighing the balance of cereals before and after the opportunity for consumption. The amount of cereal consumed in grams was the dependent variable.

3.3.5 Materials

3.3.5.1 Stimuli

Cbeebies Asia Peter Rabbit online computer game

Condition 1 included a computer game of Peter Rabbit taken from the Cbeebies Asia website. The game was called 'Hop to it', where the characters (rabbits) need to collect fruits and fill their baskets. The game featured rabbit characters jumping and running to collect fruits (i.e., berries). See Appendix C for details.

Shaun the Sheep online game

Condition 2 used a computer game taken from the Boomerang Asia TV website. The game was called Championsheep Alien Athletics, where the characters (Shaun and other sheep) need to avoid obstacles and run from an alien spaceship. The characters (sheep and aliens) jumped over or avoided obstacles to get to the finish line. The game did not contain any images of food. See Appendix C for details.

Mr Bean's cartoon programme

For Condition 3, the control condition, the present study used one episode of an animated cartoon clip (Mr Bean) edited to approximately five minutes. The clip was extracted from an episode of Mr Bean's animated series called 'Hopping Mad'. No food was shown during the clip. See Appendix C for details.

3.3.5.2 Sugared cereal

Participants were given a pre-weighed bag of breakfast cereal (Kellogg's Froot Loops), containing 20 grams each. Children were presented with unrelated food (i.e., Kellogg's Froot Loops) to the food exposed in the game (i.e., fruits) as the current study aim to explore the effect of media food cues on children's general food intake (i.e., incongruent foods). The current study used cereals to present to children due to convenience in preparing and packing. Furthermore, Kellogg's Froot Loops have been used as snacks (given without milk) and offered to children (aged 3-5 years old) in previous research (Sacrey, Arnold, Whishaw, & Gonzalez, 2013). Although the recommended portion size (i.e., stated on the cereal box) is 30 grams, we decided to re-pack and pre-weigh the cereal into 20 grams each because the cereal were offered to children as snacks (i.e., given without milk), and given outside their main meal times. Refer to Table 3.3 below for Kellogg's Froot Loops' nutrition facts. To avoid the risk of confounding, the plastic bags used were transparent and did not show any brand or logo. Each bag of cereal was labelled with the participant's ID.

Table 3-3 Kellogg's Froot Loops' nutrition facts (per serving of 20g)

Energy	78kcal
Protein	0.5g
Total Fat	0.4g
Total carbohydrates	17.6g
Dietary Fibre	0.4g
Sugars	6.6g
Sodium	86mg
Vitamin A	53.2mcg
Thiamine (Vitamin B1)	0.2mg
Riboflavin (Vitamin B2)	0.2mg
Niacin (Vitamin B3	1.5mg
Vitamin B6	0.2mg
Vitamin B12	0.2mcg
Folic Acid	24.0mcg
Vitamin C	6.0mg
Iron	1.1mg

3.3.5.3 Weighing scale

A mini digital scale of 0.1gram accuracy (AMIR, model I-2000) was used to weigh the cereal before and after the experiment.

3.3.6 Data Analysis

The current study hypothesised that food cues exposed on a computer game would encourage food consumption among children. The two independent variables are the type of cue and children's age. The first variable consists of three levels: cue type (food-cue game, non-food game and non-food non-game TV). The second variable consists of two levels: age (younger and older). The dependent variable for all analyses was the weight of cereals consumed by children following the exposure to the cue conditions (measured in grams). Initially, a preliminary analysis was conducted to test whether gender is a potential

confounding factor. A one-factor ANOVA was used with gender as the independent variable and total snack intake as the dependent variable. Secondly, the snack intake data in all conditions were tested for normality and homogeneity of variance (Levene's test).

Next, to test the hypotheses, children's immediate consumption of Kellogg's Froot Loops cereals was analysed using a two-way analysis of variance; 3 Type of cue (food game vs non-food game vs non-food non-game control) X 2 Children's age (younger vs older). Effect sizes were calculated using partial η squared (η_p^2), with 0.01 indicating small effect, 0.06 indicating medium effect, and 0.14 indicating large effect. Additionally, a series of post-hoc power analyses were conducted using G*power (Faul, Erdfelder, Lang, & Buchner, 2007) to find out whether our design had enough power to detect the effect of food cues on children's consumption. Observed power was reported in the main analyses.

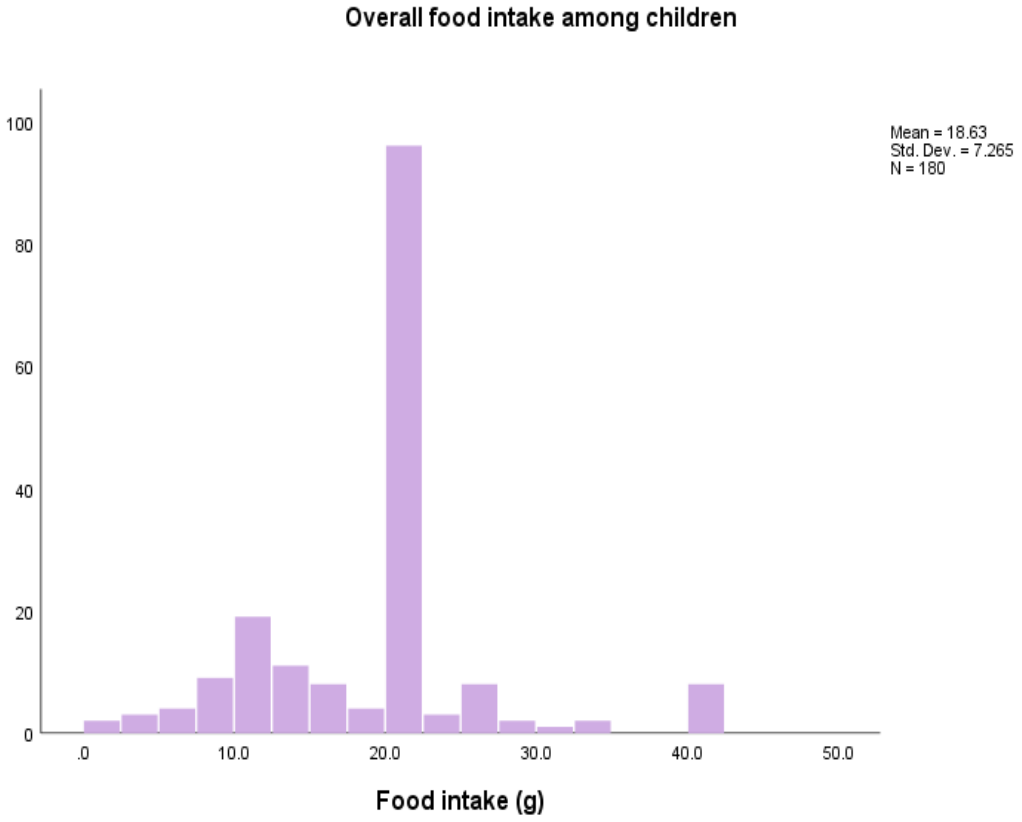
Post hoc tests (*Tukey HSD*) were conducted to examine which pair of conditions differ significantly Lastly, a series of independent t-tests were conducted to determine which pair of the three conditions and age groups differed significantly in any interaction. Cohen's *d* was used to calculate the effect size of all t-tests, with 0.2 signifying small effect, 0.5 medium effect and 0.8 large effect size. All the t-tests were two-tailed. Statistical analysis was performed using IBM SPSS version 24.0 for Windows. The significance level was set at $p < .05$ for all the tests. To correct for the multiple comparisons, we use Bonferroni adjusted significance levels. The adjusted p -value that was considered significant was .03.

3.4 Results

3.4.1 Descriptive statistics

Descriptive analysis shows an overall mean of 18.63g (SD = 7.3) of food consumption in all children across the conditions. In all 180 participants, there is only 1 child who did not eat any cereal (0g). 59 children consumed less than 20g of cereal, while the majority of them (n=95) finished the whole bag of cereal (20g), and 25 asked for a second bag of cereal. All children were included in the main analyses, as the removal of the one child who did not eat anything made no difference to the outcomes. Refer to Figure 3.1 for the prevalence of food consumption among children.

Figure 3-1 Number of children by the amount of food consumed (in grams)



3.4.2 Statistical analysis for the potential confounding factor

Prior to testing the hypotheses, we conducted an independent one-way Analysis of Variance (ANOVA) with gender as an independent variable, to determine if children's gender affects their consumption. Table 3.4 presents the means and standard deviations of children's food intake (in grams) across gender. The result showed no significant effect of gender (F (1, 178) = .024, p = .87) on children's food intake, so this was not measured in further analyses and was not regarded as a confounding factor.

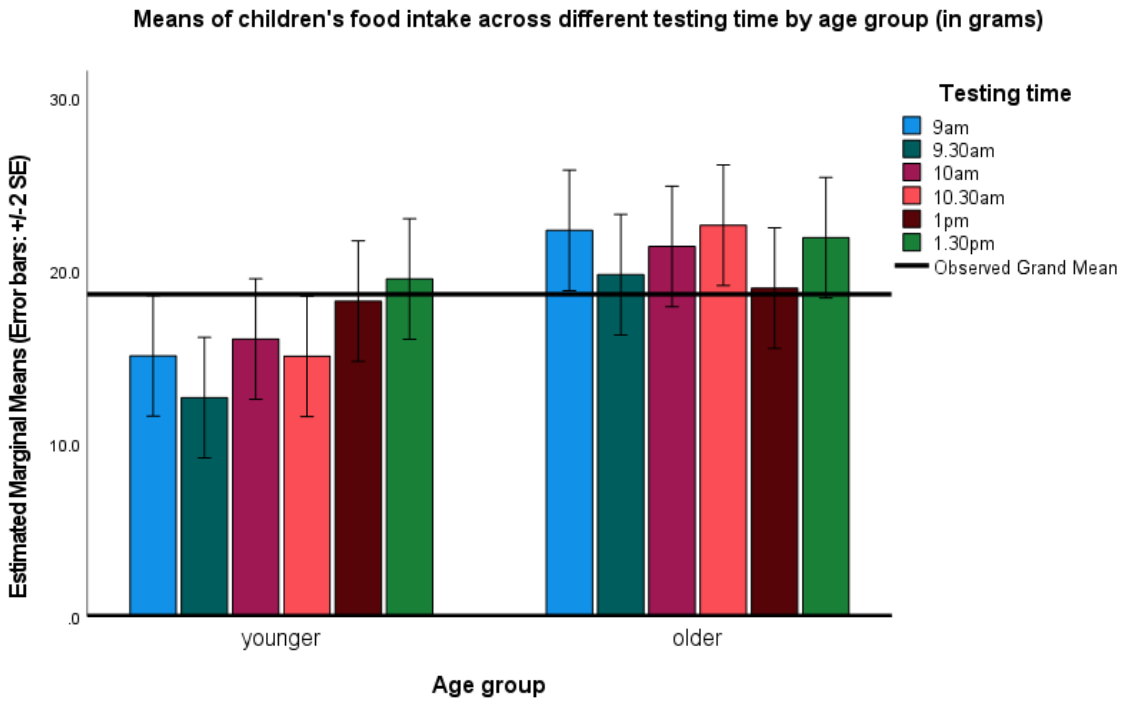
Table 3-4 Means and SD of the total food intake across gender (in grams)

	N	Mean	SD
Gender			
Male	90	18.71	6.08
Female	90	18.54	8.31
Total	180	18.63	7.26

To determine whether different testing time (variability of hunger level) has an influence on children's consumption, a two-way Factorial ANOVA was conducted with six testing times (9 am, 9.30 am, 10 am, 10.30 am, 1 pm and 1.30 pm) and two age groups (younger and older) as the independent factors. The results showed that there was no significant main effect of testing time on children's food consumption (F (5, 168) =1.35, p = .25). The result further revealed that age groups have a significant effect on children's food consumption (F (1, 168) = 25.41, p < .001). The result also revealed that there was no interaction between testing time and age groups (F (5, 168) = 1.36, p = .24) on children's

food intake. Therefore, testing time was not regarded as a confounding factor and was not included in further analyses. Refer to Figure 3.2 for the amount of food intake across different testing time by age group.

Figure 3-2 Food intake across different testing time by age group (in grams)



3.4.3 Normality checks

Standardized skewness and the *Shapiro-Wilks* test were used to examine the normality of food intake data across all conditions. The results showed that the data were statistically normal. To test the equal variance of sample size, the *Levene's F* test was performed, and the result showed a non-significant value, confirming that homogeneity of variance was not violated.

3.4.4 The effects of food cues in a computer game on children's food intake (H1)

Table 3.5 below shows the mean, standard deviation, and results of the 3x2 ANOVA. As anticipated, there was a significant main effect of the condition ($p < .001$, $\eta_p^2 = .13$), indicating that children who played the computer game featuring food cues consumed more than those who did not see any food. This result supports our main hypothesis (H1) suggesting that increased consumption among children was due to food cues exposed. Tukey HSD post hoc tests were conducted to determine which pair of conditions differ significantly. The results confirmed that food cue exposures in a computer game increased food intake among children compared to the other condition (refer to Table 3.5).

Table 3-5 Mean values of food eaten (shown in grams) and Factorial ANOVA values

Age Group	Condition			ANOVA										
	Food Game C1	Non-Food Game C2	Control C3	Age			Condition			Age x Condition			Tukey HSD (*p-value*)	
				F	*p*	η_p^2	F	*p*	η_p^2	F	*p*	η_p^2		
Younger	17.74 (4.32)	15.17 (6.56)	15.36 (5.92)	29.3	<.001	.14	13.67	<.001	.13	4.08	.018	.04	C1 – C2	.001
Older	26.36 (9.17)	19.67 (6.14)	17.48 (4.30)										C1 – C3	.001
													C2 – C3	.661

*Standard Deviation in brackets
*The mean difference is significant at the .05 level

3.4.5 The effect of age on children's food cue consumption (H2)

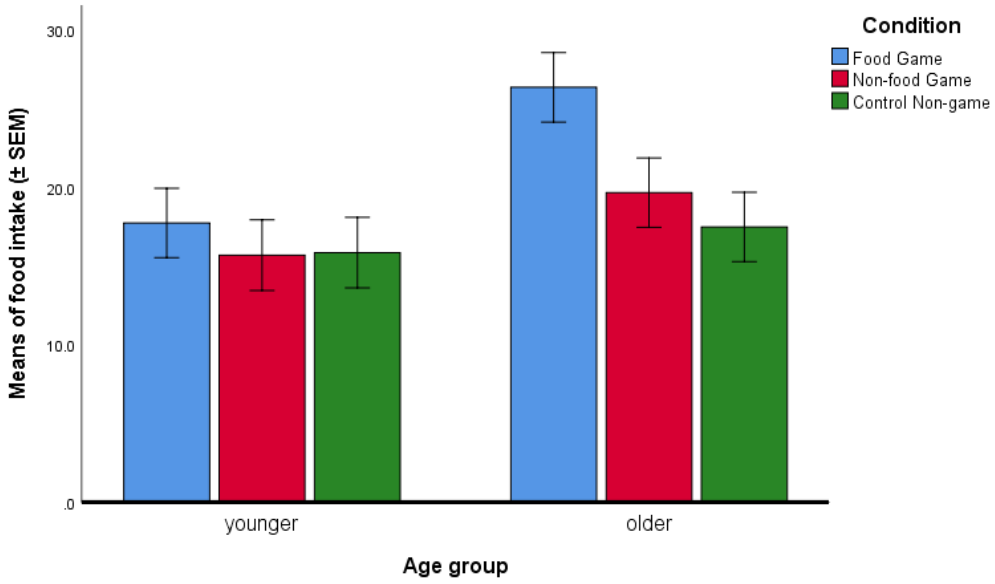
There was a significant difference in age (younger and older) on the children's snack intake ($p < .001$, $\eta_p^2 = .14$). Consistent with the second hypothesis (H2), the difference indicated that older children ate significantly more than younger children in the same condition. This result indicates that children's age plays an important role in

determining the amount of food consumed regardless of the type of cues exposed.

3.4.6 Interaction (H3)

The analyses further revealed a significant interaction between age group and condition, (p = .018, η_p^2 = .04). Figure 3.3 below shows the amount of food consumed by each condition in both age groups. However, the result is contrary to our hypothesis (H3), indicating that the effect of food exposure in computer games is stronger among older children compared to younger children.

Figure 3-3 Amount consumed in each age group by condition (in grams)



This conclusion was supported by independent t-tests, with Cohen's d used as the effect size (Table 3.6). Multiple comparisons (i.e., a total of fifteen pairwise comparisons) were corrected using Bonferroni correction with the adjusted significance level at $p < .003$ (i.e., 0.05/15). The t-tests show non-significant differences across the three conditions in the younger children group. However, they revealed significant differences between food

games and the other two conditions (i.e., non-food game and control) in the older children group, with large effect sizes observed in both comparison.

Table 3-6 Independent sample t-test results for children's food intake by conditions and age groups (mean is shown in grams)

Condition x Age	Mean	Mean Differences (X_i - Xj) (Effect sizes (d) are indicated in parentheses)					
		1	2	3	4	5	6
1. Food Game – Younger	17.74	--					
2. Non-Food Game – Younger	15.17	2.57 (.39)	--				
3. Control TV – Younger	15.36	2.38 (.40)	1.9 (0.02)	--			
4. Food Game - Older	26.36	-8.61** (2.00)	-11.18** (1.72)	-10.99** (1.86)	--		
5. Non-Food Game – Older	19.67	-1.9 (0.44)	-4.49 (0.69)	-4.31 (0.73)	6.69* (1.09)	--	
6. Control TV - Older	17.48	.26 (0.06)	-2.31 (0.37)	-2.12 (0.35)	8.87** (2.06)	2.18 (0.50)	--

The mean difference is significant at * $p < .003$, ** $p < .001$

Additionally, to determine whether the sample size used was sufficient to detectthe main effects (i.e., condition, age and interaction), a series of post hoc power analyses were calculated using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007). The G*Power analyses were performed on ANOVA with two independent variables (condition and age group), significant level was set at $\alpha = 0.05$ and observed effect size of each main effect (i.e., F=13.67 for condition, F=29.3 for age, F=4.08 for interaction). The result revealed an achieved power of .99 for all main effects, indicating that a high power was observed in detecting the main effect.

3.4.7 Summary of results

The findings from the current study supported the first hypothesis (H1), where children who were exposed to embedded food cues during computer gaming consumed more foods than those who were not exposed to any food cue. Consistent with the second hypothesis (H2), the results also show that older children ate significantly more than younger children. Finally, there was a significant interaction between children's age and condition. However, contrary to our prediction (H3), this interaction showed that the effect was stronger among older children than younger children who were exposed to food cues.

3.5 Discussion

3.5.1 Food cues embedded in computer games as a cue to consume

The primary objective of the current study was to examine the immediate effect of food cue exposures during computer gaming on children's ad libitum food intake. As predicted, the findings showed that children (i.e., older children aged 10 to 11 years) who played computer games with embedded food cues ate significantly more food than those who played computer games without any food cues or those who did not play a game at all. The results support the main hypothesis (H1), as well as the existing research on the effects of food advertising in computer games among children (Folkvord et al, 2013; 2017; Harris et al., 2012). This suggests that the increased intake of cereal among older children who played the game featuring food cues was the result of exposure to the embedded food cues in the game. In other words, core food cues (i.e., fruits) depicted in a computer game have a potential to stimulate the consumption of other type of food (i.e., cereals) among

children. However, it is important to note that children's individual characteristics such as BMI, hunger and children's liking and attitude towards the food and/or games might also influence their food intake. As the current study did not include these assessments, we are unable to determine whether the effect observed in the current study was affected by these elements.

On the other hand, consistent with the second hypothesis (H2), the result showed that the older children group consumed a greater amount of cereals compared to the younger group in the same condition, showing that older children need more food to be fully sated. Finally, the present study aimed to investigate whether children's age can potentially moderate the effect of food cue exposure, consequently reducing food consumption. Contrary to our prediction (H3), the results indicate that younger children are less affected by food cues in computer games compared to older children. The current finding is conflicting with Harris et al. (2012), who found that younger children (aged 7-8) ate more foods compared to older children (aged 9-10) when they were exposed to unhealthy food advergames. However, our finding is consistent with Folkvord et. al. (2017), who also found that food cues did not influence consumption among younger children (aged 6-8 years). Folkvord et. al. (2017) further noted that the effect was significant among older children group (aged 9-12 years) who played food advergames when compared to children who played non-food advergames. As found in our study, older children were significantly influenced by food cues exposed in a computer gam

The lack of effects found among younger children could be due to several reasons. Firstly, this might be due to younger children's shorter attention span in engaging with food games used in the current study. Exposure to core food cues (i.e., fruits) in our study

might be a factor influencing children's focus and attention which affected the lack of food consumption among younger children. Recent research on eye-tracking has demonstrated that non-core food cues attract children's visual attention to a larger extent than healthy cues or core foods (Spielvogel, Matthes, Naderer, & Karsay, 2018). The lack of effect among younger children might also be due to incongruent food offered (i.e., cereal) to children than the ones been exposed to (i.e., fruits). Secondly, the computer game used in the current study might not be as forceful in stimulating children's snack intake compared to the non-core food cues used in the studies conducted by Folkvord et al. (2013; 2015) and Harris et al. (2012). In contrast to Harris et al. (2012), the computer game used in the current study does not contain any persuasive or marketing intent. As mentioned previously, persuasive techniques used in food marketing and advertising content have distinct features that are included exclusively to promote their products or brands (see Chapter 2, section 2.3.7). The absence of these features in the game used in the present study could be another potential reason for the conflicting results found.

The current finding is also consistent with the previous research concerning the effects of food cue exposures in advertising contexts and product placements, where greater food consumption was observed among children who were exposed to food cues (Boyland & Halford, 2013; Folkvord et al., 2013; 2015; 2017; Harris et al, 2009; Matthes & Naderer, 2015; Naderer et al., 2018a; Naderer et al., 2016; Noman et al., 2018). Although in the current study the stimuli used were not associated with any advertisement or branding, and do not include any explicit persuasive message, the results found in the present study have demonstrated that visual food cues embedded in computer games can be a potential motivating factor in promoting food consumption among children.

A more recent study has also demonstrated that food marketing used in an emerging digital media platform (i.e., influencer marketing on social media) increases food intake among children (Coates, Hardman, Halford, Christiansen, & Boyland, 2019a; 2019b). Research on online games also shown that playing the advergames can increase children's positive perceptions towards consumers of the brand (Norman, Kelly, McMahon, Boyland, Chapman, & King, 2020), and can also influenced children's brand choices (Smith et al., 2020).

In the present study, children's immediate snack intake was determined by the presence of a food cue, and this influence can be regarded as a spontaneous and/or immediate response. Although the impact found in the present study may be short-term, these reactions might contribute to habituation in children's long-term eating behaviour (Epstein, Fletcher, O'Neill, Roemmich, Raynor & Bouton, 2013; Temple, Giacomelli, Kent, Roemmich & Epstein, 2007). As reported by previous research, repeated exposures to non-core food cues may influence children's dietary habits if the extent of exposure was persistent. Consequently, unhealthy eating behaviour may contribute to overall negative health impacts on children (Andreyeva, Kelly & Harris, 2011; Martin, 2011; Rosen, et al., 2014; Vik, 2013; Zimmerman & Bell 2010). However, it is important to note that the current study only observed the immediate effect of food cue exposure, hence the duration of such effect is not investigated. Therefore, the findings from the current study emphasise the direct impact of food cues depicted in the digital media, as they may stimulate children's automatic response, simultaneously motivating consumption

In addition, the result also showed that only 1 child ate nothing, and the majority of children finished the whole pack of food offered. This could be as a result of children

feeling gratified and obliged to consume the given food. However, we tried to control for this by telling children that they could eat as much or as little as they liked, and that they could also stop eating whenever they like. Future studies should include the appropriate assessments in order to control for the potential confounding factors that might have affected our findings.

3.5.2 The current findings from a theoretical perspective

The current study has discovered that brief exposure to embedded food cues in computer games might promote food consumption among children. The primary finding corresponds with the Food Cue-Reactivity theory (Jansen, 1998) which suggested that exposure to food stimuli would trigger a reaction towards the cue and subsequently encourage food consumption. The present findings indicate that embedded food cues in computer games can influence children's immediate food consumption, even when the cues were for healthy foods.

Contrary to prediction, older children were more affected by the influence of food cues in computer games than younger children. This disparity observed shows that children's responses following the exposures to food cues are different with their age. Age differences are not explained by the Food Cue-Reactivity theory (Jansen, 1998), hence the theory is not an appropriate fit for our data on children's age. Further elaboration on children's development is needed, especially on the stages involved in response to food cues, to properly predict different ages' responses.

3.5.3 Research implications

The results found in the current study have provided new insight into the effect of food cues embedded in the digital media on children's eating. Despite the absence of marketing appeals promoting food, mere exposure to food cues embedded in a computer game can prime children to consume more food. However, it is important to note that food cues were not the only difference between the games, hence the precise mechanism involved in stimulating children's food consumption cannot be evaluated. Future research is needed to replicate the findings using identical games to rule out the possible confounding effects of the attributes of the different stimuli..

In addition, previous research has suggested that food-related cues may be processed differently from non-food cues and could elicit specific motivation and rewards towards the food cue (English, Fearnbach, Lasschuijt et al., 2016; Nijs, Franken & Muris, 2008). The findings here demonstrate the direct effects of food cues embedded in games on children's actual food consumption. However, to further comprehend these effects on children's eating behaviour, further studies are needed to consider the specific mechanisms involved in promoting consumption. Hence, the following chapter will investigate the effects of congruent food cues in advergames on children's eating habits (Chapter 4).

3.5.4 Limitations

The current study has several limitations. Firstly, children who participated in the research were from seven to eleven years old, which means that the findings may not be generalisable to children in other age groups. Future research needs to include a broader range of children's age in order to examine the role of age in moderating the effect of food cue exposure. Secondly, due to limited resources and time constraints, the present

study did not assess children's hunger level and individual characteristics. The lack of these assessments such as test of hunger, BMI, impulsivity or their liking of, familiarity with and attitude towards the food and games might have also affected our findings as these characteristics could be potential confounding factors. Thus, in order to overcome these limitations, future study needs to take account of the aforementioned assessments and included them in the research.

Thirdly, children were offered only one type of food. Thus, we are unable to determine the direct implication of specific food types (i.e., core foods) on children's food consumption. However, as found in previous research, food cues exposed in computer games have a spill-over effect on other types of foods (Folkvord et al., 2013), which suggests that children would eat more foods after being exposed to food cues even when the foods are incongruent to the ones exposed. Therefore, future studies should consider offering children a variety of food choices (i.e., both congruent and incongruent cues) in order to measure the effects of specific food cue exposures on children's consumption. It is also important to note that the availability and lack of food choices in the current study might not be comparable with a naturalistic setting. In real life, availability and accessibility of foods might varies depending on children's socioeconomic status as well as parental control. Some children might have access to various types of foods at home or school setting, while others might not have the access to certain types of food. Thus, future studies should offer children a selection of food choices in order to investigate the specific food type that can stimulate children's food intake.

Moreover, a priori power analysis was not conducted in determining the amount of sample size in the current study. Nevertheless, post hoc power analyses show the observed

power of 99% in both effects of age and condition. Future studies should replicate the findings, by including a wide range of samples, children's characteristics, and individual differences as well as providing the children with congruent food and a variety of food choices. Furthermore, as the current study only observed the immediate effects of food cues, how long such effects might last is currently unknown. The extent of this effect over a delayed or longer period should be explored. Future research should consider investigating the prolonged effects of food cues that might play a role in shaping children's eating behaviour.

3.6 Summary

The current study has provided evidence that food cues embedded in computer games (although without any advertising intent) encourage food consumption among children. Importantly, older children (aged 10 to 11 years) are found to be more susceptible to the effects of media food cue exposures compared to younger children (aged 7-9 years) in the same condition. Although past researchers have suggested that children's understanding of advertisements is well developed by this age (Valkenburg & Cantor, 2001), the findings from the current study have shown that the effect of food cue exposures during computer gaming is much stronger among older children. To further understand the role of digital media in influencing children's eating behaviour, the thesis will next explore the effects of cue congruency on advergames (Chapter 4).

CHAPTER FOUR

4 The effect of congruent food cues embedded in advergames on children's immediate snack intake.

4.1 Introduction

In the previous chapter, older children (10 to 11 years old) were found to be highly influenced by the exposure to food cues embedded in the digital media (see Chapter 3). Older children's immediate eating behaviour is revealed to be affected following exposure to food cues during computer gaming. Although the previous study (see Chapter 3) has demonstrated the effect of food exposure in computer games on children's eating behaviour, the mechanisms involved in stimulating children's immediate food intake are still uncertain, particularly with integrated media advertising. Consequently, the current study aimed to discover the specific mechanism responsible for stimulating children's consumption by examining whether exposure to the promoted foods in advergames will stimulate immediate food intake of the cued foods. For that reason, the current study extended the experiment from the previous study (see Chapter 3) among Malaysian children (aged 7 to 11 years old), by investigating the effect of cue congruency in an interactive advertising context.

4.1.1 The effects of media food cues on children's eating behaviour – the role of cue mechanisms

Previous research supporting the Food Cue-Reactivity Theory (Jansen, 1998) in the food and product placement domain has suggested that food cues in children's media influence children's food preferences (Auty & Lewis, 2004; Brown et al., 2017; Matthes and Naderer, 2015; Naderer, Matthes, Marquart & Mayrhofer, 2016; Naderer, Matthes & Zeller, 2017; Naderer, Matthes, Binder, Marquart, Mayrhofer et. al., 2018). Importantly, apart from the type of cue exposed, cue mechanism might play a role in determining the efficacy of food exposures (Buijzen, van Reijmersdal, & Owen, 2010; Folkvord et al., 2016; (Naderer, Matthes & Zeller, 2017; Naderer et al., 2018a). Studies concerning such effects have shown that children who were exposed to food cues with a high-level food placement and integration (i.e., food being consumed by characters) are more likely to choose the food cue exposed (Naderer et al., 2018a; Naderer, Matthes & Zeller, 2017).

In Naderer, Matthes and Zeller (2017), a character's product interaction and its effect on children was investigated by manipulating three conditions shown in an animated movie (i.e., Smurf). Children were shown a Smurf movie clip with embedded conditions: a character product-interaction (CPI), a static placement, or no food present. M&M's chocolate candies were presented. The Smurf character ate the M&M's chocolate and showed a positive liking for the chocolate in the CPI condition. Children who were in the static placement condition were shown a Smurf character talking to M&M's figurines with the presence of M&M's chocolates, but without actually eating any of the chocolates. Children in the control group were shown the same Smurfs characters without any reference to M&M's branding. Naderer, et al. (2017) found that children exposed to brand placement in both static placement and CPI conditions were more likely to choose

the M&Ms than children who did not see any brand placement. Children who saw the character eating M&M's chocolate were more likely to choose the M&Ms compared to children who saw a static brand placement.

Naderer et al. (2018a) measured children's attitudes and reactions towards a placed product. Naderer et al. manipulated the placement frequency, placement integration, and parental mediation. In their study, children were exposed to a cartoon movie that included Fritos Corn Chips, shown in different types of stimuli: high-frequency screen placement, low-frequency screen placement, high-frequency plot placement, or low-frequency plot placement. Naderer et al. described placement frequency as the number of times the products occurred in the stimulus (with 4 times for low and 9 times for high frequencies). Placement integration was manipulated by presenting the food product either within the plot or screen placements. Plot placement involved characters handling and eating the Fritos Corn Chips, while screen placement was a product placed within the stimulus but without any interaction with the characters. Naderer et al., (2018) found that children who watched a movie character interacting with the food product (i.e., plot placement) were more likely to choose the cued product than children who only saw the product in the background (i.e., screen placement). But the frequency of placement had no effect. This highlights the importance of cue integration such as character-product interaction (CPI) in influencing children's product choices.

Moreover, Naderer et al. (2018b) compared unhealthy and healthy food placement effects on children's food choices. Prior to the experiment, children were asked about their favourite snack preferences. 35% of children indicated that their favourite snack is fruit gum, while none named mandarin or any fruit as their favourite snack. Children watched

a self-designed cartoon containing either; a low nutrition snack (fruit gums), a high-nutrition snack (mandarin fruits), or a non-food placement. After watching the cartoon, children were given two options of snacks to choose from, fruit gums or mandarin fruits. Naderer et al. (2018b) found that children who watched a cartoon with embedded food placements in both low and high nutrient foods appeared to have a stronger preference for a low nutrient snack (fruit gums) compared to children who were not exposed to any food reference. Nevertheless, children's food liking was not controlled in this study and limited food choices were presented to the children (i.e., single food choice for each type of snack). Thus, it is debatable whether the lack of preferences for high nutrition snacks (i.e., mandarin fruit) was due to the limited snack selection. Children's snack choices might be different if a variety of low and high-nutrition snacks were offered (i.e., fruits with high palatability).

In brief, the studies discussed above have shown that cue mechanisms (i.e., cue-character interaction and cue placement) play a role in motivating children's food preferences towards the food exposed. Children who were exposed to a higher level of cue placement (i.e., cue exposed in the plot) or cue-character interaction (i.e., food being eaten by characters) are more likely to choose the similar type of foods compared to those who did not see any food (Naderer et al., 2018a; Naderer, Matthes & Zeller, 2017). Although previous research has shown the effects of non-core food cues on food preferences and eating behaviour, it should be noted that the majority of the past studies about food cues were specifically directed at the food cues within the traditional media (Auty & Lewis, 2004; Boyland & Halford, 2013; Harris et al, 2009; Matthes & Naderer, 2015; Naderer et al., 2018a; 2018b).

The above-mentioned studies showed that children's food preferences were influenced by food cues, but it should be noted that these studies did not measure actual consumption of the food selected but focused specifically on children's food preferences (Auty & Lewis, 2004; Matthes & Naderer, 2015; Naderer et al., 2018a; 2018b). Hence, the role of cue mechanisms (i.e., cue placement, cue congruency, cue salience, cue-character interaction) in motivating children's actual food intake is not fully understood. Thus, the current study intended to determine whether the exposure to congruent food cues would increase children's actual consumption of cued food.

4.1.2 The digital media advertising – Advergames

As mentioned in the previous chapter (see Chapter 3, section 3.1.1), food marketers have shifted their marketing strategies from the traditional platform to integrated media. The integrated media techniques incorporate persuasive messages into compelling mediums, eventuating in positive attitudes toward the brand, while indirectly influencing purchase intent among children (Raney et al., 2003). Moreover, the researchers argued that the obscure nature of these marketing techniques may cause involuntary persuasion among children (Livingstone 2009; Rozendaal, Buijzen, & Valkenburg 2009) resulting in changes in their eating behaviour (Folkvord et al., 2016). One marketing technique called 'advergames' has been designed especially for the purpose of marketing to children (Nairn & Hang, 2012). This features messages, logos, and trade characters in a video game format (Mallinckrodt & Mizerski, 2007). Given its entertaining and engaging feature, this marketing strategy has a high potential to influence children because it contains embedded products and/or brands in an attractive game format.

As discussed in Chapter 1 (section 1.4.1), advergames are one of the most influential marketing techniques, using an engaging, interactive, dynamic and pleasurable activity to maintain consumers' positive attitudes and connections towards a brand. According to Hofmeister-Tóth and Nagy (2011), advergames incorporate online gaming and advertising which results in an evolved form of product placement, one in which the interaction with the game is centred around the brand. Advergaming demands players' active involvement and attention (Vashisht, 2015; Sreejesh & Anusree, 2017). Children's attention is fixated on the advertising content (Terlutter, & Capella, 2013) with highly embedded products or branding placement that are believed to strongly influence children's attitude towards the embedded products (Peters & Leshner, 2013; Tina & Buckner, 2006).

The use of food advergames for children has raised concerns about the nutritional value of the foods being promoted. Content analysis studies of popular advergames have shown that the most frequently advertised food products are for HFSS (i.e., high fat, salt and sugar) foods such as fast food, sweets/candy, sugared cereals, soft drinks and savoury snacks (Culp et al., 2010), and that these poor nutrient foods were advertised more frequently to children (Harris, Schwartz, et al., 2012; Lee et al., 2009). Researchers have suggested that repetitive exposure to food advergames might influence children's food preferences and behaviour and be a contributing factor in childhood obesity (Boyland & Whalen, 2015; Mallinckrodt & Mizerski, 2007). Recent research has also reported that children developed positive attitudes toward the brand featured in the advergames after engaging in advergaming (Norman, Kelly, McMahon, Boyland, Chapman, & King, 2020).

Furthermore, approximately 80% of food websites that are promoted on children's television networks feature advergames (Panic, Cauberghe, & De Pelsmacker, 2013). The food industry has been particularly competent at producing profitable games and developing sites that attract over one million children every month (Harris, Speers, Schwartz, & Brownell, 2012) with the most popular advergame sites averaging 24 minutes per visit (Harris, Speers, Schwartz, & Brownell, 2012). These exceed the exposure of television advertisements which typically last for 60 seconds or less per advertisement (Montgomery & Chester, 2009; Moore, 2006). By utilizing interactive play and fun characters in advergames, food companies attract consumer interest and widen their brand exposure (Harris et al., 2012). These amusing and entertaining advergames create enticing and trendy online activities for children and teenagers (Rideout et al., 2010), while discreetly promoting embedded food cues in the game content (Buijzen et al., 2010; Folkvord et al., 2016).

4.1.3 The effect of food advergames on children's eating behaviour

The effects of these new digital forms of marketing may be more powerful than traditional marketing (Folkvord et al., 2016) as advergames are more immersive and compelling in contrast to television advertisements. Engaging in advergames might interrupt children's critical thinking (An & Stern, 2011) as well as deprive children of the opportunity to activate their cognitive defences which is essential in recognizing and discriminating between programmes and advertisements. The repercussions of this lead to difficulty in identifying persuasive intent in advergames, hence children are unable to activate any scepticism they might have towards the cues in the advergame (Folkvord et al., 2016; Nairn & Hang, 2012), and this may cause children to be more susceptible to the

food marketing in the advergames.

Previous research into advergames focused on the content or style analyses of advergames (An & Kang, 2014; Kelly et al., 2015) and only a small number of such studies have a fully reported experimental design (e.g. Dias & Agante, 2011; 2017; Kelly et al., 2018; Redondo, 2012; Verhellen et al., 2014). Amongst these latter studies are ones that have shown that exposure to food advergames affects children's food choices (Dias & Agante, 2011; Pempek & Calvert, 2009), purchase requests (Hudders, Cauberghe & Panic, 2016; Mallinckrodt & Mizerski, 2007; 2013; Panic et al., 2013) brand attitude (Neyens, Smits & Boyland, 2017; Redondo, 2012) and, most importantly, food consumption (Folkvord et al., 2013; 2014; 2015; 2016; Harris et al., 2012; Norman et al., 2018; Pampek & Calvert, 2009).

As discussed in the previous chapter (see Chapter 3, section 3.1.1), a series of advergames studies were conducted to examine the effect of food advergames on children's actual food consumption (Folkvord et al., 2013; 2014; 2015; 2016). To further examine children's reactions towards food advergames, Folkvord et al. (2014) investigated the role of impulsivity in moderating the effects of food advergames among children. Children were assigned to one of the four conditions: an unhealthy advergame with inhibition task, an unhealthy advergame without inhibition task, a non-food advergame with inhibition task or a non-food advergame without inhibition task. The advergames used were the same advergames as in Folkvord et al. (2013) which were memory card games featuring brands and logos of the promoted products. Children in Folkvord et al.'s (2014) study were given two types of snack food whilst playing the advergames. The authors reported increased consumption among children who played the advergames promoting

energy-dense snacks (Folkvord et al., 2014).

They also found that rewarding children to refrain from eating snacks reduced the snacks intake among low-impulsive children who played unhealthy food advergames and non-food games, but the effects were not seen in impulsive children who played food advergames (Folkvord et al., 2014). Similar results were also found in their further studies of advergames (Folkvord et al., 2016; 2017), as increased snack intake by children who played advergames containing food cues was reported in both studies. The authors further noted that children's attention towards food cues in advergames may increase their effects (Folkvord et al., 2015) and that a 'protective' message in advergames did not reduce children's snack consumption (Folkvord et al., 2017).

In a more recent study, (Norman et al., 2018a) children aged 7 to 12 took part in four, six-day holiday camps in Australia and were assigned to either a multi-media (television and advergames) advertising or a single medium television advertising group. Children in both multi-media and single media groups were exposed to both food advertising and non-food advertising and were given selections of six snack foods immediately after every intervention. Norman et al (2018a) reported that children who were exposed to multi-media (both television and advergames) food advertising ate more snacks compared to those in a non-food advertising group. They also found that multi-media food advertising exposure increased children's snack intake compared to those exposed to single media. Norman et al.'s results suggest that television food advertising when supplemented with food advergames will have a stronger effect on children's snack intake compared to television advertising alone (Norman et al., 2018a).

Moreover, a latest study by Smith et al., (2020) has found that children's snack choices can be influenced by a specific type of online game (i.e., rewarded video advertising). In their study, children's brand awareness, attitudes, choices and consumption were measured following the exposure to online games; control, banner, advergames and rewarded video advertising. The authors reported that the three types of online games do not increase children's snack intake, however exposure to rewarded video advertising did influenced children's choices toward the featured brand (Smith et al., 2020).

Although the previous research has demonstrated the negative effects of food advergames on children's actual food intake, it is important to note that all these studies were conducted in the West (Harris et al., 2012; Putnam et al., 2018) or in developed countries (Norman et al., 2018a; 2018b), with most of the studies conducted in Europe (Folkvord et al., 2013; 2014; 2016; 2017). In fact, the children from developing countries such as in Asia have not been tested for these effects yet and might have different reactions towards food advergames. It is also important to consider that the advergames used to test children in the treatment conditions in these studies were self-designed (Folkvord et al., 2013; 2014; 2016; 2017), and might not have the same features and/or persuasive technique as in the real-world online advergames.

Furthermore, the studies mentioned above have focused on the effect of advergames on children's general caloric intake. Thus, the role of cue congruency in motivating children's consumption has not been observed. Therefore, the current study attempted to fill the gap in the literature by examining the effect of congruent food cues on children's immediate food intake. To our knowledge, the current study was the first to investigate the role of cue congruency in food advergames on children's immediate

consumption in Malaysia.

4.1.4 The effect of congruent food cues in a theoretical perspective (Food Cue-Reactivity theory)

The previous chapter has justified how exposures to food cues influence children's eating behaviour (see Chapter 3). The rationalisation of this effect can be explained through the Food Cue-Reactivity theory (Jansen, 1998), where food cues depicted in the media have the ability to stimulate psychological responses towards the cue and simultaneously motivate immediate food consumption. According to the FCR, any food cue exposures will elicit psychological responses towards the cue which consecutively motivate consumption. Based on this notion, the current study anticipates that children will be influenced to eat the exposed food (i.e., congruent food) following the exposure to embedded food cues in the advergames. As found in the previous study (see Chapter 3), children's immediate food consumption is greatly motivated by the cue exposed in the media. Therefore, the current study anticipates that children who played the advergame featuring the promoted food cues (i.e., congruent foods) will consume more than those who were exposed to the incongruent food cues.

4.2 Objective of the study

The main aim of the present study was to investigate the effect of congruent food cues featured in advergames on children's immediate food consumption. Because of the persuasive nature of advertising, it is expected that the effect of food advergame will be stronger among children who played the advergame with embedded congruent foods (i.e., promoted foods) than those who were exposed to incongruent foods. The second aim of

the present study was to examine the role of age in moderating the effect of food advergames. As found in the previous study (see Study 2 in Chapter 3), due to greater appetite among older children, it is predicted that consumption will be higher among older children compared to younger children in the same condition.

Nevertheless, as discussed previously (see Chapter 1, Section 1.4.4), children's age may influence their susceptibility towards advertising and consequently moderate the effect of food cues in advergame. Although the previous study (see Study 2, Chapter 3) has discovered that the effect of food cues in computer games is stronger among older children compared to younger children, the evidence of such impact is still uncertain. Therefore, the current study predicts that there will be an interaction between condition and children's age.

4.2.1 Hypotheses

H1 Children who are exposed to congruent foods during advergaming will eat more food than those who were exposed to the incongruent foods presented in the advergame.

H2 Older children will eat more than younger children when exposed to food cues, due to bigger appetite.

H3 The effect of congruent food cue will be stronger among younger children, thus there will be an interaction between age and condition.

4.3 Methodology

4.3.1 Ethical approval

Ethical approval was given by the University of Sheffield Ethics Committee to conduct the experiment. See Appendix E2.

4.3.2 Design

The current study utilized a two-way factorial ANOVA; 2 Age groups (younger children and older children) X 2 Conditions (Congruent food and Incongruent food). To address the hypotheses, the present study utilized a between-subject design, in which children were assigned to one of the two conditions (1- Congruent Food Game; 2- Incongruent Food Game). Following the computer game session, children in Condition 1 (Congruent Food Game) were given the same brand of cereals as exposed in the computer game (i.e., Kellogg's Froot Loops), and children in Condition 2 (Incongruent Food Game) were given a different brand of cereal (i.e., Nestle Cheerios). The amount of cereal consumed immediately following each condition was the dependent variable, being the behavioural response towards the cue exposed.

4.3.3 Participant recruitment and data collection

Data collection was conducted in August 2018, from an elementary school in Kedah, Malaysia. Prior to the start of data collection, invitation letters were sent to schools inviting them to participate in the study. Headteachers from interested schools were then provided with detailed experimental procedures and study objectives, together with a consent letter. Parents with children in participating schools were given an invitation letter

and information sheet (see Appendix F) detailing the purpose of the study.

Parents who requested more information were informed that the study was intended to measure the effects of food references during computer gaming on children's eating behaviour but were asked not to reveal the true purpose of the study to their children before the experiment. Parents/guardian who agreed to allow their children to participate in the study were asked to complete the consent letter (see Appendix G). All parents provided written informed consent before the start of the experiment. Children were told that they would participate in computer gaming sessions and will be given cereals following the session. We excluded children with food intolerances, allergies, or special dietary requirements related to the food used in the study. Ahead of each experimental session, children with parental consent were asked whether they would like to take part in the study. All participating children provided verbal assent to the primary researcher. At the end of the experiment, participating children were given a debrief describing the purpose of the study (see Appendix H2).

4.3.4 Participants

An opportunity sample of 120 children aged between 7 and 11 years from an elementary school in Kedah, Malaysia participated in the current study (see Table 4.1). The sample size used in the current study was estimated on the account of previous similar studies concerning the effect of food cues on children's immediate food intake (Folkvord et al., 2016 (N=133); Folkvord et al., 2017 (N=127)). Before the start of the experiment, participants answered questions regarding their age and gender.

Table 4-1 Total number of children in each age group and gender

Age group	N	No. of males	No. of females
Younger children			
7 year-olds	20	10	10
8 year-olds	20	10	10
9 year-olds	20	10	10
Older children			
10 year-olds	30	15	15
11 year-olds	30	15	15
Total	**120**	**60**	**60**

4.3.5 Procedure

Parents were given a letter inviting their children to voluntarily participate in the experiment. Parents were informed that the study was about the effects of online games on children's eating habits. Parents along with their children who agreed to participate were asked to complete a written consent form. Participating children were assigned to one of the two conditions: (1) Congruent Food Advergame and (2) Incongruent Food Advergame.

Conditions

- **Condition 1** – Congruent Food Advergame: A five-minute advergame (Kellogg's Froot Loops) featuring characters jumping and running while collecting Froot Loops cereals. Children in Condition 1 were offered a pack of cereal of the same brand featured in the advergame (i.e., Kellogg's Froot Loops).
- **Condition 2** – Incongruent Food Advergame: A five-minute advergame (Kellogg's Froot Loops) featuring characters jumping and running while collecting cereals. Children in Condition 2 were offered a pack of cereal from a

different brand (i.e., Nestle Cheerios) than the ones featured in the advergame.

All experiments were conducted in a computer lab for the computer game and an empty classroom for the eating session at their school. All experimental sessions were conducted between 9am - 11am (after breakfast) and 1pm - 2pm (after lunch). Children in these schools have a 30 minutes recess in the morning, and the time varies from 9.45 to 10.45 am depending on children's age. Lunch break is between 12 to 1 pm. Therefore, to control for the differences in the time since the last meal, each group of experimental conditions was assigned to the scheduled session shown in Table 4.2 below. Children were asked if they had eaten breakfast or lunch before the experiment session. All participants reported that they have eaten before the experiment. As utilised in the previous study (Study 2 in Chapter 3) and in line with Dovey at al. (2011), hunger was controlled by conducting the study at the same time of the day for each condition. However, further tests on children's hunger level and participant attitude towards the game and food were not conducted.

Table 4-2 Schedule of experimental sessions

Sessions	Day 1	Day 2	Day 3	Day 4
9 am	Younger Condition 1	Younger Condition 2	Older Condition 1	Older Condition 2
9.30 am	Younger Condition 1	Younger Condition 2	Older Condition 1	Older Condition 2
10 am	Younger Condition 1	Younger Condition 2	Older Condition 1	Older Condition 2
10.30 am	Younger Condition 1	Younger Condition 2	Older Condition 1	Older Condition 2
1 pm	Younger Condition 1	Younger Condition 2	Older Condition 1	Older Condition 2
1.30 pm	Younger Condition 1	Younger Condition 2	Older Condition 1	Older Condition 2

On the day of the experiment, the experimenter asked the permission of the headteacher and teachers before the start of the first session to call the children from their classroom. Initially, children were assigned to the conditions. Children followed the experimenter in groups of five to ten to the computer lab. Prior to the experiment, the experimenter gave the children brief information about the study and what it would involve. Children were told that the experimenter was interested in understanding children's media preferences and interest in online games. Children were instructed to take a seat in front of a computer screen and make themselves comfortable before starting the experiment. Each child was assigned to sit individually in front of the computer.

Children were advised that they were expected to remain quiet and to not speak with one another to avoid interrupting other children. They were told that if they had any problems during the session, they should raise their hand and the experimenter would come and help them. All computers were already set up and running with a specific advergame before the children entered the lab. Children were given instructions on how to play the game and were told that they could play for five minutes and that they would have to stop when the bell rang. The children were exposed to the advergame for five minutes, as the previous studies have used the same amount of time of exposure (Folkvord et al., 2013; Pempek & Calvert, 2009; Van Reijmersdal et al., 2012).

Immediately after playing the game, children were thanked and were asked to follow the experimenter to another room (an empty classroom), which was located next to the computer lab. Children were instructed to take a seat and were given a pre-weighed 20-grams pack of cereals (Kellogg's Froot Loops or Nestle Cheerios, depending on the condition). To avoid peer influence on the amount of cereal eaten, children were seated

separately from each other. Children were informed that the cereal was given as an incentive for their participation in the experiment and that they don't have to eat them if they don't want to. Children were told that they could eat as much, as little as they liked or none and that they could ask for more if they had finished the first pack and wanted more. They were told that they could eat the cereal in the experimental room only and that they were not allowed to take any cereal outside the experimental room. Children who finished the first pack of cereal were asked if they would like to have more. Children who asked for more cereal were given another pack (of the same brand) with the same weight (20 grams). Each pack of cereal given was labelled with a participant ID for post-experiment weighting purposes. As required in the ethical approval, bottled water was provided during the eating session, but this element of consumption was not measured in the study. Children were told that they could leave the experimental room anytime they liked.

Before leaving the experimental room, children were asked not to reveal what they had done during the experiment to their friends who had not yet done the study. An experimental session lasted for no more than 20 minutes, including briefing, playing the advergame, and eating the food. After the experiment, the experimenter collected all packs of eaten cereals and weighed the remaining balance of cereal left in each pack. The total amount of cereal consumed by each participant was recorded. Children's cereal consumption in each condition was determined by weighing the balance of cereals before and after the opportunity for consumption. The amount of cereal consumed in grams was the dependent variable.

4.3.6 Materials

4.3.6.1 Weighing scale

A mini digital scale of 0.1gram accuracy (AMIR, model I-2000) was used to weigh the cereal before and after the experiment.

4.3.6.2 Stimulus

Club Kellogg's online advergame

Both Conditions 1 and 2 used an advergame from Club Kellogg's website (see Appendix D) as a stimulus. The game was called Amaze-a-wave in which a character (i.e., toucan bird) needed to collect Froot Loops cereal pieces before the wave overcame the character. The player played the game by pressing an upward arrow key and a spacebar to control the character jumping and avoiding obstacles. This advergame contained food images, with a toucan bird character jumping and running to collect Froot Loops cereal pieces.

4.3.6.3 Cereals as food offered

Participants were given a pre-weighed pack of cereal (i.e., 20 grams each); Kellogg's Froot Loops (for Condition 1) or Nestle Cheerios (for Condition 2). As mentioned previously (see section 3.3.5.2), cereals were chosen due to convenience in preparing and availability in Malaysia. Moreover, these particular brands of cereals were chosen as stimuli on account of the advergame availability (i.e., Kellogg's Club website) and accessibility in Malaysia. The rationale for portion size was similar to the previous study (refer to Section 3.3.5.2). As the current study explored the congruency effect of food cues on advergame, Kellogg's Froot Loops cereal (as advertised in the advergame)

was offered to children assigned in Condition 1 (i.e., congruent food cue), whereas Nestle Cheerios was offered to children in Condition 2 (i.e., incongruent food cue). Refer to Tables 4.3 and 4.4 below for the cereals' nutrition facts.

Table 4-3 Kellogg's Froot Loops' nutrition facts (per serving of 20g)

Energy	78kcal
Protein	0.5g
Total Fat	0.4g
Total carbohydrates	17.6g
Dietary Fibre	0.4g
Sugars	6.6g
Sodium	86mg
Vitamin A	53.2mcg
Thiamine (Vitamin B1)	0.2mg
Riboflavin (Vitamin B2)	0.2mg
Niacin (Vitamin B3)	1.5mg
Vitamin B6	0.2mg
Vitamin B12	0.2mcg
Folic Acid	24.0mcg
Vitamin C	6.0mg
Iron	1.1mg

Table 4-4 Nestle Cheerios' nutrition facts (per serving of 20g)

Energy	76kcal
Protein	1.6g
Total Fat	0.8g
Total carbohydrates	15.4g
Cholesterol	0mg
Dietary Fibre	0.8g
Sugars	3.6g
Sodium	76mg
Calcium	115mg
Riboflavin (Vitamin B2)	0.4mg
Niacin (Vitamin B3)	3.8mg
Vitamin B6	0.4mg
Pantothenic Acid (B5)	1.4mg
Folic Acid	58.0mcg
Iron	2.5mg

4.3.7 Data Analysis

The current study hypothesised that children who were exposed to congruent food cues in advergames would consume more than those who were exposed to incongruent food cues. The two independent variables are the food given and the children's age. Both variables consist of two levels: 1; Food (congruent food vs incongruent food), 2; Age (younger vs older). The dependent variable for all analyses was the weight of cereals consumed by children following the exposure to the cue conditions (measured in grams). Initially, preliminary analyses were conducted to test whether gender and/or time of testing is a potential confounding factor. A one-factor ANOVA was used with gender as the independent variable and total food intake as the dependent variable. A two-way factorial ANOVA was conducted with testing time and children's age group as the independent variables and total food intake as the dependent variable. Next, food intake data in all conditions were tested for normality and homogeneity of variance (Levene's test).

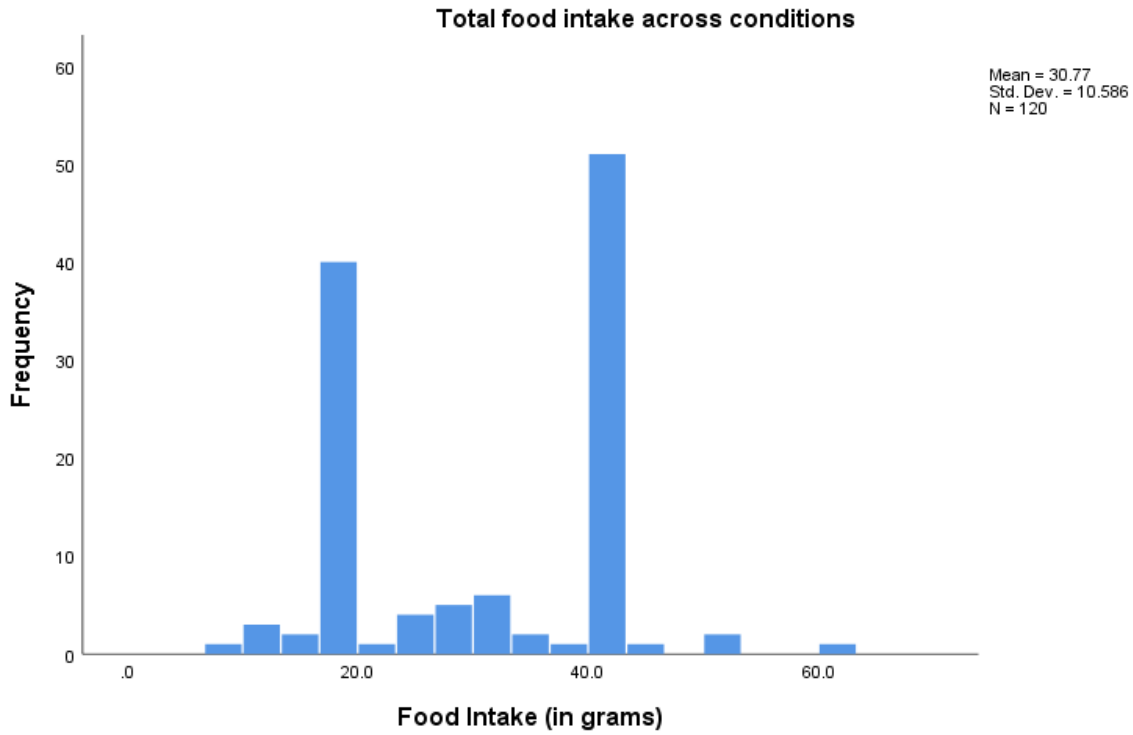
To test the main hypotheses, children's immediate consumption of cereals was measured and analysed using a two-way analysis of variance; 2 Food given (Congruent food vs Incongruent food) X 2 Children's age (younger vs older). Effect sizes were calculated using partial η squared (η_p^2), with 0.01 indicating small effect, 0.06 indicating medium effect, and 0.14 indicating large effect. Additionally, a series of post-hoc power analyses were conducted using G*power (Faul, Erdfelder, Lang, & Buchner, 2007) to find out whether our design had enough power to detect the effect of food cues on children's consumption. Observed power was reported in the main analyses. Statistical analysis was performed using IBM SPSS version 24.0 for Windows. The significance level was set at $p < .05$.

4.4 Results

4.4.1 Descriptive statistics

Descriptive analysis shows an overall mean of 30.77g (SD = 10.6) of children's food consumption across conditions. All 120 children ate at least 8g of cereal, of which only 7 children consumed less than 20g. The analysis also shows that 39 children finished the whole pack of cereal (20g) and 74 children asked for more cereal. Out of the children who asked for more (N=74), 51 children finished the second pack of cereal, and 4 children asked for the third pack of cereal, but only 1 finished the third pack. All children were included in the main analyses. Refer to Figure 4.1 for the number of children and the amount of food consumed in both conditions.

Figure 4-1 Number of children by the amount of food consumed in grams)



4.4.2 Statistical analysis for the potential confounding factor

Prior to testing the hypotheses, we conducted an independent one-way Analysis of Variance (ANOVA) with gender as the independent variable to determine whether children's gender affects their consumption. Table 4.5 presents the means and standard deviations of snack intake (in grams) across gender. The result showed no significant effect of gender (F (1, 118) = .016, p = .90) on children's snack intake, so this was not measured in further analyses and was not regarded as a confounding factor.

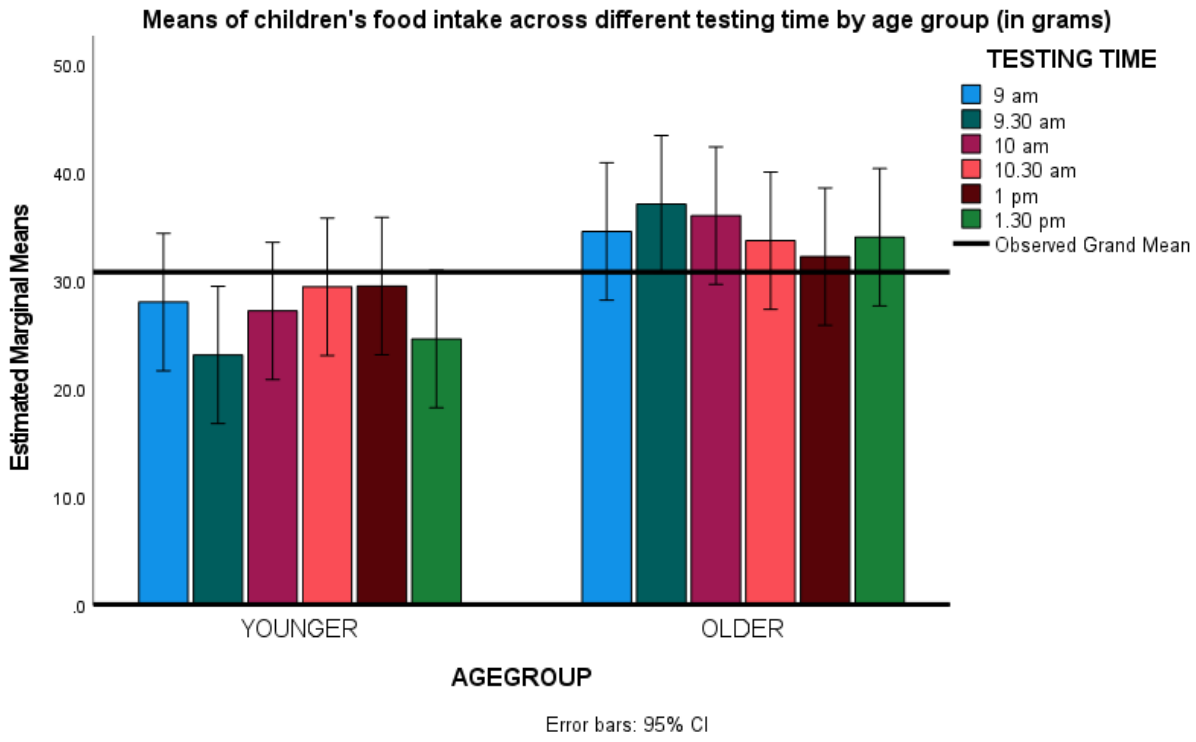
Table 4-5 Means and SD of the total snack intake across gender (in grams)

	N	Mean	SD
Gender			
Male	60	30.89	10.69
Female	60	30.65	10.56
Total	120	30.77	10.59

As we did not measure children's hunger levels, a two-way factorial Analysis of Variance (ANOVA) was performed; with six testing times (9 am, 9.30 am, 10 am, 10.30 am, 1 pm, 1.30 pm) X two age groups (younger children and older children) to analyse the influence of these on children's food consumption. The result revealed that testing times did not have a statistically significant effect on children's food intake (F (5, 108) = .16, p = .97). A simple main effect analysis further revealed that age groups have a significant effect on children's food consumption (F (1, 108) = 16.93, p < .001). The finding also revealed that there was no interaction between the testing times and age groups (F (5, 108) = .79, p = .56) on children's food intake. Therefore, testing times were not regarded as a confounding factor and were not included in further analyses. Refer to Figure 4.2 below for the amount of food consumed across testing times in each

age group.

Figure 4-2 Amount of food consumed across different testing time by age group



4.4.3 Normality checks

Standardized skewness and the *Shapiro-Wilks* tests were used to examine the normality of the data. The test showed that the data were statistically normal. The normal Q-Q plot showed that data points are close to the diagonal line, confirming that data were normally distributed to perform ANOVA. To test the equal variance of data, *Levene's F* test was performed. The result showed a non-significant value which confirms that homogeneity of variance was not violated.

4.4.4 The effects of food cue congruency depicted on advergames (H1)

A two-way factorial ANOVA was conducted on the influence of two independent variables (conditions, age group) on the amount of cereal consumed immediately after the exposure to the food cue. Refer to Table 4.6 for the factorial

ANOVA results with means and standard deviations of snack intake.

Table 4-6 Mean and standard deviation of children's consumption (in grams) and Factorial ANOVA results

Age Group	Condition		ANOVA								
	Congruent Food C1	Incongruent Food C2	Age			Condition			Age x Condition		
			F	*p*	η^2	F	*p*	η^2	F	*p*	η^2
Younger	28.04 (10.37)	25.88 (9.30)	17.77	<.001	.13	2.22	.14	.02	0.08	.77	.001
Older	36.19 (9.56)	32.97 (10.32)									

*Standard Deviation in brackets
*The mean difference is significant at the .05 level.

Contrary to the prediction, the analysis found that the main effect of the condition was not significant (p = .14). This result refutes H1, indicating that there was no difference in the amount of food that children consumed between congruent and incongruent cue groups (i.e., whether the food given was similar to the ones featured in the game or not) after exposure to the food cues in advergame. This result suggests that food cue congruency does not play a role in motivating children's immediate food consumption following the exposure.

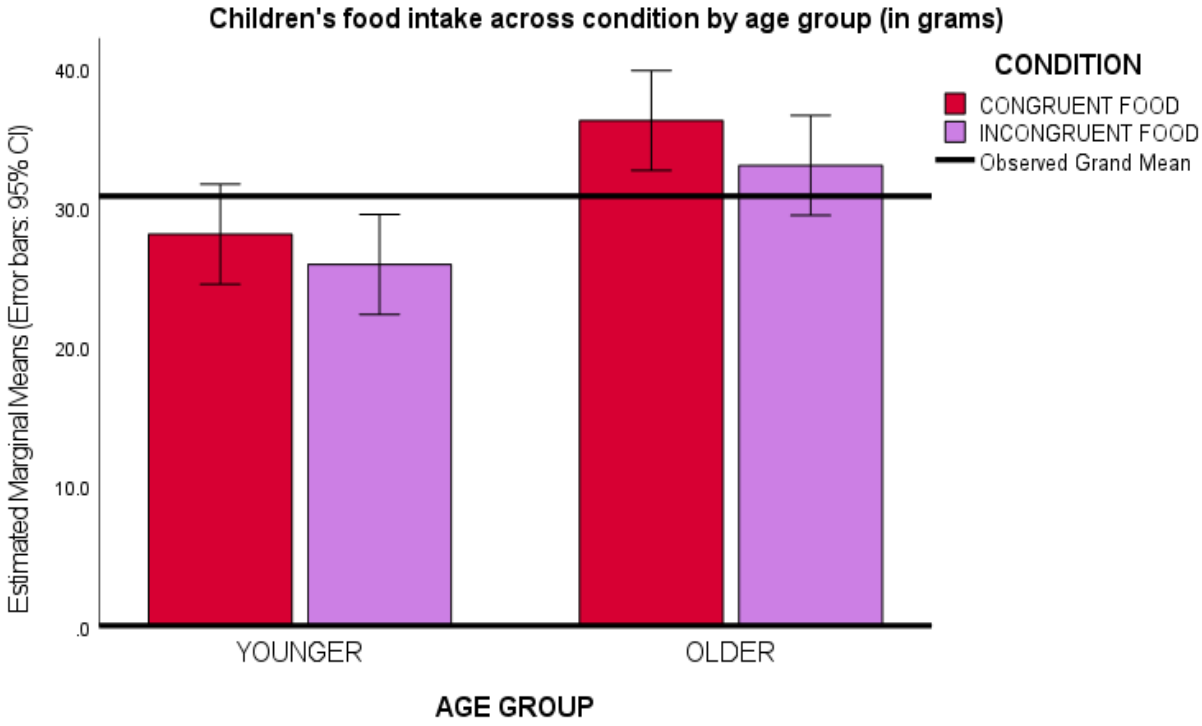
4.4.5 Children's ages (H2)

There was a significant effect of age ($p < .001$), which demonstrates that older children consumed significantly more foods than younger children in the same condition. This result supports H2, suggesting that older children need more food in order to be fully satiated.

4.4.6 Interaction between condition and age group (H3)

The analysis further revealed that there was no interaction found between age group and condition (p = .77). Refer to Figure 4.3 for the amount of children's food intake across the two conditions in each age group. This result is inconsistent with our prediction (H3).

Figure 4-3 Amount of children's food intake across condition by age group



Finally, a series of post hoc power analyses were conducted using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) to ascertain whether the lack of significant finding was due to insufficient sample size. The G*Power analyses were performed on ANOVA with two independent variables (condition and age group), significant level was set at $\alpha = 0.05$ and observed effect size of each main effect (i.e., F=2.22 for condition, F=17.77 for age, F=.08 for interaction). The result revealed an achieved power of .99 for main effects of condition and age, and 0.14 for interaction effect.

4.4.7 Summary of results

In summary, results from the present study suggest that cue congruency does not play a role in stimulating children's immediate food intake following exposure to food cues in advergames. As anticipated, the present study also found that older children require more food intake to be sated. The findings further indicate that children's age does not moderate the effect of food cue congruency, as there is no interaction effect observed across age groups and conditions.

4.5 Discussion

4.5.1 The effect of congruent food cues on children's immediate snack intake

The main objective of the current study was to investigate the effect of congruent food cues embedded in advergames on children's immediate food consumption. Contrary to our prediction, the results revealed a non-significant difference between children who were offered the same brand of cereal (Froot Loops) and those who were offered a different brand of cereal (Cheerios) after playing the advergame promoting Froot Loops. The result refutes the main hypothesis (H1), suggesting that congruent food cues shown in advergames do not influence children's immediate food intake. This finding suggests that cue congruency does not play a role in stimulating immediate food consumption among children who were exposed to food cues in advergames. However, it is important to note that the current study was preliminary research, hence further studies are needed to establish the effect of cue congruency on advergames on children's eating behaviour.

The second aim was to establish the influence of age in moderating the effect of exposure to unhealthy food cues in advergame. Older children ate more compared

to younger children in the same condition, as expected. Contrary to our prediction, the findings also revealed a non-significant interaction between age and condition, which suggests that age does not influence children's susceptibility towards the effect of congruent food cues in advergames.

Moreover, the findings also revealed that none of the children ate nothing. This could be due to the fact that children were told that the food was offered to compensate for their participation, thus they might feel obligated to consume the offered food. The findings also show that in overall food consumption, 33% (N=39) of children finished the whole pack of cereal (i.e., 20 g) and 43% (N=51) finished two packs (i.e., 40 g). These two spikes in overall food intake could be in consequence of children's individual differences such as feeling obliged to finish the food offered and their willingness to ask for more. Nonetheless, as the current study did not measure for these attributes, it is uncertain whether children's individual characteristics might have affected our results. Therefore, it is recommended for future research to include appropriate assessments (i.e., children's individual characteristics such as BMI, liking, familiarity, attitude to food and games) in order to evaluate the effect of food cue exposure more accurately.

4.5.2 The current findings in relation to the previous studies

The current study anticipated that children who were exposed to congruent food cues in advergame would consume more foods than those who were exposed to incongruent food cues. However, the finding revealed that cue congruency did not increase children's intake of food following the exposure to food cues in advergame. Since the current study was the first to measure the role of food cue congruency in advergames, it is uncertain whether the non-significant effect found in the current study

can be generalised in the wider context. Previous research on the effect of non-core food advertising in other advergame studies (Folkvord et al., 2013; 2014; 2015; 2016; Norman et al., 2018a) has found that unhealthy food advergames influence children's overall snack intake.

However, as mentioned previously, these studies have not shown any effect of cue congruency, rather children's overall snacks intake (i.e., amount of snacks eaten regardless of the type) was measured as the main effect of food advergame. This effect of food exposure has also been found in television food advertising (Anschutz, Engels & Van Strien 2009; Boyland, Kavanagh-Safran, & Halford, 2015; Halford et al., 2006). In these studies, the authors found that children who were exposed to unhealthy food cues consumed more energy-dense foods (regardless of the type of foods) than those who were exposed to different food cues (i.e., healthy foods). Therefore, our finding is consistent with the previous literature, where cue congruency does not play a significant role in influencing children's immediate consumption following the exposure to food cues. On the other hand, the result from the current study corresponds with the studies by Norman et al. (2018a, 2018b), where the author found a non-significant effect of age (7 to 12 years old) on the amount of food consumed by children following the exposure towards food stimuli.

4.5.3 Theoretical implications

Crucially, the finding of the present study conflicts with the predictions of the Food Cue-Reactivity theory (Jansen, 1998), which proposes that exposure to food cues would elicit intake of the cued food (i.e., congruent food cue). As found in the current study, congruent food cues exposed in the advergames do not increase children's food intake compared to the incongruent food cues. Thus, the Food Cue-Reactivity theory

is insufficient to be used in predicting the effect of food cue exposures. However, it could be explained by stimulus generalisation in Pavlovian conditioning, where the similarities of conditions might influence children's responses. According to Pavlovian theory, the existence of a physically parallel stimulus might reinforce responses that have been stimulated previously (Fields, Reeve, Adams, & Verhave, 1991; Honig & Urcuioli, 1981).

In previous studies, the effects of food advergames were not brand specific but were shifted to other palatable unhealthy foods (Folkvord et al., 2013; 2015). This "spillover effect" of food advertising on different products or brands other than the ones advertised has also been found in television food advertising (Boyland, Kavanagh-Safran, & Halford, 2015; Anschutz et al., 2009; Halford et al., 2006). These studies suggested that food advertising that promoted a specific brand or product would have a strong influence to enhance the intake of other products within the same category. Therefore, a revised theory, perhaps integrating Pavlovian stimulus generalisation into Food Cue-Reactivity theory, is required to fully consider the specific mechanisms entailed in cue exposures to implement the theory appropriately.

4.5.4 Limitations

The current study has encountered several limitations. The major limitation is that we do not have a control condition to measure the effect of food cues exposed in advergames on children's overall food intake. Previous research has shown that food cues embedded in advergames have a strong effect on children's immediate food intake (Folkvord et al., 2014; 2015; Harris et al., 2012). Additional research using similar methods and stimuli might have helped in understanding the effect of cue congruency further. Thus, it is essential to conduct subsequent research, as well as to include a

control condition to explore the role of cue congruency more accurately.

Secondly, only children between seven to eleven years are included in the current study. This inadequacy of age range might contribute to the discrepancies between our results and the previous research. For example, Harris et al. (2012) and Norman et al. (2018a; 2018b) included children from seven to twelve years old in their studies. Future research needs to include a wider age range to fully investigate the role of children's age in moderating the effect of food cues. Furthermore, we did not include an explicit hunger measurement in the current study. We tried to control for the variability of time since last meal by conducting each experimental condition in various time point. Because of the lack assessment of hunger, it is unknown whether children's food intake was influenced by their state of hunger. Thus, future studies need to explicitly control for hunger and include appropriate hunger tests to precisely evaluate children's food intake following congruent food cues.

Moreover, as the nature of the current study is a non-laboratory setting, children were informed that the cereal was given as an incentive for their participation and time spent in the experiment. Due to this, it might be possible that children feel obliged to eat the cereal. Their reactions to food offered might be different if they were told that the study was trying to examine children's food preferences towards different types of foods. Another limitation of the current study is the lack of food options offered. Thus, we are unable to observe children's responses towards specific food (i.e., congruent and incongruent food) following the exposure to food cues. Therefore, future research should consider offering selections of foods to investigate the influence of food cue congruency in stimulating eating among children.

The current study did not measure participants' characteristics such as BMI status, impulsivity as well as attitude, liking and preferences toward brands, foods, and games. Previous research has shown that children's weight status may be an indicator in determining children's food choices and intake (Folkvord et al., 2015). The lack of these measures in the current study has restrict us from evaluating the relationship between children's individual characteristics and their behaviour towards food cues.

As found in the current study, none of the children ate nothing, and majority of the children finished the cereals given. This could be due to individual differences among children (i.e., their willingness to ask for more and/or feeling obliged to finished the food offered). Thus, it is essential for future research to address these limitations by evaluating children's characteristics in order to assess the effect of cue congruency more precisely. Furthermore, demographic status such as children's socioeconomic and educational background were not evaluated. All children in the current study were recruited from a peri-urban region of Malaysia with mixed ethnicity (Malays, Chinese, and Indians) and different socioeconomic backgrounds. Thus, we are not able to explore whether there is an association between demographic status and children's eating behaviour. Therefore, future research must challenge these limitations by including necessary measures to further evaluate the effect of cue congruency on children's immediate food intake following exposure to food advergames

4.6 Conclusion

The findings from the present study have conveyed evidence that cue congruency did not substantively reinforce higher food consumption among children who were exposed to food cues. In other words, children who were exposed to congruent food cues in advergame did not consume more than those who were exposed to incongruent food cues. Due to the lack of baseline condition, the current study is unable to assess the precise effect of food cues featured in advergames. Therefore, future studies should include an appropriate control condition to replicate our findings as well as examine the effect of food cues in advergames more accurately.

CHAPTER FIVE

5 GENERAL DISCUSSION AND CONCLUSIONS

5.1 Overview of chapter

The overall aim of this thesis was to ascertain the effects of visual food cues on children's eating behaviour grounded on the Food Cue-Reactivity theory. Initially, this thesis explored the extent and nature of food cues currently depicted within the media environment in the UK and Malaysia. The next aim was to investigate the effect of food cues embedded in computer games on children's actual food intake. The final objective was to explore the role of congruent food cues featured in advergames in motivating children's immediate food consumption. The research questions were:

RQ1 To what extent are foods and beverages being promoted within children's television programmes?

RQ2 Does exposure to food cues depicted in the digital media (i.e., computer games) in a non-advertising context influence children's immediate food intake?

RQ3 Do congruent food cues featured in advergames play a role in motivating children's immediate consumption?

Throughout this thesis, we have explained the importance of investigating food cue exposures directed at children. This final chapter will discuss the results and findings from all the studies.

Research conducted in this thesis contributes to the literature concerning children's eating behaviour, the influence of media food promotion and the effects of

cue congruency on children's food intake. In the next section (section 5.2), we will review the findings of our research. In particular, the extent and nature of food cues in children's television programmes, the effects of food cue exposures in the digital media and the role of cue congruency in motivating food consumption among children will be discussed. We will also discuss the strength and originality of our research. Next, section 5.3 will provide a synthesis of research findings with the current literature. The following section (section 5.4) will demonstrate how the findings in the present thesis have contributed to the existing theoretical literature. Section 5.5 will provide practical implications of our research and how our findings are relevant to society in general. Next, we will discuss the limitations of the studies (section 5.6) and provide recommendations for future research (section 5.7), respectively. Section 5.8 will provide a summary and concluding remarks of the present thesis. The final section (Section 5.9) will illustrate the challenges and shortcoming faced by the present author in completing the current thesis.

5.2 Summary of research findings

5.2.1 Food promoted within children's television programmes and food advertisements in the UK and Malaysia

Study 1 examined the extent of food and beverage cues in television programmes and advertisements targeted at children in the UK and Malaysia respectively, with the emphasis on non-core food items which appeared during broadcasted programmes. Study 1 also considered the type of appeals used in food advertising promoted on television in both countries. Contrary to our prediction, Study 1 demonstrated that core foods were frequently shown on children's programmes in the UK, with just over half the foods being core food items. It is important to note that the

high proportion of core foods was shown primarily on the non-commercial channels (i.e., BBC children's channels). On the other hand, we found that non-core foods appeared more frequently on the UK commercial children's channels. In Malaysia, Study 1 found that the proportions of core and non-core foods shown were approximately equal. Overall, non-core foods accounted for about half of the total food appearances in both countries, with the high energy food items (desserts/cookies/cake/biscuits) making up the largest single category.

Moreover, our content analyses (i.e., Study 1) also found a similar pattern in both advertising channel categories (UK and Malaysia), with non-core food cues shown most commonly than core food items. On the other hand, a higher proportion of core food cues was observed in non-advert UK channels. Additionally, the outcome indicates that the type of food cues shown was significantly associated with channel categories, suggesting that non-advert channels (CBBC and CBeebies) have depicted proportionately more core food cues than advertising channels in both countries (UK and Malaysia).

In analysing the food advertisements, Study 1 has shown that most of the food advertisements shown in both countries were for non-core foods (e.g., added sugar cereals, fast foods, added sugar yoghurts, snacks and confectionary), with less than 5% of advertisements for core-foods (i.e., low sugar breakfast cereals). The mean number of food advertisements was approximately two advertisements per hour in the UK and 2.7 advertisements per hour in Malaysia. We also found that at least four types of persuasive appeals were used in each non-core food advertisement aimed at children in both countries. These appeals were used in combination and included techniques such as emotional appeals of fun and happiness, palatability, or the use of special characters. Persuasive appeals used in food advertisements are effective tools able to influence

children's attitudes, preferences and motivation towards the products advertised (see Chapter 2). Importantly, our findings were the first to explore food depictions targeted at children in Malaysian television programmes.

5.2.2 Effects of food exposure in computer games on children's eating behaviour

Study 2 aimed to explore the immediate effects of food cues embedded in computer games on children's eating behaviour. In this study, we found that engaging in an interactive game that contained food cues increases children's snack intake. The main finding has shown that children ate more foods when exposed to food cues in a computer game. However, this effect was found to be stronger among the older children's group (aged 10-11 years). We found that older children consumed more than younger children in the same condition. This confirms the prediction that older children needed more food to be sated. Finally, the significant interaction found revealed that there was a moderating effect of age, although it was not what we had predicted. The interaction showed that older children (aged 10-11 years) who played a computer game featuring food cues consumed greater amounts of snack foods compared to younger children (aged 7-9 years) in the same condition (see Chapter 3, section 3.4.5). This finding suggested that older children (aged 10 to 11 years) were susceptible to food cues embedded in games, while the younger children (aged 7-9 years) were not.

Importantly, the games used in Study 2 did not contain any persuasive message or food advertisement/branding. Notwithstanding the absence of persuasive techniques, our finding has shown that exposure to food cues could prime food intake among older children (aged 10-11 years). These findings revealed that food cues exposed during computer gaming are influential enough to prompt immediate eating among children, at least for the older children group (aged 10-11 years).

5.2.3 Effects of congruent food cues featured in advergames on children's eating behaviour

The primary aim of Study 3 was to examine the role of cue congruency in motivating children's immediate food consumption. Contrary to our prediction, Study 3 demonstrated that cue congruency does not play a role in stimulating children's immediate food intake. The children who played advergames featuring congruent food cues did not eat more than those who played the advergames with incongruent cues. Study 3 also found that older children (aged 10-11 years) ate more than younger children (aged 7-9 years) in the same condition. The finding validates our expectation that older children require more foods to get satiated. Moreover, children's age did not moderate the effect of congruent foods in advergames, as there was no interaction effect observed across age groups and conditions.

5.2.4 Originality of the research

To the author's knowledge, at the point of writing this thesis, Study 1 was the first to explore the prevalence of food cues within editorial content in Malaysian children's television programmes. Our research has provided evidence that children, regardless of their cultural background or demographic region, are still being exposed to non-core foods on television. By successfully implementing similar methods to those used in previous studies (Folkvord et al., 2013; 2014), the present research has demonstrated that the methods used in the current thesis are effective for investigating the direct effects of food cues on children's eating behaviour.

The studies in the present thesis investigated the effects of food cue exposures beyond commercial contexts by using non-advertising food cues as stimuli in Study 2. Importantly, the empirical studies in this thesis were conducted in Malaysia. To the

author's knowledge, the present research is the first to investigate the immediate effects of food cues among children in South East Asia. Children in developing countries (i.e., Malaysia) are frequently exposed to non-core foods on television. These media food cues have been shown to influence children's food intake (Boyland & Halford, 2013; Folkvord et al., 2013; 2014; Harris et al., 2009; 2012). This allowed us to generalise beyond the usual Western samples. Hence, our results support the common effects of food cues irrespective of the culture of the children.

5.3 Synthesis of research findings

5.3.1 The extent of food promotion in children's TV programmes and food advertisements in the UK and Malaysia.

Consistent with previous studies (Radnitz et al., 2009; Scully et al., 2014; Whalen et al., 2017), Study 1 showed that food and beverage items were regularly presented during children's programmes in both the UK and Malaysia, with an average of 10 food items per hour. Contrary to our prediction, Study 1 also found that healthy foods were shown more frequently in the UK, specifically in the non-commercial channels. This finding is inconsistent with the previous study by Scully et al. (2014), where the authors reported non-core foods as the most common food type shown in children's television programmes in the UK. On the other hand, we also found that high-sugar foods (i.e., desserts/cookies/cakes/biscuits) were the most common specific food type depicted in both the UK and Malaysia. This finding is consistent with the previous study in the UK (Scully et al., 2014) and the US (Radnitz et al., 2009).

Study 1 also found that only about one-twentieth of all the food advertisements were for healthy foods. These findings were consistent with other studies in Western countries (Boyland et al., 2011; Scully et al., 2014; Whalen et al., 2017) and Asia-

Pacific countries (Karupaiah et al., 2008; Kelly et al., 2016; Li et al., 2016). These studies also found that most foods advertised in children's programmes or programmes watched by children were energy-dense and poor nutrient foods. Additionally, Study 1 has demonstrated that non-core food advertisements recorded in the current thesis used at least four types of persuasive appeals in each advertisement in both countries. In the UK, consistent with previous research (Batada et al., 2008; Boyland et al., 2011), our study has found that the most frequently used appeals were emotional appeals of fun/happiness.

Apart from emotional appeals, premium offers, health claims and licensed characters were the next common appeals used on UK television. This is parallel with Batada et al., (2008), which also showed that movie, cartoon, and animated characters were utilized regularly in children's food promotion. On the other hand, in Malaysia, the most frequently used persuasive technique in food marketing was the appeal of taste, followed by emotional appeal, programme/movie sponsorship, characters and health claims. Consistent with Gantz et al. (2007), who also noted that the primary appeal used in food advertisements directed at children and youth was palatability of taste. Contrary to the UK advertisements, the least common appeal used in Malaysia was premium offers.

Researchers have suggested that the current obesogenic environment, defined as the profusion of unhealthy palatable food presence (Wardle, Carnell, Haworth & Plomin, 2008), is responsible for the excessive exposure to food and food-related cues that will encourage unhealthy eating behaviour (Boyland & Halford, 2013; Folkvord et al., 2016), and may lead to cases of childhood obesity (Larson & Story, 2013). Our research has provided evidence of the extent of food promotion depicted in children's

traditional media. Although in a few countries such as the UK, Australia and Germany, there have been recent advertising regulations about HFSS foods advertised on television, children are still being exposed to unhealthy food advertising in most other countries (Kelly et al., 2010).

5.3.2 The effects of food cues depicted in digital media on children's immediate snack intake.

As demonstrated in Study 2, food cues embedded in computer games are effective in motivating eating among children (aged 10-11 years). This finding was consistent with similar studies on traditional media (Boyland & Halford, 2013; Harris et al., 2009; Matthes & Naderer, 2015; Naderer et al., 2018; Naderer et al., 2016) as well as digital media (Pampek & Calvert, 2009; Harris et al., 2012; Folkvord et al., 2013; 2014; 2015; 2016; 2017; Norman et al., 2018a; 2018b). However, children's age range between these studies and our study was varied. For example, Folkvord et al.'s studies only tested children from seven to ten years old (Folkvord et al., 2014; 2015; 2016), and Pampek and Calvert (2009) tested children between nine to ten years old.

As mentioned previously, the studies above focused on the advertising context exclusively. Nevertheless, our study has demonstrated that even with the absence of persuasive techniques in advertising, food cues depicted in computer games have a strong influence in stimulating children's (aged 10-11 years) immediate food consumption. Although previous studies have suggested that food advertisements might contribute to a higher intake of energy-dense food among children (Boyland et al., 2013; Harris et al., 2009), research concerning the influence of non-advertising food cues is limited. Our result has given a new insight towards a better understanding of media food cue exposure on children's eating habits. As found in previous studies concerning the effects of advergames (Folkvord et al., 2013, 2014, 2018; Harris et al.,

2012, Norman et al., 2018a, 2018b), our findings have demonstrated that children who played a computer game featuring food cues consumed more foods after playing the games.

Furthermore, Study 2 also found that only older children (aged 10-11 years), were affected by food cues in computer games. This finding is consistent with Folkvord et al. (2017), where the authors noted that the type of advergame (food vs non-food) did not affect younger children's total food intake (children aged 6-8 years), while a significant effect was observed among older children (aged 9-12 years) who played food advergames than children who played the non-food advergame (see Chapter 3, section 3.5.1). However, there are a couple of disparities between our study and Folkvord's. Primarily, the type of food cue used in Folkvord's study was for non-core food, while our study was for core food. Secondly, Folkvord's study utilised advergames as stimuli, whereas our study used non-advert computer games. Regardless of these differences in the stimuli used, the consistent findings of our study and Folkvord's showed that children's age might moderate their consumption of food following the exposure to food cues, although not as predicted.

Moreover, our finding is inconsistent with the previous study by Harris et al. (2012), where the authors observed stronger effects among younger children (aged 7-8 years) who were exposed to non-core food advergames. The conflicting results might be because of the differences in the food cues and type of game used in Harris et al., (2012). Contrary to Harris et al., our study utilized healthy food cues as stimuli, and the game used in our study does not contain any elements of persuasion or advertising. The absence of persuasive messages, as well as healthy foods used in our study, could be important factors affecting the lack of intake among younger children group. As scholars have suggested, younger children are more susceptible to the effect of

advertising due to the presence of persuasive messages (Rozendaal, Lapierre, Van Reijmersdal, & Buijzen, 2011; Van Reijmersdal, Rozendaal, & Buijzen, 2012). The discrepancies between our findings and Harris's could be due to younger children's susceptibility to persuasive techniques embedded in the stimuli used in their study, consequently, leading to increased intake among younger children. The absence of these features (i.e., advertising/persuasive messages) in our study could be a possible reason behind the lack of food intake among younger children.

Importantly, our study has demonstrated that even without the presence of persuasive messages or marketing appeals explicitly promoting foods, just mere exposure to food cues in a fun context would subsequently prime older children to eat more. The unintended effects of a food cue embedded in computer games unconsciously stimulate children's automatic response toward food. As found in the previous research, a food-related cue may be processed differently from a non-food cue and may elicit motivation and reward responses towards food (Bruce et al., 2010; Bruce et al., 2013; Nijs, Franken, & Muris, 2008), eventually leading to increased consumption.

5.3.3 The role of cue congruency in motivating children's immediate food consumption.

The research in Study 3 had shown that cue congruency did not play a role in motivating children's food intake. A potential explanation for the result found in Study 3 is that the effects of food cues featured in advergames were not brand specific but were shifted to other palatable foods that are physically similar to the food exposed. Previous studies have found increased consumption of overall snack foods among children who were exposed to food cues (Anschutz et al., 2009; Boyland, Kavanagh-Safran, & Halford, 2015; Folkvord et al., 2013, 2014; Halford et al., 2006). Although

these studies did not explicitly test the role of cue congruency, the findings from these studies have demonstrated that children's general intake of low-nutrient foods increases following the exposure to food cues, irrespective of incongruent cues.

This spill-over effect of food advertising to different products or brands other than the ones advertised has also been found in another advergame study (Folkvord et al., 2013), and in television food advertising studies (Boyland, Kavanagh-Safran, & Halford, 2015; Anschutz et al., 2009; Halford et al., 2006). Moreover, no interaction effect was observed between children's age and condition. Nevertheless, the result from Study 3 corresponds with the studies by Norman et al. (2018a, 2018b), where the author also found a non-significant effect of age (7 to 12 years old) on the amount of food consumed by children following the exposure towards food stimuli.

Additionally, Study 3 was unable to reproduce the finding of Study 2 (i.e., higher effects among older children) possibly due to several reasons; first, the different type of food cues (i.e., core vs non-core food cues) used in the two studies. As discussed previously, older children in Study 2 were found to be influenced by food cues on computer games with an increased consumption observed among older children who were exposed to food cues. In Study 2, children were exposed to core-food cues (i.e., fruits), and were offered a non-core food (i.e., cereals) following the exposure. On the other hand, in Study 3, children were exposed to non-core food cues (i.e., cereals) and were offered a non-core food (i.e., cereals). The different type of food cues exposed between the two studies could potentially explain the lack of replication, as it might influence the effect of cue exposure on children's consumption.

Secondly, the discrepancies in the stimuli used in the two studies could be a possible explanation for the failure to replicate the findings of Study 2. In Study 2,

computer games used were not designed for commercial purposes, thus they do not contain any persuasive appeal or marketing technique. On the contrary, Study 3 utilised an advergame as a stimulus, which comprised interactive marketing elements specifically intended for marketing. Hence, the lack of replication of Study 2 in Study 3 (i.e., higher effect observed among older children) could be due to higher or similar food consumption among younger children in Study 3 (i.e., when compared to older children). Finally, the difference in sample size between the two studies could possibly be the reason for the lack of replication in findings, as in Study 3, the sample consists of 120 children, one-third lower than the sample in Study 2.

Although we did not make explicit comparisons between the findings in Study 2 and 3, the difference in mean scores among children who were exposed to non-advertising food cues in Study 2 and those children who were exposed to food advergames in Study 3 is immense, with nearly twice the food intake among children in Study 3. It is, however, still unclear whether the differences in intake among children who were exposed to food cues in both studies were due to the mechanism of cue (i.e., cue congruency or interactivity) or the type of food cue exposed (i.e., core vs non-core food cues). Thus, additional research is warranted to explore this further.

5.4 Theoretical implications

The findings from our studies were consistent with existing theories by providing evidence that food cues presented in the media can stimulate children's consumption of palatable foods. The finding observed in our empirical study (i.e., Study 2) corresponds to the Food Cue-Reactivity theory (Jansen, 1998). Our results are also consistent with the assumption of REFCAM theory (Folkvord et al., 2016), in which exposure to embedded food cues in interactive media will result in increased

consumption of foods. As found in Study 2 (see Chapter 3), the main finding is parallel to the prediction of the Food Cue-Reactivity theory (Jansen, 1998), where children (aged 10-11 years) who were exposed to food cues consumed more than those who did not see any food. The food cues exposed in the computer game (in Study 2) acted as a conditioned stimulus by priming the activation of cue-reactivity, which resulted in a conditioned response of increased consumption among older children.

Our finding is consistent with the prediction of the Food Cue-Reactivity theory (Jansen, 1998), which emphasises on the food itself as a cue to stimulate eating responses among older children. Additionally, as discussed earlier in the thesis (see section 1.3.2), the FCR predicted that Pavlovian extinction process might occur when food cue that was previously stimulate consumption subsides. This extinction process might explain the lack of anticipated overconsumption among children who were exposed to congruent food cues in our study (see Study 3). However, as children in our studies were exposed to food cues only for a brief period of time, it is uncertain of how the process of extinction might occur.

Nevertheless, it is important to note that several findings in our studies were not predicted by the FCR. As found in Study 2, children's maturity does not reduce their susceptibility towards exposure to food cues, instead, we found that it might increase the effect of food cue exposure. The lack of age prediction in FCR suggests the need for further elaboration, specifically on the developmental phases involved in the process of stimulus reactivation following the exposure to food cues. Moreover, the finding in Study 3 refutes the prediction of FCR, where it has been revealed that cue congruency does not play a significant role in increasing children's food consumption. Hence, a revised theory is warranted to make a precise hypothesis on the effect of food cue exposures. The revised theory should include; 1: a rationalisation of children's

development phases (i.e., children's age and their susceptibility of cue exposure) , 2: stages of cue-reactivity processes, and 3: the mechanisms of food cues (i.e., cue congruency, cue integration, cue salience, hedonic value etc.) involved in motivating children's consumption.

As opposed to FCR, the current research provides support for Pavlov's stimulus generalisation. As shown in Study 3, cue congruency does not play a role in motivating children's consumption. Rather, a similar amount of food consumption was observed among children who were exposed to congruent and incongruent food cues following the exposure to food advergames. This similarity of cues might influence children's responses to cue exposure. According to Pavlov's theory, stimulus generalisation "occurs when behaviour becomes more probable in the presence of one stimulus or situation as a result of having been reinforced in the presence of another stimulus or situation" (Martin & Pear, 1999, p. 145). This can happen as a result of physical similarity of stimuli or conceptual learning, where the response that has been reinforced previously by a stimulus occurs in the existence of a physically parallel stimulus (Fields, Reeve, Adams, & Verhave, 1991; Honig & Urcuioli, 1981).

5.5 Practical implications

The present research has contributed to our understanding of children's current media food environment and its impact on children's eating behaviour. Our research has provided evidence that food cues exposed in the media can motivate eating among children. As demonstrated in the current thesis (i.e., Study 1), as well as in previous research (Kelly et al., 2010; Nairn & Hang, 2012; Schwartz, Kunkel, & Delucia, 2013; Staiano & Calvert, 2012), children's media environment is dominated by low nutrient and high energy food products. This suggests the need for the media industry to review

the contents of media entertainment targeting children. The findings of our research could be the basis for eating interventions among children. Whether children respond negatively or positively to food cue exposure should be the concern of future research.

As research has proven that advertising plays a role in influencing children's behaviour and lifestyles (see Chapter 1, Section 1.5), our research has provided evidence of the influence of media food exposure among children. Children are still frequently exposed to non-core foods in both advertisements and editorial content on television (see Study 1 in Chapter 2), and the exposure to food cues influences children's eating behaviour (see Study 2 in Chapter 3). Hence, from what has been revealed in our studies, it is necessary to consider possible strategies to prevent the detrimental effects of non-core food exposures on children, as well as implement strategies to promote healthy eating choices among children.

To reduce the negative impact of advertising and non-core food promotion, it is essential to nurture critical thinking among children and young adolescents, for them to evaluate and have a better understanding of advertising messages and intent. Caregivers, parents, and teachers should work together to provide support and facilitate children. Furthermore, teachers and educational providers should initiate appropriate strategies that can be used within an educational setting. Apart from traditional media, advertising literacy should include digital media as part of the curriculum. As found in the present research, children are susceptible to food cues depicted in the digital media. Hence, it is important to consider including media studies in the school setting to help support children against the negative effect of media exposure.

The findings from our research also suggest an intervention of core foods within children's media content. Our research (i.e., Study 2) found that children's general food

intake can be motivated by core food cues embedded in computer games. However, as our research did not offer core food options following the exposure of core food cues (i.e., fruits), it is uncertain whether the exposure to core food cues would stimulate intake of such foods among children. Thus, it is vital for future research to explore the role of core food cues in motivating food consumption among children. Moreover, our research (i.e., Study 3) also suggests that cue congruency did not increase children's immediate food intake of that particular food. Nevertheless, it is vital to note that the food cues in our studies were exposed for a very short duration. Repeated and prolonged exposures to healthy foods have been found to increase liking and intake among children (Caton, Ahern, Remy, Nicklaus, Blundell, & Hetherington, 2013; Laureati, Bergamaschi, & Pagliarini, 2014).

Regarding policy implications, our research (i.e., Study 1) has shown that children are still being exposed to non-core foods within the traditional media (i.e., television). However, core food exposures have been shown to motivate general food consumption among children (i.e., Study 2). Although in the UK restrictions on television food placement have been in place since 2010 and food advertisements have been banned during children's TV programmes (Ofcom, 2016), our research has shown that these food promotions are still being depicted on children's television. Notwithstanding the existing regulations on the traditional media, there is a lack of policy concerning the new integrated media and embedded advertising formats targeting children. The UK is the first country to introduce guidance to online advertising in 2017, *Recognition of Advertising: Online Marketing to Children under 12*. The guidance includes requirements for marketers to improve the online advertising disclosure to facilitate children in identifying web advertisements (Committee of Advertising Practice, 2017). As revealed in our findings (Study 2, Chapter 3), increased

effects were found in the older children group (aged 10-11 years), regardless of the absence of advertising or persuasive appeals. Therefore, to minimise the negative effect of food exposure in the media, our research suggests the need for the policymakers and regulatory authorities to strengthen the advertising regulation, and restriction to non-core food placement on children's media.

5.6 Limitations of our research

Notwithstanding the strengths and contributions of our research, several limitations need to be acknowledged. First, in neither of the empirical studies (Studies 2 and 3), did we measure children's individual characteristics such as food preferences (i.e., liking of specific foods), impulsivity and hunger level. Although we have controlled children's hunger practically by conducting the studies within the same time every day for each condition, children's hunger level was not assessed. The lack of hunger assessment might have affected our findings since we are unable to make an evaluation of children's state of hunger. Therefore, future studies should consider taking this into account by assessing children's hunger level in order to rule out the confounding effect of hunger on children's consumption.

In both of our empirical studies, children's BMI status was not measured. The reasons we did not include BMI measurement were; firstly, it would require further time to conduct the study, as we were given a restricted duration to access the schools for our research; secondly, parent's self-report of their children's weight and height status might not be reliable and suitable substitute for the our studies. Previous research have shown that children's body size and weight have been miscalculated by their parents (Chaimovitz, Issenman, Moffat & Persad, 2008; Dubois & Girad, 2007), raising concern regarding the consistency of parent's self-report. Hence, as BMI calculation

would impose a challenge to data collection, we did not include BMI measurement in our research. Therefore, the difference between overweight and lean children was not assessed in our studies, even though children's weight status may be a primary indicator in determining children's food choices and intake (Folkvord et al., 2015).

Furthermore, as our research only measure children's ad-libitum food consumption, parental influence or family dietary habits were not assessed. Thus, we are unable to evaluate whether children's food intake were influenced by their parents/family dietary behaviour. It is recommended that future research take this into consideration to determine if there is any association between parental mediation/ dietary habit and its influence on children's responses toward food cue exposure.

Another limitation of our studies was the lack of variability in the food offered. In our research, we did not offer core food options following exposure to core food cues (in Study 2). Thus, it is unclear if the effect observed in Study 2 was influenced by the type of food offered. It is also uncertain whether the effect of food cues extends beyond the type of cue exposure. Children who were exposed to food cues in Study 2 might have responded differently if core food options had been available (Folkvord et al., 2015; Norman et al., 2018a). Furthermore, the availability of food offered in our studies (i.e., in Studies 2 and 3) might not be comparable to realistic settings. Children in real life may not have the access to snack foods that they can spontaneously eat during or following media engagement.

Moreover, as in previous similar studies (Boyland et al., 2013; Dovey et al., 2011; Folkvord et al., 2013, 2015; Halford et al., 2004; 2007; 2008), the children in our studies were given food immediately after seeing the stimuli. Therefore, it is not possible to determine whether the effect of exposed cues would be sustained over a

longer period. Another limitation of our studies is the duration of food cue exposures. Children in our studies were only allowed to play the games for five minutes, whereas, in actual settings, they might have unlimited access to play the game. Recurrent and prolonged exposures to food cues embedded in media could lead to stronger effects on children's food intake than the ones observed in our studies (Harris et al., 2012).

Another limitation of the current research is the lack of a control condition in Study 3. The effect of advergames' cue congruency on overall children's food consumption could be observed if there was a control condition to compare with. Due the restricted time given to access the school, and limited resources available, we are unable to conduct the follow-up study in order to investigate the role of cue congruency further. As found in the previous advergames studies, children's consumption is determined by the type of cue (i.e., food cues) exposed in the advergames (Folkvord et al., 2014; 2015; Harris et al., 2012; Norman et al., 2018a). Therefore, it is imperative to scrutinise the role of cue congruency in order to understand how such exposure could affect children's eating behaviour.

Furthermore, our studies also did not provide an adequate age range to compare the effect of age in moderating the effect of food exposure among children more accurately. In both of our empirical studies, we only included children from seven to eleven years old. The limited age range used in our studies may be a factor contributing to the inconsistencies of findings between our studies and the previous research.

As discussed previously (see Chapter 1, Section 1.3.4), children's cognitive development plays an essential role in understanding media messages (Lapierre, 2013; 2019). Among the important elements is the executive function, particularly inhibitory control (Lapierre, 2019; Lapierre & Rozendaal, 2019; Moses & Baldwin, 2005;

Rozendaal et al., 2011). Researchers have suggested that the attainment of inhibitory control starts around the age of four (Diamond, 2013), and continues developing parallel with brain maturation (Menon, & Reiss, 2002), as children grow older into young adulthood (Williams, Ponesse, Schachar, Logan, & Tannock, 1999). Future research needs to address the aforementioned limitations – particularly including a wider range of children's ages.

5.7 Future research

The slight increase of older children's food intake after a brief exposure to food cues in our research indicates the need for further research. Researchers have suggested that media food promotion together with simultaneous eating and excessive screen exposures are associated with childhood obesity by promoting weight gain among children (Robinson, Banda, Hale, Lu, Fleming-Milici, Calvert, & Wartella, 2017). As discussed in Chapter 1 (see section 1.5.3), excessive energy consumption, among other factors, is one of the most common contributors linked to childhood obesity. However, it is vital to keep in mind that the aetiology of obesity is highly complex and involves the association of genetic, physiologic, environmental, psychological, social and economic factors to promote the development of obesity (Aronne, Nelinson & Lillo, 2009). Consequently, due to the minimal effect observed in our study, the relevance of the observed food intake in relation to obesity risk is indeed very low relative to the other factors underlying the development and maintenance of obesity.

Moreover, our research only observed the immediate effect of food cue exposures, it is uncertain whether the same effect would last for a longer period. Additionally, children in our research were exposed to food cues for only a brief duration, and may not reflect children's actual media use. Thus, we are unable to

examine the effect of prolonged exposure to food cues. As found in our content analyses study (see Chapter 2), children in real life are frequently exposed to far more food cues on a daily basis. Therefore, further research is needed to scrutinise the long-term effect of media food cues on children's food consumption.

Future research should consider the effects of food advertisements and the unintended effects of food cues depicted within non-advertising contexts. Although our research has demonstrated that food cue (in a non-advertising context) exposures have an effective force in motivating children's food consumption, future research is needed to replicate the finding and to further explore the mechanism involved in priming children's food intake. Future research needs to address the limitations discussed above, such as including different types of food as stimuli, control conditions and a sufficient age range to further examine the impact of food cues on children's eating behaviour. Because of the complexity of children's developmental processes and their intellectual capacity, it is critical to developing a concept that could explain the disparity of children's responses found to make predictions more precise.

Future research should also consider exploring different varieties of children's food choices following the exposure to food cues. While a previous study (Dixon, 2007) has suggested that nutritious food exposures might increase children's attitudes and preferences regarding healthy food, there is a lack of research into the similar effects on children's direct consumption. Future research could include healthy food cues to investigate their influence in moderating non-core food consumption, and possibly in promoting and reinforcing healthy eating behaviour among children. As found in a previous study (Folkvord, Anschutz, & Geurts, 2020),core food consumption can be promoted through media exposure if they offer core food options to children. This can be done if future experiments include core food cues as a stimulus

and present children with core food options together with non-core food selections (Folkvord et al., 2020).

As discussed in Chapter 1 (see Section 1.2), repeated exposure to a specific type of food increases the liking and consumption of that food (Cooke, Chambers, Añes, & Wardle, 2011; Wardle, Herrera, Cooke, & Gibson, 2003). Furthermore, researchers have found that children's preferences and intake of healthy foods can be stimulated by presenting them with healthy foods frequently (Caton, Ahern, Remy, Nicklaus, Blundell, & Hetherington, 2013). Repeated exposure to a variety of vegetables was found to be the most effective approach to encourage acceptance and consumption of vegetables among children (Barends, Weenen, Warren, Hetherington, de Graaf & de Vries, 2019). Therefore, further investigation into the efficacy of repeated exposure of core foods is needed to ascertain how media could be utilized in motivating healthy eating among children.

The substantial differences in children's overall food intake between our research; grand mean of 18.63g in Study 2 and 30.77g in Study 3, indicate the need for further research. Although our research did not find a significant role of cue congruency in motivating children's consumption, subsequent research is needed to explore this further. In both studies, only one type of food cue (i.e., core food in Study 2, and non-core food in Study 3) was used as a stimulus (in each study) and as food offered. Therefore, it is uncertain whether the outcome would be similar if different types of food cues were used to test the effect of cue congruency. Furthermore, the type of food cue used in Study 3 (i.e., cereal as food offered) might have potentially affected our findings as children's perception towards this type of cereal is unknown. Children might have perceived the offered cereal as a core-food, consequently resulted in an increased consumption. Thus, it is recommended for future research to ascertain

children's food preferences and perception/attitudes towards food so that an accurate observation could be done. Future research should consider using various types of food cues (i.e., core and non-core foods) as stimuli as well as offering different food choices to explore the role of cue congruency further.

Moreover, emerging research has shown that food cues exposed with children's character's might play an important role in influencing food consumption among children. However, there is a lack of research on the influence of counter-example characters (e.g., Super Potato promoting fruits and vegetables in Peppa Pig TV programme) in promoting children's food intake. Thus, future studies should include stimuli such as character-product interaction cues to explore the potential effect of this cue in stimulating children's consumption further. As shown in product placement research, children's responses to food cues are determined by the component of cue exposure (Matthes & Naderer, 2015; Naderer et al., 2018; Naderer et al., 2016). Subsequent research should consider replicating our studies and include different cueing conditions (i.e., cue congruency, cue integration, character-product interaction and cue salience) to determine how food portrayal in the media motivates consumption among children, and consequently modify their eating behaviour.

Additionally, it is recommended for future research to include analysis on the extent of media food exposure during the recent COVID-19 pandemic lockdown. As found in the recent studies, children and adolescents spend more time on screen (i.e., television and the Internet), and are likely to engage in more sedentary activities during the lockdown (Kharel et al., 2022: Stockwell et al., 2021), thus it is important to explore whether the lockdown has an impact on children's media consumption in regards to the exposure to food cues, as well as the effect of such exposure to children's actual food intake.

5.8 Concluding remarks

In summary, the present thesis has provided insight into our understanding of the effects of food cues on children's eating behaviour, specifically the immediate effects of food cues on children's general food intake. Whether in a developed or a developing country, children are still frequently exposed to non-core foods through the traditional media. Throughout this thesis, food cues portrayed in media contexts were explored for their potential influence on children's eating behaviour. As found in our content analysis research, foods are being regularly depicted on children's television programmes in the UK and Malaysia. Importantly, the proportion of non-core food items being aired is still relatively high in both countries. Moreover, the extent of food advertising observed in the UK and Malaysian channels might promote unhealthy eating environment among children. Frequent and excessive exposures to food cues can potentially motivate children's food preferences, consumption, and eventually alter their eating behaviour.

Our empirical research has shown that exposure to food cues in the media can stimulate eating among children (aged 10-11 years). Crucially, this thesis has demonstrated foods depicted through the non-advertising digital media (i.e., computer games) have the potential to influence older children's eating behaviour by priming their consumption of palatable food. Therefore, by recognising the influence of media food cues on children's eating behaviour, further measures could be taken in directing this effect positively. Media content creators and regulatory authorities should be encouraged to consider utilising media food exposure to promote healthy eating among children.

5.9 Author's note

There are several challenges that I have encountered during my PhD research, primarily during participant recruitment and data collection. Firstly, the process of recruiting participants takes longer than I've anticipated. Due to my empirical research being conducted in Malaysia, it was challenging for me to travel back to Malaysia several times in order to complete the experiments. I've also been given a restricted time to access the schools to perform the experiments, thus having to remove some of the measures that I've initially planned for. Due to personal and financial circumstances as well as limited resources, I am unable to conduct additional experiments (i.e., follow-up study) to further test the efficacy of cue congruency in motivating children's consumption. If I had additional time and resources, I would include children's individual characteristic assessments (i.e., BMI, attitudes, liking, hunger, attentional bias, impulsivity etc) as well as offering children several options of foods (both core and non-core food options). I would also include a control condition (i.e., for Study 3) in order to evaluate the effect of food advergames on children's immediate eating. I am also interested to test the impact of food cues depicted on different types of media (i.e., TV, YouTube, and social media channels), as well as the cue mechanisms (i.e., cue congruency, cue integration, cue salience etc) involved in stimulating food consumption among children .

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Appendices

Appendix A - Food advertisements on the UK television

Food advertising featured on children's television in the UK


FRUBES
WIN AN ISLAND HOLIDAY!
ANGRY BIRDS
UK & ROI, 18+. Enter by: 31.10.16. Promotional packs only. Purchase required. Skill element required for ROI.
Family=2 adults + 2 children under 16. Full T&Cs: angrybirds.frubes.co.uk/terms-and-conditions.


yoplait
Petits Filous
Petits Filous
Petits Filous
Petits Filous
BIG POTS
Vitamin D & STRONG
Calcium for BONES


WIN
A FAMILY ADVENTURE
SQUASHUMS
HUGE TUBES!
ALL NATURAL INGREDIENTS
3 x Strawberry
3 x Raspberry
Munch Bunch
PETS
18+. T&Cs apply. Visit www.munchbunch.co.uk to enter


TEAM GB
Kellogg's
PROUD SPONSOR
Kellogg's
COCO pops
CROC
POPS
BACK BY POPULAR DEMAND


NEW
NEW
Munch Bunch
SQUASHUMS
HUGE TUBES!
ALL NATURAL INGREDIENTS
LARGE SIZE
3 x Strawberry
3 x Raspberry
www.munchbunch.co.uk


coco pops
Enjoy as part of a balanced diet and active lifestyle. 30g bowl = 9% RI for sugar.
Activate Windows


MAKE A WEETABUDDY
WEETABUDDIES.COM
Weetabix


WIN A WEETABUDDY
WEETABUDDIES.COM

Appendix B – Food advertisements in Malaysian television

Food advertising featured on children's television in Malaysia


Chips more
EVEN MORE CHIPS & MORE CHOCOLATEY TASTE!*
ORIGINAL
Chips more ORIGINAL
Malaysia's No. 1 Cookie!*
*Based on Nielsen Malaysia Retail Index Service for Biscuit MAT Mar 2015


Paddle Pop
RAINBOW POWER


SUPER JIMAT BOX
Daripada
RM8.95
LIL' ZINGER BOX
WRAP BOX
SNACKER BOX
VARIETY BOX
SIGNATURE BOX


New
KFC
Bucket
Sensasi
FROM ONLY
RM39.90
pepsi


Nestlé
MADE WITH WHOLE GRAIN
KOKO KRUNCH
GREAT CHOCOLATEY TASTE
VITAMINS
DIETARY FIBRE
NILAI RM1 SETIAP SAJIAN HEBAT!
Nestlé Products Sdn. Bhd (45229-H)
Satu sajian 30g KOKO KRUNCH.
Berdasarkan purata harga runcit yang disyorkan (dibundarkan), tidak termasuk paket KOK
Nestlé
Good Food, Good Life


Berusaha memastikan sarapan
LEBIH BERMAKNA SETIAP HARI
Nestlé
MILO
STARS
DISCOVER NEW GALAXIES
KOKO KRUNCH
GREAT CHOCOLATEY TASTE


lazat dimasak
macam kari mak
Kari


ENERGY TO
GO FURTHER
Nestlé
MILO
Nestlé
MILO

Appendix C – Stimuli used in Study 2

Computer games

Cbeebies Asia Peter Rabbit online computer game

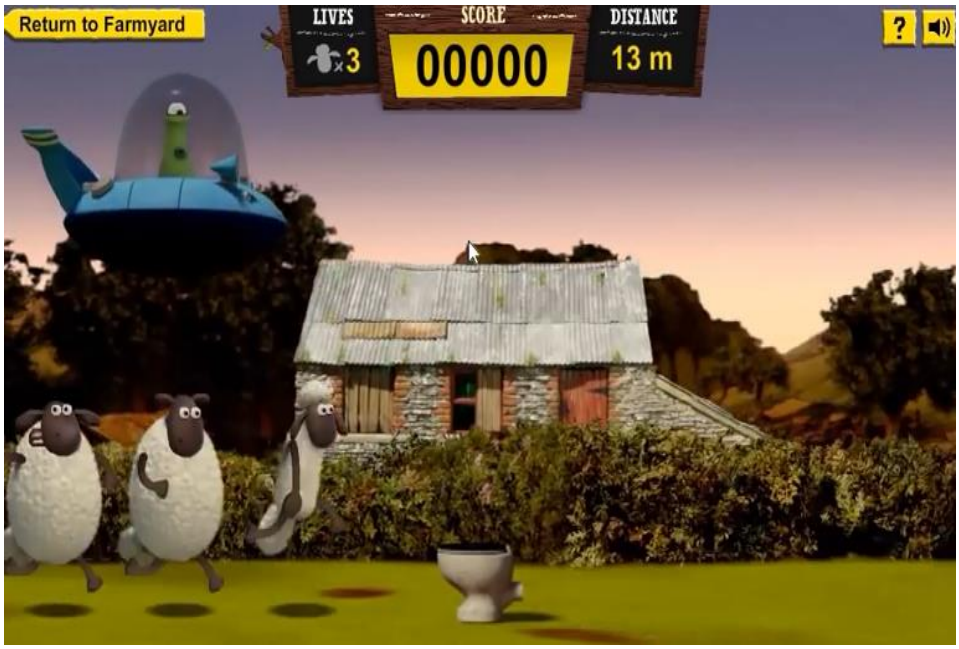
Condition 1 included a computer game about Peter Rabbit taken from Cbeebies Asia website. The game was called ‘Hop to it’, where the character needs to collect fruits and fill baskets. The player used a key and spacebar characters jumping over or avoiding obstacles. The game showed rabbit characters jumping and running to collect fruits.

Cbeebies Peter Rabbit game

Shaun the Sheep online game

Condition 2 included a computer game taken from Boomerang Asia TV website. The game was called Championsheep Alien Athletics, where the characters (Shaun and other sheep) need to avoid obstacles and run from an alien spaceship. The characters (sheep and aliens) jumped over or avoided obstacles. The game did not contain any images of food.

Shaun the Sheep Championsheep Alien Athletics


Return to Farmyard
LIVES
x3
SCORE
00000
DISTANCE
13 m
?

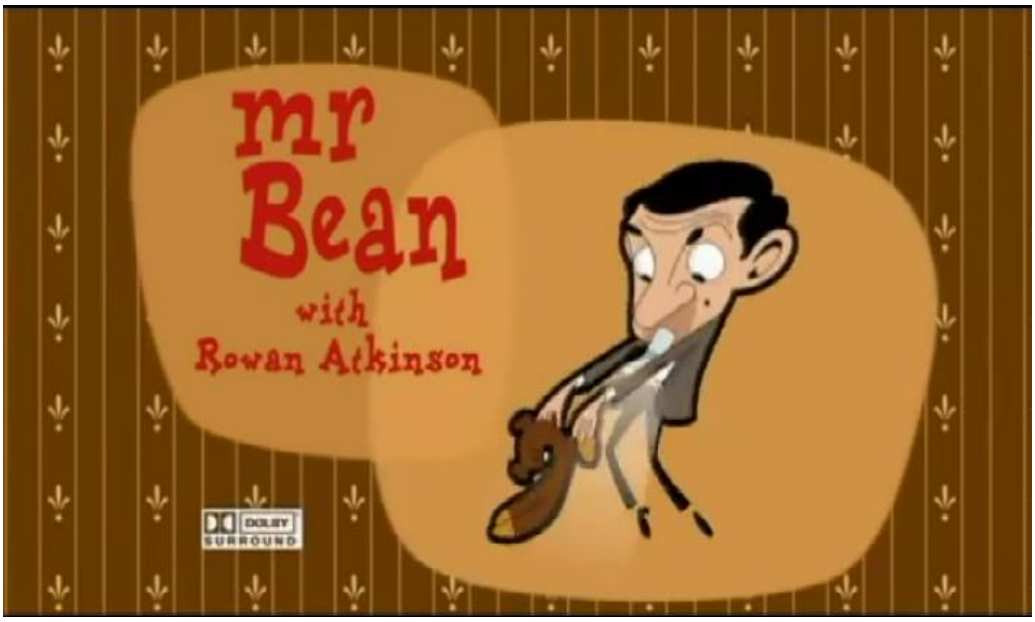

Return to Farmyard
LIVES
x3
SCORE
00060
DISTANCE
31 m
?

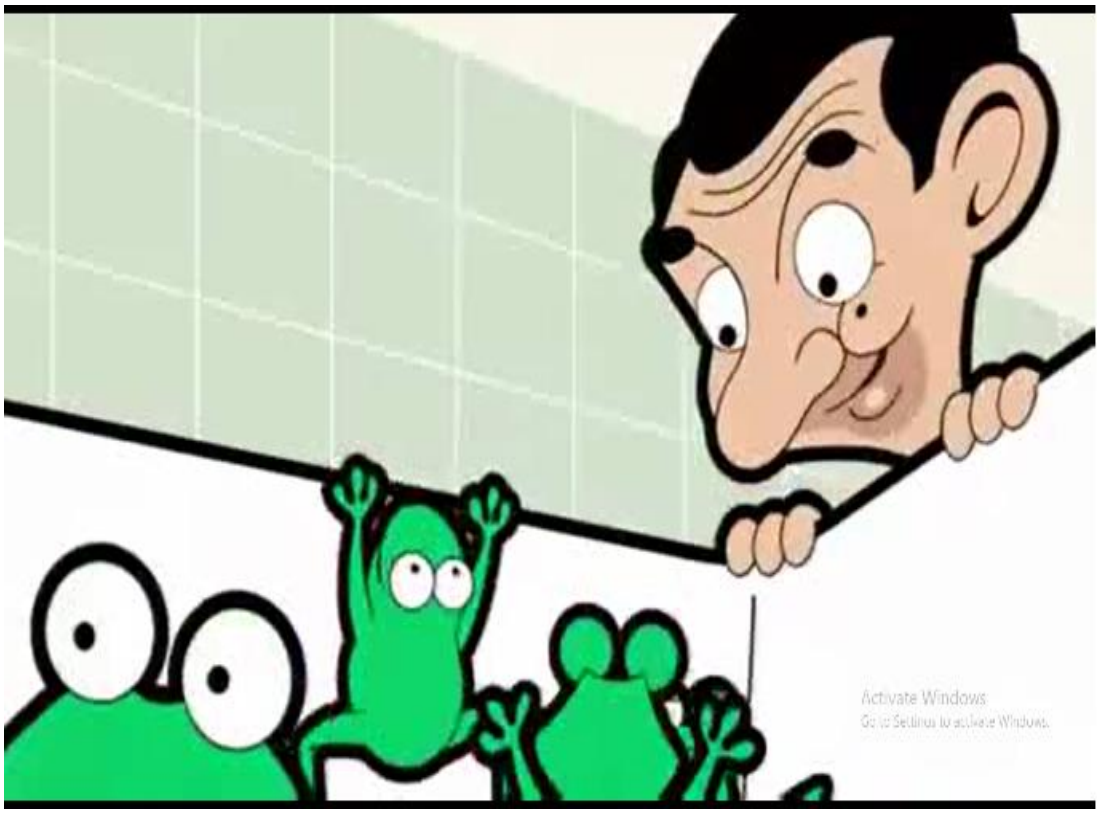
Television programme used in Study 2

Mr Bean's cartoon programme

For Condition 3, the control condition, the present study used one episode of an animated cartoon clip (Mr Bean) edited to approximately five minutes. The episode starts with Mr Bean walking in the park, reading a book about frogs. He decides to take some frogspawn from the park and puts the frogspawn into his bathtub and feeds it. When he wakes up in the next morning, the spawn has turned into frogs. Once the little frogs turn to adult frogs, they become aggressive. The cartoon clip did not contain any images of food.

Mr Bean's television footage taken from animated series entitled "Hopping Mad"



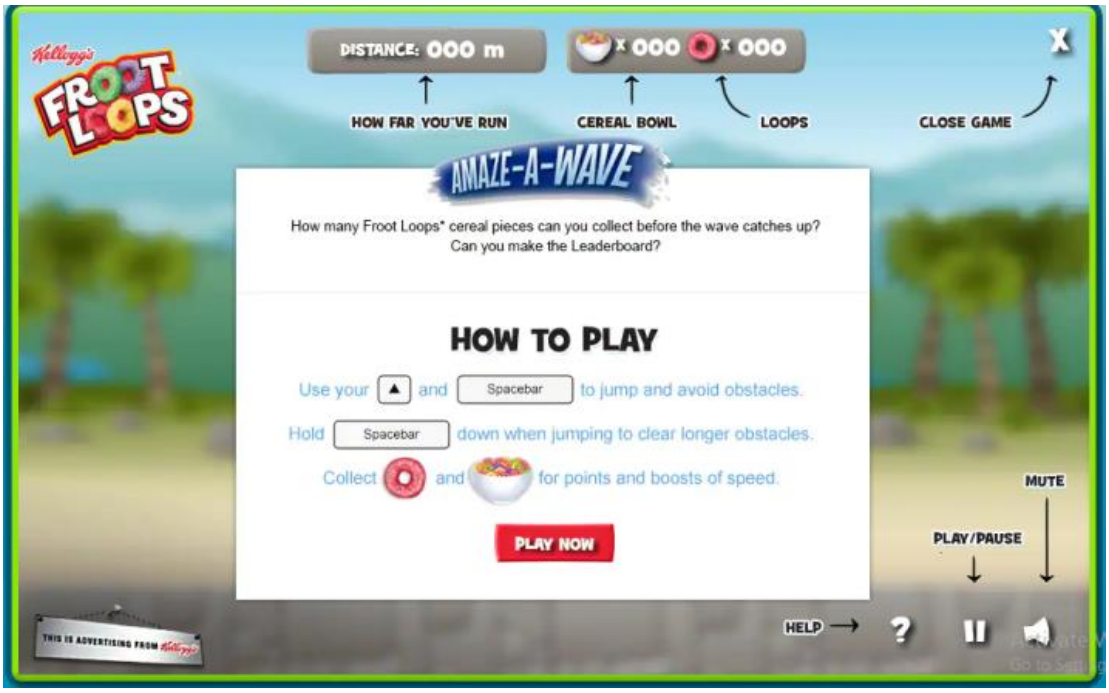

Activate Windows
Go to Settings to activate Windows.

Appendix D - Stimulus used in Study 3

Club Kellogg's online advergame

Conditions 1 and 2 included an advergame from Club Kellogg's website. The game was called Amaze-a-wave in which a character needed to collect Froot Loops cereal pieces before the wave overcame the character. The player played the game by pressing an upward arrow key and a spacebar to control the character jumping and avoiding obstacles. This advergame contained food images with a toucan bird character jumping and running to collect Froot Loops cereal pieces.

Club Kellogg's Amaze-a-wave advergame




AMAZE-A-WAVE
SAM


Kellogg's
FROOT LOOPS
DISTANCE: 9 m
x 0
x 4
THIS IS ADVERTISING FROM Kellogg's


Kellogg's
FROOT LOOPS
DISTANCE: 32 m
x 0
x 27
X
FROOT LOOPS
THIS IS ADVERTISING FROM Kellogg's
?

Appendix E1 - Ethical approval of Study 2

Ethical approval of Study 2

The University Of Sheffield.

Downloaded: 16/08/2020
Approved: 05/04/2018

Mark Blades
Psychology

Dear Mark

PROJECT TITLE: Effect of food images in videogames
APPLICATION: Reference Number 018274

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 05/04/2018 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 018274 (form submission date: 27/02/2018); (expected project end date: 11/05/2018).
- Participant information sheet 1040868 version 1 (27/02/2018).
- Participant consent form 1040869 version 1 (27/02/2018).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Thomas Webb
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix E2 - Ethical approval of Study 3

Ethical approval of Study 3

The University Of Sheffield.

Downloaded: 16/08/2020
Approved: 09/07/2018

Mark Blades
Psychology

Dear Mark

PROJECT TITLE: Effect of food images in video games (2)
APPLICATION: Reference Number 021513

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 09/07/2018 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 021513 (form submission date: 25/06/2018); (expected project end date: 30/09/2019).
- Participant information sheet 1047162 version 1 (25/06/2018).
- Participant consent form 1047163 version 1 (25/06/2018).

The following optional amendments were suggested:

The University Ethics Committee have produced an example consent form that's a little more detailed than the ones we've been using, due to the introduction of the General Data Protection Regulation. You can find it here: https://docs.google.com/a/sheffield.ac.uk/viewer?a=v&pid=sites&srcid=c2hlZmZpZWxkLmFjLnVrfGdkcHJ8Z3g6Njk0ZTc5Y2QyZmU2ZDNjNQ You may wish to check and add in a few extra elements to your consent form (such as the fact that children will be told that they can withdraw at any time without penalty, and that because the data is collected anonymously it will not be possible for participants or parents to withdraw after the event).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Thomas Webb
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopply_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix F – Information sheet for empirical studies

Information sheet for Studies 2 and 3 (translated from Bahasa)

Food in videogames

Information sheet

Dear Parent/Guardian

My name is Hanis Durrani. I am a research student in the Department of Psychology at the University of Sheffield in the UK. I am doing a project to find out how much children are affected by images of food that they see on screens.

We have carried out previous studies showing that if children see food in a television advertisement, or in a television program they will eat more food immediately after seeing the food on television.

Children also see food advertisements when they play videogames, but there have been no studies of whether seeing food in videogames also leads children to eat more.

I want to ask some children to play a videogame for 5 minutes or to watch a television extract for 5 minutes. Children will see different videogames: some will play a videogame which includes images of Kellogg's Froot Loops, some will see a videogame that includes images of fruit and vegetables, and some will see a videogame with no food images at all. All the videogames are running and jumping games in which a character runs across the screen trying to touch as many prizes (e.g. Froot Loops or fruits and vegetables) as possible in 5 minutes.

The games are all age appropriate and easy to play so that all children achieve high scores. Other children will see a children's television cartoon (Mr Bean) for 5 minutes that does not include any food images at all.

After playing the videogame or watching the cartoon each child will be given a small bowl of Froot Loops (without milk) or a small bowl of Nestle Cheerios (without milk) and told that they can eat as many or as few Froot Loops/Cheerios as they like. Children will also

be provided with water to drink.

I want to find out if children eat more cereal (irrespective of whether it is the advertised cereal or not) after playing the Froot Loops videogame than after playing the other games or watching the cartoon. This will allow me to assess the effects of different food images and find out which images lead to children to eating the most food.

I do not need to record any details of the children, apart from their age in years. I will not keep a note of children's names, therefore their participation will be anonymous and nothing a child does in the course of the study will be identifiable.

The Head Teacher (*insert name of Head*) has given me permission to ask children to take part. Children will be asked if they want to take part on the day of the study. Only children who have their parent's permission and who agree to take part themselves will be included in the study. An adult will be present all the time and a first aider will be available in case of any need.

If you are happy for your child to take part, I'd be very grateful if you would fill in the slip below and ask your child to return it to (*name of class teacher or school secretary*).

If you would like any more information about my study please do contact me at the address below or email me at hdmohamadramdzan1@sheffield.ac.uk.

Alternatively you can contact my supervisor, Dr Mark Blades at m.blades@sheffield.ac.uk.

Many thanks for your support. It is very much appreciated.

Signature: (*experimenter's name*)

Department of Psychology
University of Sheffield
Cathedral Court
1 Vicar Lane
Sheffield,
S1 2LT

Appendix G – Consent letter for parents

Parental consent forms for Studies 2 and 3 (translated from Bahasa)

Letter of Consent

I have read the details of Hanis's study and I am willing to let my child …… (please add your child's name) to take part in the study.

My child is allowed to eat Froot Loops and Cheerios.

My child has no allergy to cereal/ nuts/ gluten.

I understand that my child's name and personal details will not be recorded anywhere.

Name of parent ……..

Signature ……

Date …….

Please return this slip to (*name of class teacher or school secretary*).

Appendix H1 – Debrief sheet for Study 2

Debrief sheet for Study 2 (translated from Bahasa)

Debrief (for children) (English version) – this note was given to participating children at the end of the study in each school. The same information was given to the children verbally.

Thank you for taking part in this study. Your time and effort is appreciated.

I work at the University of Sheffield in the UK. I am carrying out a study to find out if playing a computer game that includes images of food encourages people to eat more food.

I asked everyone to play a computer game or watch a cartoon. Some children saw pictures of food while they were playing the game. Other children didn't see any images of food. After playing the game or seeing the cartoon I gave everyone the chance to eat some Froot Loops. I wanted to find out if children who saw the images of food while they were playing the game ate more Froot Loops than the children who did not see the images of food. When I did the study I made a note of how many Froot Loops were eaten, but I never made a note of anyone's name, so I don't know how many Froot Loops you ate!

I will be doing my study in a few schools and when I have finished I will tell all the schools what I have found out. If you want to know more about my study please ask me now, or you can ask your class teacher [*insert name of class teacher*] who can tell you more about my study.

Thank you again for taking part.

Hanis

Appendix H2 – Debrief sheet for Study 3

Debrief sheet for Study 3 (translated from Bahasa)

Debrief (for children) (English version) – this note was given to children at the end of the study in each school. The same information was delivered to the children verbally.

Thank you for taking part in this study. Your time and effort is appreciated.

I work at the University of Sheffield in the UK. I am carrying out]= a study to find out if playing a computer game that includes images of food encourages people to eat more food.

I asked everyone to play a game online, and you might see pictures of food while you were playing the game. After playing the game, I gave everyone the chance to eat some Froot Loops or Cheerios. I wanted to find out if children ate more Froot Loops or Cheerios after playing the game containing Froot Loops images. When I did the study I made a note of how many Froot Loops/ Cheerios were eaten, but I never made a note of anyone's name, so I don't know how many Froot Loops/Cheerios you ate!

I will be doing my study in a few schools and when I have finished I will tell all the schools what I have found out. If you want to know more about my study please ask me now, or you can ask your class teacher [*insert name of class teacher*] who can tell you more about my study.

Thank you again for taking part.

Hanis