KU LEUVEN

FACULTEIT SOCIALE WETENSCHAPPEN

Persuasive Mechanisms Behind the Influence of Food Marketing During Childhood: The Role of Positive Affect and Food Cue Reactivity

Evy Neyens

Proefschrift aangeboden tot het verkrijgen van de graad van Doctor in de Sociale Wetenschappen

Promotor: Prof. Dr. Tim Smits
Onderzoekseenheid: Instituut voor Mediastudies

Copromotor: Prof. Dr. Emma Boyland
[University of Liverpool, UK]

2019

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Prof. Dr. Trui Steen (voorzitter)
Prof. Dr. Tim Smits (promotor)
Prof. Dr. Emma Boyland [University of Liverpool, UK] (copromotor)
Prof. Dr. An-Sofie Claeys [KU Leuven]
Prof. Dr. Charlotte De Backer [Universiteit Antwerpen]
Prof. Dr. Heidi Vandebosch [Universiteit Antwerpen]
Prof. Dr. Bieke Zaman [KU Leuven]

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INTRODUCTION

Obesity is one of the most challenging global public health threats of the 21sth century (e.g. GBD 2015 Obesity Collaborators; Jaacks et al., 2019; James, 2018; Kumar & Kelly, 2017; World Health Organization, 2015b). Being overweight is associated with increased risk of developing various non-communicable diseases, such as cardiovascular disease, type 2 diabetes, asthma, chronic inflammation, liver disease, cancer, and social and psychological problems (e.g., GBD 2015 Obesity Collaborators; Gluckman, Nishtar, & Armstrong, 2015; Karnik & Kanekar, 2012; Williams, Mesidor, Winters, Dubbert, & Wyatt, 2015). The prevalence of obesity has been estimated to be three times as high compared to thirty years ago (Hurt, Kulisek, Buchanan, & McClave, 2010). In the United States, about 66% of adults are currently either overweight or obese (Ogden, Carroll, Kit, & Flegal, 2012). In European countries the prevalence of overweight in adults varies between 51% (Republic of Moldova) and 67% (Turkey, cf. Belgium, 59,5%) whereas the prevalence of obesity varies between 18% (Bosnia-Herzegovina) and 32% (Turkey, cf. Belgium, 22,1%, WHO, 2016). Of particular concern is the rising incidence of overweight and obesity in children (Gisle & Demarest, 2013; Kumar & Kelly, 2017), with prevalence rates of about 30% in the U.S. and between 20% and 30% in Europe (Branca, Nicogosian, & Lobstein, 2007; Ogden et al., 2016; Wijnhoven et al., 2014). In Belgium about 23.6% and 24.3% of boys and girls aged 5 to 19 years old are overweight (NCD Risk Factor Collaboration, Abarca-Gómez et al., 2017). Children who are obese are at high risk of becoming (and staying) obese adults and to suffer from typical 'adult' health problems that previously never occurred in children, such as type 2 diabetes, hypertension, nonalcoholic fatty liver disease etc. (Kumar & Kelly, 2017; Skinner, Perrin, Moss & Skelton, 2015).

Unhealthy eating behaviors play a major role in the onset of overweight and obesity (Drewnowski & Darmon, 2005; Williams et al., 2015). But why do people adopt unhealthy eating habits? Previous research demonstrates that next to internal factors such as hunger, external factors such as the availability, pricing, and marketing of foods and beverages (i.e. the obesogenic environment) also influence people's diet (cf. McCrickerd & Forde, 2016; Spence, Okajima, Cheok, Petit & Michel, 2015). Food marketing is considered to be an important external factor that drives our eating behavior by actively encouraging and normalizing overconsumption of unhealthy foods and beverages (Swinburn et al., 2011). As such, obesity can also be viewed as a 'socially communicable disease' (Lobstein, 2018).

Food marketing refers to any paid form of non-personal communication by an identified sponsor that aims to enhance people's awareness of, attitudes towards, and intentions to purchase specific food products or brands (Belch & Belch, 2008). Typically, the appeal of food brands is enhanced by linking them with positive, affective associations and hedonic desires that stimulate indulgence. Extensive empirical evidence shows that food marketing contributes to unhealthy food choices and an increased intake of high-caloric foods in children (e.g., Boyland et al., 2016; Norman, Kelly, Boyland, & McMahon, 2016; Sadeghirad, Duhaney, Motaghipisheh, Campbell, & Johnston, 2016).

Child-targeted food marketing is considered to be especially alarming since young children (< age 12) experience more trouble defending against commercial messages than adults (Rozendaal, Lapierre, van Reijmersdal, & Buijzen, 2011). Food and beverage companies invest exorbitant amounts of money to target children through various media-channels, ranging from traditional TV advertising and packaging, to new, online- and integrated forms of advertising (Galbraith-Emami & Lobstein, 2013; Powell, Harris, & Fox, 2013). A key problem is that the vast majority of child-targeted foods and beverages are unhealthy because they contain excessive amounts of sugar, fat, and salt (cf. Castonguay, Kunkel, Wright, & Duff, 2013; Lodolce, Harris, & Schwartz, 2013; Powell, Schermbeck, & Chaloepka, 2013). For example, the top five food categories that are most often promoted to young people are sugared breakfast cereals, salty snacks, soda, candy and pastry (Kelly, Hattersly, King, & Flood, 2008; WHO, 2016).

Recent empirical reviews and meta-analyses have consistently shown that food marketing has a considerable influence on children's food brand attitudes and purchase request intentions, their food preferences and choices, and actual eating behavior (e.g. Boyland et al., 2016; Norman et al., 2016; Sadeghirad et al., 2016; Smits, Vandebosch, Neyens & Boyland, 2014). International health organizations have therefore concluded that pervasive food marketing is an important environmental agent that contributes to the current childhood obesity crisis by encouraging poor diet preferences and overconsumption (Institute of Medicine, 2006; Federal Trade Commission, 2012; WHO, 2013; 2016).

But *how* exactly does food marketing influence children's brand responses and food intake? Although there is extensive empirical support for the direct effects of food marketing on children, little is known about the underlying *persuasive mechanisms* that explain these effects. Theoretical models that specifically predict how marketing affects children's brand responses and eating behavior, such as the *Processing of Commercial Media Content Model* (PCMC, Buijzen, van Reijmersdal, & Owen, 2010) and the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord, Anschütz, Boyland, Kelly, & Buijzen, 2016), have only recently been

developed and many of their theoretical assumptions have not yet been adequately tested. Much of the research up to now has focused on advertising literacy as the main explanatory mechanism behind child-targeted food marketing effects. The advertising literacy perspective generally assumes that: a) younger children are more responsive to advertising than teenagers and adults due to their underdeveloped advertising literacy and consumer experience, and b) enhancing children's advertising literacy will diminish their responsiveness to advertising effects (cf. Friestad & Wright, 1994; Livingstone & Helsper, 2006; Rozendaal et al., 2011). However, other plausible mediating variables, such as affective responses towards advertising and food cues, have received far less research attention. Gaining a deeper understanding into the persuasive processes through which food marketing influences children is crucial in order to develop efficient intervention strategies to protect children.

Furthermore, acknowledging the new media landscape, it is still unclear whether the underpinning persuasive mechanisms differ between traditional (i.e., TV ad) and new, non-traditional forms (i.e., brand placement in games and movies) of food marketing. Thus far, only a limited number of studies have actually examined and compared the persuasive processes that underlie both traditional and non-traditional marketing tactics (e.g., Hudders, Cauberghe, & Panic, 2015; Panic, Cauberghe, & De Pelsmacker, 2013; Verhellen et al. 2014; Waiguny & Terlutter, 2011). Since these previous studies are restricted in their generalizability due to the use of small sample-sizes and rather narrow age intervals, research efforts should be extended to reveal, and potentially distinguish, the processes that underpin the influence of both types of marketing on young people's brand responses.

In addition, far too little attention has been paid to *which* children are more vulnerable to food marketing effects than others. Although some research has shown that body weight, impulsivity and attentional bias moderate the impact of food marketing on children's food intake (cf. Folkvord, Anschütz, Wiers, & Buijzen, 2014; Folkvord, Anschütz, Nederkoorn, Westerik, & Buijzen, 2014; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford et al., 2008), these moderating factors are still poorly understood due to the lack of empirical studies. Likewise, the role of age in advertising susceptibility is still unclear. The *cognitive defense view* assumes that older children who are more advertising literate are less susceptible to advertising than younger children (Friestad & Wright, 1994; Kunkel et al., 2004; Livingstone & Helsper, 2006). However, few studies have actually examined the potential moderating role of age in advertising effects. As Livingstone and Helsper (2006) noted, it is remarkable that, given the centrality of age to the advertising literacy paradigm, the moderating role of age in advertising effects has not yet been systematically investigated. Hence, more research is also needed on individual susceptibility

factors, such as children's level of impulsivity and age, that may moderate the influence of food marketing on children's brand responses and eating behavior.

Finally, intervention strategies to protect children from the harmful consequences of food marketing have almost exclusively focused on advertising literacy as the main coping mechanism. It has been argued, however, that such interventions will be insufficient to counter automatic, behavioral food marketing effects (Ambler, 2008; Harris, Brownell, & Bargh, 2009; Nairn & Fine, 2008), since children are not always aware they are being targeted by advertising and the ability to resist marketing induced food cravings requires well-developed self-regulating capacities such as *inhibitory control* (Groppe & Elsner, 2014; 2017; Jasinska et al., 2012). Previous studies in the field of human eating behavior have already shown that inhibitory control training procedures significantly reduce snacking and overeating in adults (cf. Houben & Jansen, 2015; Haynes, Kemps, & Moffitt, 2015). However, the contribution of such interventions to the domain of child-targeted food marketing has only recently been recognized by researchers. Folkvord, Veling, and Hoeken (2016), for instance, have found that a Go/No-Go training, in which No-Go cues were associated with unhealthy foods, diminished the impact of playing a food advergame on children's (age 7-10) snack intake. With only one published study thus far (cf. Folkvord et al., 2016), it remains unclear whether such inhibitory control interventions may also be effective among older children and adolescents and across different advertising media. Furthermore, prior studies on the development of inhibitory control during adolescence have shown that as inhibitory control increases so does impulsivity (e.g. Romer, 2010; Steinberg, 2010; Shulman et al., 2016). Hence, inhibitory control procedures are a promising new line of research for the field of child-targeted food marketing and require further research attention.

The aim of the current dissertation is to fill the previously described research gaps by focusing on *how* food marketing impacts brand responses and food consumption in children. A first objective is to identify the underpinning mechanisms that explain food marketing effects on children's brand outcomes (attitudes and purchase intentions), and to compare them between traditional and non-traditional types of marketing. A second objective is to examine how embedded food cues can have a direct influence on children's eating behavior. A third objective of this dissertation is to examine the effectiveness of inhibitory control strategies among an older age-group of children, and another marketing context, than has previously been investigated. Furthermore, an additional objective is to explore whether individual susceptibility factors such as children's age and level of impulsiveness moderate the influence of food marketing exposure on children's brand responses and eating behavior.

This dissertation is composed of an introductory chapter, four main chapters and a concluding discussion. The remainder of this introductory chapter will describe the current child-targeted food marketing landscape and policies. It will then provide a literature review on the impact of food marketing on children and outline the theoretical background of this dissertation. This theoretical framework draws upon the *Processing of Commercialized Media Content Model* (PCMC, Buijzen et al., 2010) to explain how children process advertising. Further, the *Reactivity to Embedded Food Cues in Advertising Model* (REFCAM, Folkvord et al., 2016) will be used to clarify how food cues can affect children's eating behavior. Then the introduction will continue and the theoretical premise and extant evidence base of efficacy of inhibitory-control interventions will be evaluated. Finally, the specific research objectives of this dissertation will be further refined.

After this introductory chapter, the first part of this dissertation examines *how* food marketing influences children's brand attitudes and behavioral intentions. Chapter 1 will look at how children process traditional and newer, more subtle, forms of food advertising and how this influences their brand responses. More specifically, Chapter 1 examines the mediating roles of cognitive advertising literacy and affective responses towards advertising in the influence of the advertising format (TV advertisement vs advergame) on children's brand outcomes (brand attitude and purchase request intentions). In addition, it explores whether children's age moderates these persuasive processes. Chapter 2 will extend these insights to a case study of child targeted media, demonstrating that affect-based marketing stimuli designed to promote high fat, sugar and salt (HFSS) foods and beverages to children are still omnipresent on online branded websites despite of industry self-regulatory codes to limit the marketing of unhealthy foods to children.

Part 2 will focus on how food cues can have a direct influence on children's eating behavior. While Part 1 suggests that food marketing does have persuasive effects on children's food attitudes, it also makes one wonder whether the daily omnipresence of food cues, even if they do not strictly pertain to food marketing, might affect children. Research on adults at least suggests that the presence of food cues can influence consumption (Federoff, Polivy & Herman, 1997; Harris, Bargh, & Brownell, 2009b). Chapter 3 applies this reasoning to a children's setting and shows that even food cues outside of a marketing context, namely the foods shown on a TV cooking show, can have a direct effect on children's eating behavior.

Part 3 therefore addresses the question how children could be guarded against the impact of food cues coming from food marketing or other media exposures. As Part 1 and Part 2 suggest that the effects on attitudes and behaviors are rather direct, it is indeed a pressing issue to understand how to intervene in these processes. Part 3 thus focuses on the role of inhibitory control intervention tasks to reduce the automatic impact of food advertising exposure on children's eating behavior.

More specifically, Chapter 4 investigates whether inhibitory control enhancing interventions may reduce the impact of food marketing exposure on children's unhealthy snacking behavior. In addition, it explores whether individual susceptibility characteristics, such as behavioral approach system (BAS) and behavioral inhibition system (BIS), function as moderators of the effect of food advertising on children's food intake. Furthermore, Chapter 4 explores whether age moderates the influence of food advertising exposure on children's snacking behavior.

Child-Targeted Food Marketing: State of the Art

Marketers use various affect-based persuasive techniques to establish positive associations around a food brand and to stimulate indulgence (Calvert, 2008; Lindstrom, 2012; Nairn & Fine, 2008; Poels & Dewitte, 2006). Child-targeted food promotions typically use positive stimuli that appeal to this target group, such as fun shapes and colors, celebrity endorsers and fictional media characters, and references to popular child-targeted movies, TV series and games (Elliott, 2008; Hebden, King, Kelly, Chapman, & Innes-Hughes, 2011). In addition, images of tasty foods and beverages are an inseparable part of food advertising because these food cues immediately trigger appetite (Boswell & Kober, 2016; Folkvord et al, 2016). These affective and palatable stimuli are present in traditional advertising media, like TV commercials and packaging, and online advertising media, like branded websites and social network sites (FTC, 2012; Powell, Harris, & Fox, 2013; WHO, 2013).

Although television remains the dominant food advertising format, the use of online and more subtle and integrated forms of marketing has increased rapidly in recent years (FTC, 2012; Powell et al., 2013; WHO, 2013). Next to traditional, explicit marketing tactics such as TV advertising, print advertising, radio, packaging, billboards etc. marketers increasingly use non-traditional, subtle marketing tactics that have no apparent commercial nature or intentions and are therefore more difficult to recognize as advertising (Harris et al., 2009; Nairn & Fine, 2008). In contrast to explicit marketing techniques, subtle marketing techniques obscure the commercial purpose of the advertising message by blending it within entertaining media programming in order to reach children off guard (Campbell, Mohr, & Verlegh, 2013; Aerts, Neyens, Keldermans, & Smits, 2017; WHO, 2016). Popular examples include paid brand placements in children's favorite movies, TV series, websites, games and apps, sponsored online advergames (games developed by food brands to promote their products by featuring branded messages, logos and/or characters; Mallinckrodt & Mizerski, 2007), and sponsored social media content. Another type of subtle marketing tactics are the use of persuasive cues that appear to be incidental and non-commercial in

nature – for instance verbal or graphic advertising cues such as portion-size suggestions and images of fruit and vegetables that influence consumer behavior (Nairn & Fine, 2008; WHO, 2016; Neyens, Aerts, & Smits, 2015). In our previous work on this topic, for example, we found that the image-size of depicted food on a cereal packaging affects how much food kids consume. More specifically, we found that children (age 4 to 5) ate significantly more cereal and drank more milk when they were exposed to a larger-sized image as compared to a smaller-sized image (Neyens et al., 2015).

It has been argued that, in contrast to explicit forms of advertising that persuade through deliberate mental processes, subtle forms of advertising persuade quasi-automatically through implicit and unmindful mental processes (Ambler, 2009; Nairn & Fine, 2008). Since these effects occur subconsciously rather than by deliberate association between the marketing cue and the food or its consumption, (young) consumers are unlikely to pay conscious attention to the integrated advertising message and pause and reflect about how these cues are designed to affect them (Nairn & Fine, 2008; Rozendaal et al., 2011). Thus, subtle marketing techniques might actually circumvent the use of cognitive protection mechanisms related to advertising and health literacy. In other words, when children do not realize that they are being targeted by advertising, they are less likely to be skeptical and employ cognitive coping mechanisms (Friestad & Wright, 1994). This is especially the case among children who do not yet have acquired adult-like skills to cope with advertising (Mallinckrodt & Mizerski, 2007; Owen, Lewis, Auty, & Buijzen, 2013).

Furthermore, according to the *Limited Capacity Model of Motivated Mediated Message Processing* (Lang, 2000), children are likely to devote the majority of their cognitive resources to the primary media content (e.g. movie, game etc.), leaving too few resources to critically process the embedded commercial message, while the uncritical processing of these commercial cues might still have important effects. Even if children are taught to recognize subtle tactics as advertising, they are more cognitively engaged with the primary media content. Hence, they might still lack the resources to actually notice and think about the source and purpose of a brand placement (Nairn & Hang, 2012).

One could thus wonder whether subtle marketing tactics might even have more pervasive and automatic effects on children's brand responses and eating behavior compared to traditional marketing tactics. Are subtle forms of food marketing indeed more likely to be processed automatically? Are children indeed less able and/or motivated to use cognitive defenses when exposed to subtle compared to explicit forms of food marketing? Chapter 1 aims to address these research questions by examining and comparing the persuasive processes that mediate advertising format effects on children's brand responses.

Policy and Regulations on Child-Targeted Food Marketing

Despite the ubiquity of increasingly cunning techniques to promote high fat, sugar, and salt (HFSS) food products to children, legislation to protect children against the potential harmful impact of food marketing is falling short. There currently are three approaches to regulate the impact of food advertising on children's health: national legislation, general marketing and media guidelines, and industry self-regulatory codes (Verdoodt, Lambrecht, & Lievens, 2016). Specific national legislation on the promotion of foods and beverages to children is scarce in European countries (with the exeption of the UK & Ireland). In Belgium, for example, there currently is no legislation to regulate food marketing aimed at children. Most countries only impose general advertising guidelines and emphasize the importance of self-regulatory codes of conduct (Chambers, Freeman, Anderson, & MacGillivray, 2015; Harris, LoDolce, Dembek, & Schwarz, 2015; WHO, 2016).

General marketing regulations, such as European guidelines regarding unethical marketing methods (2005/29/EC), and national legislation (e.g. Danish Marketing Practices Act ; Belgian Law on Marketing Practices and Consumer Protection (LMPC, 6/04/2010)) assert that children's vulnerability should not be exploited. Media guidelines, such as the *European Union Audiovisual Media Services Directive* (2010/13/EU) and the *e-Commerce Directive*, legally bind marketers to disclose the commercial nature of their digital marketing communications to consumers (Verdoodt, Lievens, & Hellemans, 2015; Verdoodt et al., 2016). These media and marketing directives are monitored by national governmental bodies. For instance, the Flemish Media Regulator in Belgium and Ofcom in the UK are responsible while, sometimes, industry organizations have adjacent responsibilities (e.g. the Jury for Ethical Practices in Advertising (JEP) in Belgium) (Verdoodt et al., 2016). However, these general principles seldom refer specifically to food promotions and rarely cover all media channels and marketing tactics (Verdoodt et al., 2016; WHO, 2016).

Hence, the current policy on child-targeted food marketing mainly relies on industry self-regulation (Harris et al., 2015, WHO, 2016). Large food companies, such as Unilever and Kraft Foods, have developed self-regulatory codes to restrict the marketing of unhealthy foods and beverages to children under age twelve. Examples of these codes of conduct are the *EU Pledge* (2007), and the *Children's Food and Beverage Advertising Initiative* (Council of Better Business Bureaus, 2006; WHO, 2016). In Belgium, the federation of the food industry (FEVIA) and the union of Belgian advertisers (UBA) developed a *food advertising code* in 2004, and initiated the *Belgian Pledge* in 2012 (Belgian Pledge, 2012; Verdoodt et al., 2016). The *food advertising code* is

based on the ICC Framework for responsible food and beverage communications (International Chamber of Commerce) and contains specific provisions for the protection of children (Verdoodt et al., 2016). For example, advertising intended for children should not: a) use media figures in a way that obscures the commercial character of the advertisement, b) create a sense of urgency, c) undermine parental authority, d) encourage children to pester their parents to buy certain food products, and e) mislead children about the health and other benefits of a food product (Reclamecode voor voedingsmiddelen, FEVIA, 2005). In the *Belgian Pledge*, food companies promise to follow the guidelines of the *EU Pledge* and thus to refrain from advertising unhealthy foods and beverages to children under age twelve. However, since adherence to the *food advertising code* and the *Belgian Pledge* is mainly monitored by the advertising industry themselves - more specifically by the Jury for Ethical Practices in Advertising (JEP), a self-regulatory body of the Belgian advertising industry- these codes lack credibility.

Moreover, the guidelines of the *EU Pledge* and the *Belgian Pledge*, have some considerable loopholes. First, they only pertain to media of which the target audience consists of at least 35% children under age 12 (EU Pledge, 2016). Food advertising in media targeting a wider audience, for example prime-time TV shows where children are nevertheless frequently exposed to, therefore do not fall under these restrictions (Galbraith-Emami & Lobstein, 2013; WHO, 2016). Second, the age demarcation of twelve years old is based on outdated cognitive-developmental models assuming that children acquire the cognitive capacities to defend themselves against marketing from early adolescence (age 12 to 16) (Friestad & Wright, 1994; Rozendaal et al., 2011; WHO, 2016). However, recent studies show that teenagers have trouble to identify non-traditional forms of advertising (Blades, Oates, & Li, 2013; Owen, Lewis, Auty, & Buijzen, 2013), and there currently is insufficient empirical evidence that the impact of food marketing actually declines with increasing age (Mathes & Naderer, 2015). Moreover, such age-based restrictions disregard the pervasive, automatic effects of food marketing on food choices and food consumption (Nairn & Fine, 2009; Harris et al., 2009; WHO, 2016) that even persist among advertising literate adults. Third, industry definitions of unhealthy foods and beverages are not always based on scientific nutritional guidelines, thereby permitting a considerable amount of non-core food products to permeate through the gaps. According to the *EU Pledge Nutrition Criteria*, for instance, cereal cakes may contain up to 35 grams of sugar (per 100 grams) to be labeled as 'healthy'. Fourth, since industry guidelines focus on advertising media instead of persuasive techniques, more subtle tactics, such as celebrity licensing, product placements, cross-promotions, sponsorships, and portion-size suggestions, often fall outside of their scope (EU Pledge, 2016; Powell et al., 2013), certainly if these techniques are applied in non-regulated media. Finally, due to the non-binding nature of these

initiatives, industry compliance with these guidelines is not controlled by independent organizations, and sanctions are not imposed when food companies do not adhere to their own guidelines (Galbraith-Emami & Lobstein, 2013).

In the U.S., several studies have already shown that industry self-regulation is unsuccessful (e.g. Kunkel, Castonguay, & Filer, 2015; Powell, Schermbeck, Szczypka, & Chaloupka, 2012; Powell et al., 2013). In European countries, few academic studies have verified whether food companies actually live up to their promises, and those that have clearly show that these codes are not effective at reducing exposure (Jensen & Ronit, 2015). Therefore, Chapter 2 also explores to what extent Belgian and Dutch child-targeted food and beverage brands abide to their own self-regulations.

The Impact of Child-Targeted Food Marketing on Children: Empirical Findings

Since the seventies, the influence of food marketing on children has been extensively investigated from various academic disciplines such as communication sciences, social-cognitive psychology, and nutritional sciences (cf. Borzekowski & Robinson, 2001; Galst & White, 1976; Gorn & Goldberg, 1982; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Harris, Brownell, & Bargh, 2009; Kotz & Story, 1994; Robinson, Borzekowski, Matheson, & Kraemer, 2007). This academic attention has led to a large and growing body of literature. Communication scientists have mainly focused on the cognitive and attitudinal outcomes of child-targeted food marketing by measuring children's brand recall, brand attitudes and purchase requests. Psychologists and nutritionists, however, have predominantly measured behavioral marketing effects such as food choices and actual food intake (Smits, Vandebosch, Neyens, & Boyland, 2014).

The existing literature suggests that food marketing influences children's consumer attitudes and behavior. Food advertising exposure has been shown to affect children's brand attitudes, purchase (request) intentions, food preferences, choices and eating behavior (e.g. Boyland & Whalen, 2013; Cairns, Angus, & Hastings, 2009; Institute Of Medicine, 2006; FTC, 2008; 2012; WHO, 2013; 2016). Scientists and public health experts have therefore expressed concerns about the harmful effects of food marketing on children's health (WHO, 2016). However, it is still unclear *how* exactly food marketing influences children and which conditions might facilitate or diminish this impact (Harris, Brownell, & Bargh, 2009).

To date, research on child-targeted food marketing has mainly focused on the influence of TV food advertising on food intake using between-subjects experimental designs. Typically, in

these experiments, children are randomly assigned to a food, non-food, or no advertising condition, and subsequent *ad libitum* food intake is measured either during or immediately after exposure. These experiments have consistently shown that children who were exposed to TV food advertising ate significantly more (in grams and kilocalories) compared to children who were exposed to non-food or no advertising (e.g. Harris, Bargh, & Brownell, 2009a; Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Halford, Boyland, Hughes, Oliveira, & Dovey, 2007; Halford et al., 2008). Moreover, these effects have been shown to go beyond the advertised brands with both children (and adults) eating more of any available foods. In a landmark study, for instance, Harris, Bargh, et al. (2009) conducted a between-participants experiment in which children (age 7 to 11) were randomly assigned to (individually) watch a cartoon episode that either contained four 30 second food commercials (energy-dense breakfast and snack products) or four non-food commercials (entertainment products). The children were given a bowl of (not advertised) goldfish crackers (150 grams) to snack on while watching the cartoon episode, after which children's food intake was measured. Harris et al. (2009) found that children who had been exposed to food advertising ate significantly more of the crackers (45%, d= .60) than children who saw non-food advertising. Recent meta-analyses have also concluded that TV food advertising significantly affects children's short-term food choices and increases their overall food intake (Boyland et al., 2016; Folkvord, Anschütz, Boyland, Kelly, & Buijzen, 2016; Norman et al., 2016; Sadeghirad et al., 2016). However, these studies typically concern the acute, short-term effects of food marketing exposure on children's eating behavior whereas more longitudinal research is required to demonstrate a long-term and causal influence of food marketing exposure on children's actual weight gain and health (Smith, Kelly, Yeatman, & Boyland, 2019).

In addition to TV advertising, many other persuasive tactics are used to promote foods and beverages to children, including endorsement marketing, on-pack branding, online marketing and brand placement. Food endorsement marketing, for instance, is a highly prevalent persuasive technique whereby a food brand uses spokes-characters (i.e. celebrities, cartoon characters, brand mascots) to appeal to children (Callcott & Lee, 1995; Neeley & Schumann, 2004). Two recent academic reviews have concluded that food endorsing characters increase children's (age 3-12) liking of and preference for endorsed over (the same) unendorsed foods, and significantly increase children's food intake (Smits et al., 2014; Kraak & Story, 2015). In an iconic experiment, for instance, Roberto, Baik, Harris, and Brownell (2010) asked young children (age 4 to 6) to rate the taste of three identical food pairs of which one item was endorsed by a licensed character. This study showed that children preferred the taste of, and were significantly more likely to choose the endorsed over the exact same unendorsed foods as a snack. Similar food endorsement tactics have

already been found to be effective for various advertising media, including TV advertising, on-pack branding, and online marketing (Smits et al., 2014; Kraak & Story, 2015).

Research interests have recently shifted to hybrid or integrated forms of advertising, since marketers are increasingly integrating commercial content into entertaining media content. Hybrid advertising is often referred to as a more covert or subtle advertising practice since it deliberately aims to mislead consumers by fading the boundaries between advertising and entertainment (Nairn & Fine, 2008). These covert techniques take many forms such as sponsored food advergames (i.e. branded online games), brand placement in children's favorite movies and TV series, and in-game advertising. Previous studies have established that exposure to movie brand placements and advergames result in significantly more positive brand attitudes and increased purchase request intentions in children (e.g. Auty & Lewis, 2004; Hudders, Cauberghe, & Panic 2015; Hudson & Elliott, 2013; Mallinckrodt & Mizerski, 2007; van Reijmersdal, Rozendaal, & Buijzen, 2012; Waiguny & Terlutter, 2012). Furthermore, experimental studies have shown that children ate significantly more snacks after playing an advergame with embedded food cues compared to children who played the same advergame without food cues (e.g. Folkvord, Anschütz, Buijzen & Valkenburg, 2013; Folkvord et al., 2014; Harris, Speers, Schwarz, & Brownell, 2012). Previous research indicates that these subtle marketing tactics can influence children even when they have not consciously perceived them (Auty & Lewis, 2004; Mallinckrodt & Mizerski, 2007). Auty & Lewis (2004), for example, found that a movie brand placement influenced children's product choice regardless of whether they had consciously perceived the placement, and this effect was observed in young (age 6-7) as well as older children (age 11-12).

Recent meta-analyses have reviewed the effects of traditional and non-traditional forms of food advertising on young people. Results showed small to moderate effects of food marketing exposure on children's short-term food preferences and overall food intake *(*Boyland et al., 2016; Folkvord et al., 2016; Sadeghirad et al., 2016). A meta-analysis conducted by Boyland et al. (2016) reported a small to moderate increasing effect of food advertising exposure on food intake (SMD: 0.37; 95% CI: 0.09; 0.65). In a meta-analysis of 26 randomized experiments, Sadeghirad et al. (2016) found a moderate effect of food advertising exposure (TV food commercials, advergames, and on-pack branding) on children's (age 2-18) dietary intake during and immediately after exposure (pooled estimate = 30.4 kcal, 95% CI 2.9; 57.9), and a small yet nonsignificant effect on children's food preferences (SMD = 0.23, 95% CI 0.04; 0.5). However, according to Sadeghirad et al. (2016) overall study quality was rather poor due to the lack of double-blinded experiments.

Both meta-analyses reported that the magnitude of food marketing effects did not appear to depend on the type of marketing tactic (TV advertising, advergames, branding) (Boyland et al.,

2016; Sadeghirad et al., 2016). Furthermore, in both studies subgroup analyses revealed an age-effect. Sadeghirad et al., (2016) found larger effects on caloric intake among younger children (≤ 8 years vs > 8 years). Boyland et al. (2016) found that, while exposure to TV or Internet food advertising did not significantly affect adult's food intake, it did significantly increase children's immediate food intake.

In their comprehensive literature review, Norman and colleagues (2016) evaluated the existing empirical evidence according to the Bradford Hill Criteria for causality in epidemiological studies. They concluded that there is sufficient evidence to assume a causal relationship between food marketing exposure (TV advertising, advergames, movie brand placement, endorsing characters, and premium offers) and food behaviors (cf. food preferences & choices, short-term food consumption and dietary intake) in children. However, Norman et al., (2016) notice that the evidence base is especially strong for the immediate, short-term effects of food marketing exposure on young children's (age 3-12) food behaviors. Hence, more research is still needed into the effects of food marketing on adolescents' (age 13-18) food behaviors, as well as on longer-term influences on eating behavior and actual weight gain and becoming overweight (Norman et al., 2016).

Together, the current empirical evidence consistently suggests that food marketing has a significant yet small-to-moderate effect on short-term food intake among children between age 3 to 12 (Boyland et al., 2016; Norman et al., 2016). However, the above cited meta-analyses all have small to moderate effect sizes (cf. 0.37 in Boyland et al., 2016), suggesting that a large part of the variance remains to be explained by mediating and moderating factors (Norman et al., 2016). Many researchers suggested that advertising literacy would be such a mediator.

Does Advertising Literacy Mediate the Influence of Food Advertising on Children?

Children are assumed to be more vulnerable to advertising effects compared to adults due to their immature *advertising literacy* (i.e. knowledge on advertising's intentions and tactics) and limited consumer experience (e.g. Friestad & Wright, 1994; Harris et al., 2009). Advertising literacy develops with age and enables children to recognize the persuasive intentions of advertising and employ critical coping tactics to defend against its influence (Friestad & Wright, 1994; Rozendaal et al., 2011). Although several studies have examined the role of advertising literacy in child-targeted food marketing effects, most of these studies were rather limited in scope and only addressed the correlations between a measurement of advertising literacy and a measure of advertising effectiveness.

The current empirical evidence suggests that conceptual advertising literacy (i.e. the ability to recognize advertising and understand its persuasive intentions) does not suffice to empower children against the influence of food advertising (An & Stern, 2011; Mallinckrodt & Mizerski, 2007; Rozendaal et al., 2011; Rozendaal et al., 2012). Several studies indicate that conceptual advertising literacy is negatively related to advertising outcomes for traditional, but not for covert types of food marketing (e.g., Mallinckrodt & Mizerski, 2007; van Reijmersdal et al., 2012; Panic, Cauberghe, & De Pelsmacker 2013; Waiguny & Terlutter, 2011; Rifon et al., 2014; Verhellen, Oates, De Pelsmacker, & Dens, 2014; Rozendaal, Slot, van Reijmersdal & Buijzen, 2013). In addition, conceptual advertising literacy has only been shown to moderate the effects of TV advertising but not advergames (Verhellen et al., 2014).

The attitudinal component of advertising literacy (i.e. critical attitude towards advertising), however, has been shown to be negatively linked to children's food brand attitudes and purchase intentions for both traditional and non-traditional forms of food advertising (i.e. advergames, targeted social network advertising) (Hudders et al., 2015; Rozendaal et al., 2013; van Reijmersdal, Rozendaal, Smink, Van Noort, & Buijzen, 2013). Moreover, a few comparative studies have shown that the influence of the advertising format (traditional vs non-traditional) on purchase requests is only mediated by attitudinal but not conceptual advertising literacy (Hudders et al., 2015).

In addition, researchers have tested whether interventions based on advertising literacy education and/or advertising disclosures may diminish the impact of food advertising on children's attitudinal responses and behavioral intentions. Advertising disclosures, such as ad-break warnings, warning logos and counter-advertising, are designed to facilitate children's identification of advertising, thereby enabling them to use their advertising literacy as a coping tactic (Hudders et al., 2017). A number of studies indicate that advertising disclosures can indeed motivate children (7-12 years) to activate and use their conceptual and attitudinal advertising literacy (i.e., advertising literacy performance). However, this does not automatically translate into critical advertising processing and a reduced advertising effectiveness (brand attitudes & purchase intentions) (e.g. An & Stern, 2011; Buijzen, 2007; Dixon, Scully, Kelly, Chapman, & Wakefield, 2014; Livingstone & Helsper, 2006; Rozendaal et al., 2011; Rozendaal, Buijs & van Reijmersdal, 2016). Dixon et al. (2014), for instance, found that counter-advertisements that question on-pack promotions ("What if athletes ate the foods they advertised?") were able to prompt higher levels of elaboration in children (10-12 years old). Nevertheless, in their experiment, counter-advertisements did not affect children's preference for a promoted unhealthy snack versus a similar healthy snack.

Most experimental studies suggest that advertising disclosures are only effective when they are designed to activate *affective defenses* (ad skepticism and disliking; attitudinal advertising

literacy), but not *cognitive defenses* (ad recognition, understanding selling and persuasive intent; conceptual advertising literacy) (e.g. Buijzen, 2007; Rozendaal et al., 2016; van Reijmersdal, Boerman, Buijzen, & Rozendaal, 2017). This finding appears to be particularly true in the case of integrated forms of advertising such as advergames (e.g. Hudders, Cauberghe, Panic, & De Vos, 2016; Vanwesenbeeck, Walrave, & Ponnet, 2016).

The current literature suggests that cognitive defenses are typically activated through external cues that warn children that a message wants to persuade them to like and buy a product. Examples of such warnings are (audio)visual disclaimers stating that a specific media content contains advertising that aims to influence them (e.g. "We'll be back after the commercial break", Panic et al., 2013, p. 269; or "This commercial is made to sell product X"). Affective defenses, on the contrary, are usually activated by appealing to children's skepticism towards advertising and disliking of advertising. This is for instance manipulated using (audio)visual warning cues such as "Commercials are not always fair" (Rozendaal et al., 2016).

Rozendaal and colleagues (2016), for instance, have tested two types of advertising disclosures that appeared as an audiovisual warning message during the commercial break prior to exposure to a TV food advertisement. A first disclosure was used to prime a conceptual understanding of advertising's commercial intents: "Now it's time for the commercials, but pay attention: commercials want you to like and buy their products". A second disclosure was used to prime skeptical attitudes towards advertising by disclosing advertising's manipulative intent: "Now it's time for the commercials, but pay attention: commercials are not always fair, sometimes they tell things that are untrue." (p. 4). This study revealed that the priming of manipulative intent was effective in reducing children's (age 8-12 years, $N = 159$) product desire by activating their skepticism towards the TV commercial (attitudinal advertising literacy). The priming of children's understanding of commercial intent (conceptual advertising literacy), however, was only effective when an additional warning cue was presented.

These studies indicate that attitudinal coping strategies (a general critical attitude towards advertising) are more successful in decreasing advertising effectiveness among children compared to conceptual coping strategies. A possible explanation is that children tend to process advertising at a low level of elaboration which inhibits the use of conceptual advertising knowledge (Nairn & Fine, 2008). At such low levels of elaboration, only low-effort, affective coping mechanisms, such as attitudinal advertising literacy, can be applied (Rozendaal, Opree, & Buijzen, 2016). The affective dimension of advertising literacy is believed to automatically induce negative feelings towards the advertisement which subsequently transfer to the advertised brand (Hudders et al., 2017; MacKenzie & Lutz, 1989; Rozendaal et al., 2011). Despite the mitigating effect of attitudinal

advertising literacy on children's brand outcomes (brand attitudes and product desires), there currently is no theoretical nor empirical evidence that advertising disclosures may also reduce the impact of food marketing on children's actual food choices and eating behavior.

In conclusion, the current literature indicates that food marketing has a consistent significant yet moderate influence on children's food brand preferences, food choices and eating behavior. Although there is ample empirical evidence for the direct effects of food marketing on children, little is known about *how* exactly food marketing persuades children. Most systematic reviews and meta-analyses on child-targeted food marketing have focused on medium-specific effects (TV advertising, online marketing, packaging) rather than the effects of specific persuasive techniques (e.g. endorsement marketing, brand placement). More particularly, of the seven recent reviews and meta-analyses previously described, five looked at medium-specific effects (Boyland & Whalen, 2015; Boyland et al., 2016; Folkvord et al., 2016; Norman et al., 2016; Sadeghirad et al., 2016), and only two looked at the direct effects of a particular persuasive technique (Kraak & Story, 2015; Smits et al., 2014).

Overall, these meta-analyses have shown that acute exposure to food marketing has a small to moderate increasing effect on children's short-term calorie intake, and preference for the advertised foods and beverages. Moreover, subgroup analyses revealed no significant differences in children's food intake and preferences depending on the type of marketing medium. So far, however, there has been little research into the indirect mechanisms that explain food marketing effects on children and whether these mechanisms differ depending on the type of persuasive technique. Moreover, more research is needed on the potential moderating factors that might strengthen or mitigate these effects.

This is in sharp contrast with research in adults where various theoretical process models have been tested that predict whether and why a certain message will have an effect (e.g. Meyers-Levi & Malaviya, 1999; Petty & Cacioppo, 1986). This type of research typically compares the impact of peripheral and central advertising cues between adults who are high (high motivation) or low (low motivation) in elaboration (Petty, Cacioppo, Strathman, & Priester, 2005). These studies have demonstrated that highly motivated adults are more persuaded by argument strength, whereas low involved adults are more persuaded by simple cues such as celebrity endorsement (e.g. Petty, Cacioppo & Schumann, 1983; Petty & Cacioppo, 1986; Petty et al., 2005; Priester & Petty, 2003). Among children, however, such framework does not exist. Research into the impact of advertising on children has long been informed by a cognitive developmental perspective and adult persuasion theories (Harris et al., 2009). Based on these theoretical models, it was generally assumed that children are more easily persuaded by simple advertising cues (e.g., colors, jingles, cartoon

characters) than adults because they do not yet have the cognitive skills to critically process information.

As Livingstone and Helsper (2006) argue :

> *… it can be hypothesized that less media-literate viewers (generally younger children) are more interested in such superficial or peripheral features of advertising as celebrity sources, jingles, and colorful and entertaining images. On the other hand, it can also be hypothesized that more media-literate children (or older children and adults) are more attentive to the creativity or informative nature of the commercial or to the value of the product in their lives and are thereby more influenced by the quality of the arguments and claims of advertising, providing that they attend, that they are motivated to engage with the message, and that its arguments are convincing. (p. 572-573)*

Theoretical models that specifically predict how advertising affects children, such as the *Processing of Commercial Media Content Model (PCMC,* Buijzen et al., 2010) and the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord et al., 2016), have only recently been developed and their propositions have not been fully tested yet. So which persuasive mechanisms explain *how* food marketing tactics persuade children? Are some children more susceptible to these effects than others? A growing group of scientists agree that addressing the *persuasive processes* that underpin child-targeted food marketing effects is of crucial importance since these processes determine the type of intervention strategies that might be effective (i.e., Harris et al., 2009; Nairn & Fine, 2008; Smits et al., 2015; WHO, 2016). Building on this call for a new kind of research, the current dissertation will focus on *how* food marketing influences children's brand responses and food intake and whether this depends on the marketing tactic (traditional versus subtle), and individual susceptibility factors. In addition, this dissertation explores whether the potential of inhibitory control interventions to diminish the impact of food marketing on children's eating behavior depends on children's age and individual susceptibility factors.

The Impact of Child-Targeted Food Marketing: Theoretical Perspectives

The previous paragraphs gave an overview of the evidence demonstrating that food marketing has an extensive influence on children's food preferences and consumption. However, the mechanisms underpinning this influence are still poorly understood. Hence, the following part of the introduction will review existing theoretical models that seek to explain how food marketing

affects children. A first part will focus on how children process advertising and how this influences their brand responses. A second part will focus on how food cues can have a direct influence on children's eating behavior. The section below will critically evaluate the extent to which the *Processing of Commercial Media Content Model (PCMC*, Buijzen et al., 2010), the *Persuasion Knowledge Model (PKM*, Friestad & Wright, 1994), and the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord et al., 2016) can explain how food marketing influences children's brand responses and eating behavior.

How Does Food Marketing affect Children's Brand Responses?

In the literature, there are three main theoretical frameworks that seek to explain how children are persuaded by food marketing messages: dual-and-multiple process models of persuasion, advertising literacy theories, and food cue reactivity theories. Dual-process models propose at least two separate mental processes (explicit or implicit) that determine whether and how an advertisement has an effect on recipients brand-related attitudes and intentions. Advertising literacy models assume that understanding the purpose of commercial communication diminishes a person's responsiveness to advertising. Food cue reactivity models assert that visual food cues in advertising can have a direct impact on people's eating behavior.

A first theoretical framework provides insight into the influence of advertising on children by interpreting adult dual-process models from a cognitive-developmental perspective (Harris, Brownell, & Bargh, 2009). *Dual-process models*, such as the *Elaboration Likelihood Model (ELM)*, state that advertising can either have an influence through a thoughtful persuasion process based on information (i.e. message-arguments, the central or systematic route) or a more superficial process based on peripheral advertising cues or simple decision rules (the peripheral or heuristic route) (Chen & Chaiken, 1999; Meyers-Levi & Malaviya, 1999; Petty & Cacioppo, 1986). Peripheral cues are like the "packaging" effects of the message and include audiovisual and production features such as bright colors and spokes-characters that increase the liking for the message (Ambler, 2008; Gigerenzer, 2008; Petty & Cacioppo, 1996; Scholten, 1996). According to this model, central route processing requires significant cognitive capacities and processing motivation (i.e. involvement) whereas peripheral route processing occurs when either the capacities or processing motivation are low (Petty & Cacioppo, 1986; Petty et al., 2005). Numerous studies have shown that highly motivated adults are swayed by argument strength, whereas low involved adults are persuaded by simple advertising cues (e.g. Petty, Cacioppo & Schumann, 1983; Petty & Cacioppo, 1986; Petty et al., 2005; Priester & Petty, 2003).

With regard to children, the general trend has been to suggest that children (< age 12) are restricted to process advertising through the peripheral route since they have not yet developed a mature level of cognitive abilities to process advertising critically and systematically (Buijzen et al., 2010; Harris et al., 2009). Previous studies have indeed established that the cognitive capacities that are required to systematically process advertising messages, such as information-processing, social perspective taking, and executive functioning, only mature between age twelve and eighteen (e.g., John, 1981; 1999; Hudders et al., 2017; Moses & Baldwin, 2005; Selman, 1980). Children's immature cognitive abilities are assumed to make them more likely than adults to base their product attitudes on trivial advertising cues like colors and spokes-characters (Bargh, McAlister, & Cornwell, 2011; Brucks, Armstrong, & Goldberg, 1988; Livingstone & Helsper, 2006; Te'eni-Harari, Lampert, & Lehman-Wilzig, 2007). Several studies indeed suggest that children (age 7-11) develop brand attitudes based on simple cues such as spokes-characters (e.g. Derbaix & Bree, 1997; Mallinckrodt & Mizerski, 2007; Moore & Lutz, 2000; Pecheux, 1999; Smits et al., 2014; Te'eni-Harari et al., 2007; van Reijmersdal et al., 2012).

Although dual-process models have received extensive empirical support among adults (e.g. Petty et al., 1983; Petty & Cacioppo, 1986; Petty et al., 2005; Priester & Petty, 2003), they have been insufficiently tested among children. Preliminary research suggests that young children do not process advertising according to the predictions of adult dual-process models. For example, a study conducted by McAlister & Bargh (2016) showed that, in contrast to adults, argument strength does not appear to influence the product attitudes (on a novel breakfast cereal) of highly involved children (age 3-5), whereas the attractiveness of peripheral cues does have a decisive influence. Moreover, unlike adults, low-involved children appear to be positively inclined towards an advertised product without considering either argument strength or cue attractiveness.

Since adult persuasion models cannot be directly applied to contemporary forms of child-targeted marketing (Büttner, Florack, & Serfas, 2014), Buijzen, van Reijmersdal and Owen (2010) developed a theoretical model on youngster's processing of commercial media content that is adapted to the current marketing landscape. The *Processing of Commercial Media Content model* (*PCMC-model*, Buijzen et al., 2010), proposes three persuasive mechanisms by which advertising can affect children: 1) a thoughtful and elaborate persuasion process based on information (the systematic or central route), 2) a less elaborate process based on simple decisions or peripheral cues (the heuristic or peripheral route), *and* 3) a low-elaboration process based on automatic, affective associations (the automatic route).

Systematic processing requires high levels of attention to, and awareness of the message and the motivation to cognitively elaborate upon the advertising message (Petty & Cacioppo, 1996).

Recipients who process advertising systematically are aware of its persuasive intentions and will use this knowledge to critically elaborate upon the information presented in the advertisement (Buijzen et al., 2010). At this level, persuasion is the result of a learning process which manifests itself in cognitive responses such as argument evaluation and source-derogation (Heath, 2009).

Heuristic processing is characterized by moderate levels of attention to, and awareness of the persuasion attempt, and usually occurs when either the abilities or motivation to process the message are low (Buijzen et al., 2010; Petty & Cacioppo, 1996). Persuasion through the heuristic route implies that a general evaluation is quickly formed based on rules of thumb which are inferred from associations with peripheral cues (Petty & Cacioppo, 1996).

Automatic processing occurs at the lowest level of cognitive elaboration and is distinct from peripheral processing in that it occurs without awareness of the message, the intent of the message or its effect (Chartrand, 2005; Harris et al., 2009). When children do not pay explicit attention to the advertisement and are unaware of the persuasion attempt, they are very unlikely to reflect upon it and activate coping strategies based on advertising literacy (Buijzen et al., 2010; Nairn & Fine, 2008; Rozendaal et al., 2011). Persuasion through the automatic route is driven by *automatic affective responses* that are involuntary activated upon perceiving positive advertising stimuli or contexts (Ambler, 2008; Gawronski & Bodenhausen 2006). These affective responses are assumed to carry over to the brand by various *implicit associative mechanisms*, such as evaluative conditioning and affect-transfer (e.g. Bargh, 1992; Buijzen et al., 2010; Chartrand, 2005; De Houwer, Thomas, & Baeyens, 2001; Dijksterhuis, Smith, Van Baaren, & Wigboldus, 2005; Harris et al., 2009). The automatic persuasion process results in the formation of *implicit attitudes* which are expected to become stronger by repeated exposure, and that are highly predictive of spontaneous consumer behavior (e.g., Fazio, 2001; Friese, Wänke, & Plessner, 2006).

According to the PCMC-model, the underpinning persuasion process not only depends upon children's level of cognitive development, but also upon the specific characteristics of the advertising message and its media context (Buijzen et al., 2010). Children are hypothesized to be more likely than adults to process advertising via low elaboration mechanisms (i.e. peripheral or automatic processing) due to their less developed cognitive abilities and consumer experience (Buijzen et al., 2010). This is expected to be particularly the case for newer, non-traditional forms of advertising (e.g. advergames & movie brand placements) whose interactive and engaging features might further facilitate low-level processing (Buijzen et al., 2010; Harris et al., 2009; Heath & Nairn, 2005; Livingstone & Helsper, 2006; Nairn & Fine, 2008). The interactive and engaging media content (i.e. movie, game) in which advertising messages are increasingly hidden is believed to distract children from the commercial source and intention of these messages thereby depleting

their cognitive resources to resist persuasion (Buijzen et al., 2010; Lang, 2000). Hence, it is expected that children will automatically process embedded advertising messages or food cues. This means that the entertaining media content in which the commercial message is embedded will evoke positive automatic affective responses, which will subconsciously transfer to the product or brand (Buijzen et al., 2010).

To recapitulate, the impact of food advertising on children's brand responses and eating behavior is expected to be stronger for non-traditional compared to traditional forms of advertising. However, few studies have addressed the underlying persuasive mechanisms that explain food marketing effects on children and only a limited amount of studies have examined whether these mechanisms differ between traditional and non-traditional forms of food marketing. Since there has been little research comparing the influence of different types of marketing tactics, several questions have remained unanswered. Do the underlying persuasive mechanisms indeed differ depending on the type of marketing? Are non-traditional, highly integrated forms of marketing actually processed at lower levels of elaboration compared to traditional forms of marketing? Or are affect-based mechanisms the primary persuasion process for both traditional and non-traditional types of advertising? Does the role of advertising literacy differ depending on whether children are exposed to a traditional or a more subtle advertising format? This dissertation therefore aims to identify the underpinning mechanisms that explain food marketing effects on children's attitudes and behavioral intentions, and compare them between traditional and non-traditional types of marketing.

The Role of Advertising Literacy in Children's Susceptibility to Advertising

A second theoretical framework explains the effects of food marketing on children from the concept of *advertising literacy*. Advertising literacy is a multidimensional construct consisting of the abilities to: a) recognize and understand the tactics and intentions of advertising (*cognitive or conceptual advertising literacy*), b) develop skeptical attitudes towards advertising (*affective or attitudinal advertising literacy*), c) reflect on the moral appropriateness of advertising (*moral advertising literacy*), and d) employ appropriate coping strategies (*advertising literacy performance*) (Ham, Nelson, & Das 2015; Hudders et al., 2017; Rozendaal et al., 2016). According to the *Persuasion Knowledge Model (PKM*; Friestad & Wright, 1994), knowledge of advertisers' persuasive motives and tricks armors children against marketing appeals by enabling them to recognize persuasive attempts and activate critical coping mechanisms such as counter-argumentation (e.g. Friestad & Wright, 1994; John, 1999; Rozendaal, Buijzen, & Valkenburg, 2009; Wright, Friestad, & Boush, 2005).

Children's advertising literacy gradually develops as they mature and is expected to reach a mature-like efficiency between age twelve and sixteen (e.g. Boush, Friestad, & Rose 1994; Gunter, Oates, & Blades, 2005; John, 1999; Kunkel, Wilcox, Cantor, Palmer, Linn, & Dowrick, 2004; Mcalister & Cornwell, 2009; Rozendaal et al., 2011). Overall, most children are able to identify advertising from age five, understand advertising's commercial purpose from age eight, and its persuasive intentions from age ten (Rozendaal et al., 2011). However, up until late childhood (10-12 years) children are *cued processors* who need an external cue (e.g. forewarning cue or advertising disclosure) to be able to put their advertising literacy into practice (Buijzen & Valkenburg, 2013; Brucks et al., 1988; John, 1999; Moses & Baldwin, 2005).

Recently, several academics have argued that advertising literacy interventions, such as advertising literacy education and the use of advertising disclosures to trigger advertising literacy, will be insufficient to counter the automatic effects of contemporary food marketing tactics on children (Ambler, 2008; Büttner et al., 2014; Folkvord et al., 2016; Harris et al., 2009; Hofmann, Friese, & Wiers, 2008; WHO, 2016). Since contemporary food marketing effects occur subconsciously rather than by deliberate association between the marketing cue and the food or its consumption, (young) consumers are unlikely to pause and reflect about how these cues are designed to affect them (Nairn & Fine, 2008). Hence, the cognitive dimension of advertising literacy either does not get activated as a defense mechanism, or gets overruled by the affective responses that are evoked by marketing cues (Ambler, 2008; Harris, Brownell, et al., 2009).

The ability to overthrow the *automatic affect transfer* between advertising cues and the brand is very difficult and requires the skills to redirect attention from the entertaining features of advertising to the actual commercial message (e.g., Ambler, 2008; Hudders et al., 2017; Nairn & Fine, 2008). Children have not yet acquired these skills, or are unable to spontaneously use them. Therefore, researchers have developed advertising disclosures that warn children about the commercial nature and persuasive intentions of advertising (e.g. "This is advertising", "This ad aims to sell"), and have tested whether such disclosures may stimulate children to use their advertising literacy as a defense mechanism during advertising exposure. However, these disclosures only appear to reduce the influence of food marketing exposure on children's brand responses when external cues prompt children to activate and use their affective instead of cognitive advertising literacy (i.e. advertising skepticism or a general critical attitude towards advertising) (e.g. Rozendaal et al., 2011; 2012; Hudders et al., 2015; Hudders et al., 2016; Rozendaal et al., 2016; van Reijmersdal et al., 2017; Vanwesenbeeck et al., 2016). One explanation for this finding might be that the activation of affective advertising literacy (skepticism or disliking) can occur automatically without any cognitive effort (Rozendaal et al., 2012; Hudders et al., 2017).

Nevertheless, there currently are no theoretical nor empirical indications that affective advertising literacy might also inhibit behavioral food marketing effects. In their *Food Marketing Defense Model (FMDM),* Harris and colleagues (2009) state that the ability to overthrow behavioral food marketing effects, such as food cravings, not only requires awareness and understanding of the persuasion attempt, yet also the abilities and motivation to resist these advertising-induced cravings. Therefore, the current dissertation will also look at children's abilities to self-regulate their impulsive responses towards palatable foods.

How Does Food Marketing Affect Children's Actual Eating Behavior?

A third theoretical framework provides insight into how visual food cues that are embedded into advertising can directly affect children's actual food choices and eating behavior. Human eating behavior is not always the result of internal hunger cues or an actual energy-deficiency, but can also be implicitly evoked by external food-related cues (Bruce et al., 2015; Spence, Okajima, Cheok, Petit, Michel, 2016). Dual-process models of behavior predict that food choices and intake are guided by two different systems: a reflexive and an impulsive system (Strack & Deutsch, 2004). In some situations, eating behavior is driven by the reflexive system which is based on executive functioning and inhibitory control. In this case, food choices and intake are influenced by factors such as health and nutritional knowledge, personal values and dieting goals. In other situations, eating behavior is driven by the impulsive system which is based on automatic and affect-based motivations and associations (Bruce et al., 2015; Strack & Deutsch, 2004). In this case, rewarding environmental cues, such as the mere sight of palatable foods, may activate a motivation to seek and indulge in rewarding foods (Appelhans, 2009; Strack & Deutsch, 2004). This implies that not only internal physiological cues, but also food-related environmental stimuli, such as images of tasty foods in advertising, can automatically affect peoples' eating behavior through an impulsive system.

According to the *Food Cue Reactivity Theory* (Jansen, 1998), exposure to food-related stimuli, such as the sight or scent of food, can indeed prime a hedonic desire for food which stimulates appetite and food intake, even in the absence of an energy-deficit (cf. Folkvord et al., 2016; McCrickerd & Forde, 2016; Spence et al., 2016). Various studies have demonstrated that visual food cues attract attention and prompt thoughts about food (Nijs, Muris, & Franken, 2010), trigger physiological responses such as increased heart rate, salivation, raised blood pressure, skin conductance and gastric activity (cf. Alonso-Alonso et al., 2015; Castellanos et al., 2009; Nederkoorn, Smulders, & Jansen, 2000), and increase food cravings and intake (cf. Boswell & Kober, 2016; Fedoroff, Polivy, & Herman, 1997; Ferriday & Brunstrom, 2011; Wadhera &

Capaldi-Phillips, 2014). A recent meta-analysis has also confirmed that food cue reactivity explains a medium to large part of the variance in eating behavior and weight gain (Boswell & Kober, 2016).

Of course, visual images of palatable foods and beverages are a crucial and prominent part of food marketing communication. According to the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord et al., 2016), appetitive food cues in advertising can induce eating-related motivations and cravings. This reactivity to embedded food cues can automatically affect eating behavior on the basis of three processes. These are: an advertising effect process, a classical conditioning process, and an incentive-sensitization process. The *advertising effect process* explains how images of palatable foods in advertisements trigger physiological (i.e. salivation, gastric activity) and psychological responses (i.e. thoughts and cravings) which stimulate eating behavior (Folkvord et al., 2016). Furthermore, repeated pairings of advertisements, as conditioned stimuli, with rewarding food cues, as unconditioned stimuli, will cause these advertisements to evoke the same responses as food cues, through a *classical conditioning process*. This implies that these advertisements, over time, become able to trigger appetite and eating behavior (Folkvord et al., 2016; Herman & Polivy, 2008). Finally, the association between food cues and food intake will become stronger every time a person snacks in response to embedded food cues, thereby reinforcing cue reactivity. This process is called *incentive-sensitization.*

In addition, the REFCAM proposes that food cue reactivity, or the extent to which food cue exposure induces eating behavior, differs depending on message factors (i.e. level of integration) and individual factors (i.e. weight, impulsiveness). Drawing upon the PCMC-model, message factors are expected to moderate embedded food cue responsiveness by influencing children's level of cognitive elaboration upon these cues (Buijzen et al., 2010; Folkvord et al., 2016). More specifically, food cue reactivity is expected to be stronger for integrated compared to traditional forms of food marketing since children are more likely to process highly embedded food cues automatically without much cognitive elaboration (Folkvord et al., 2016).

Based on the *Differential Susceptibility to Media Effects Model* (Valkenburg & Peter, 2013), individual factors are expected to moderate the impact of food cue exposure on eating behavior because not everyone has equal abilities to resist tempting food cues. Many studies in the field of eating behavior have already shown that individual susceptibility factors such as BMI or weight status, and impulsiveness moderate the strength and direction of food cue effects (e.g. Guerrieri, Nederkoorn, & Jansen, 2007; Houben & Jansen, 2015; Jansen et al., 2003). Jansen and colleagues (2003), for instance, found that overweight children are more likely to overeat in response to food cues compared to lean children. However, the potential moderating influence of such individual susceptibility variables has only recently been receiving research attention within the domain of

child-targeted food marketing. A few studies showed that the influence of TV food advertising exposure on food intake is greater among obese compared to normal-weight children (Halford et al., 2004; Halford et al., 2008). In addition, two recent experiments revealed that highly impulsive children (age 7 to 10), and children with a greater attentional bias for food-related cues (age 8 to 10), are more susceptible to the effects of a food promoting advergame on snack intake (Folkvord et al., 2014; Folkvord, Anschütz, Nederkoorn et al., 2014). However, due to the limited amount of studies, the potential moderating role of individual susceptibility factors is still poorly understood and requires further research attention.

The prevailing assumption is that someone's degree of impulsivity has a great influence on their abilities to resist the influence of tempting food marketing cues (Büttner et al., 2014; Folkvord et al., 2016). But are highly impulsive children more sensitive to food marketing compared to low impulsive children? And if so, can interventions that enhance impulse-control empower children to resist food marketing effects? The following chapter will first describe the link between impulsiveness and food cue reactivity in greater detail. Then, a short overview will be provided of the literature on impulse-control interventions and how these can be an interesting new research path for the literature on child-targeted food marketing.

Does Impulsivity Moderate the Impact of Food Marketing Exposure on Children's Eating Behavior?

Eating behavior is the result of a synergy between an impulsive system that pursues hedonistic desires and a reflective system that pursues informed decisions (Strack & Deutsch, 2004). Palatable food cues in advertising typically evoke hedonistic cravings that are difficult to resist, especially among people who lack self-control to inhibit these impulses (Stice, Lawrence, Kemps, & Veling, 2016). Hence, impulsivity is an important concept to understand the impact of food marketing on eating behavior.

Impulsivity, is a multidimensional personality construct which consists of insufficient inhibitory control and increased reward sensitivity (e.g. Bickel, Jarmolowicz, Mueller, Gatchalian, & McClure, 2012; Franken, Muris, & Rassin, 2005; Nigg, 2000). *Inhibitory control* or response inhibition involves the ability to suppress unwanted actions (Nigg, 2000), or *"stop, change or delay a behavioral response"* (Logan, Cowan, & Davis, 1984; cf. Jones et al., 2016, p . 17). *Reward sensitivity* refers to the extent to which a person is pursuing rewards in response to environmental cues (Nigg, 2000).

According to Gray's (1970) psychobiological model of personality, individual levels of inhibitory control and reward sensitivity are determined by two neurological brain systems: the

Behavioral approach or activation system (BAS) and the Behavioral inhibition system (BIS). The BAS responds to rewarding stimuli such as appetitive foods by activating approach behaviors in order to seek and obtain a specific reward (Corr, 2008; Franken et al., 2005; Gray, 1987). The BIS, by contrast, reacts to aversive stimuli related to punishment and non-reward and serves to inhibit or avoid behaviors that are associated with negative consequences (Carver & White, 1994). Therefore, higher levels of reward sensitivity are indicative of a more sensitive BAS, whereas higher levels of inhibitory control indicate a stronger BIS (Gray, 1982, 1987; Pickering & Smillie, 2008).

A number of studies have shown that higher levels of reward sensitivity and lower levels of inhibitory control are related to overeating and being overweight or obese (e.g., Guerrieri, Nederkoorn, & Jansen, 2007; 2008; Jasinska et al., 2012; Nederkoorn, Guerrieri, Havermans, Roefs, & Jansen, 2009; Nederkoorn, Jansen, Mulkens, & Jansen, 2007). Both overweight adults and children have been found to be more responsive to palatable food cues and less able to regulate their eating behavior compared to normal weight people (e.g. Nederkoorn, Braet, Van Eijs, Tanghe, & Jansen, 2006; Nederkoorn, Coelho, Guerrieri, Houben, & Jansen, 2012; Nijs & Franken, 2012; Thamotharan, Lange, Zale, Huffhines, & Fields, 2013). Moreover, several experiments have shown that impulsive reactions towards food stimuli have a stronger influence on actual eating behavior when inhibitory control is low (Hofmann, Friese, & Roefs, 2009; Hofmann, Rauch, & Gawronski, 2007; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010). Likewise, food cue reactivity has been found to be greater when reward sensitivity is high. Tetley, Brunstrom, and Griffiths (2010), for example, found that highly impulsive women experienced a greater increase in appetite after exposure to a pizza cue compared to low impulsive women, regardless of being food deprived or not.

Although the literature on eating behavior clearly shows that food cue responsiveness is moderated by reward sensitivity and inhibitory control, these moderating effects have barely been explored in the field of child-targeted food marketing. Thus far, only two studies looked at the role of individual susceptibility factors related to impulsiveness. In a randomized between-subjects experiment, Folkvord, Anschütz, Nederkoorn, Westerik, and Buijzen (2014), examined whether stimulating children's inhibitory control would diminish the impact of playing a food advergame on caloric intake. Inhibitory control was manipulated by promising half of the children a reward to refrain from eating. This experiment showed that the inhibition task significantly decreased the impact of playing a food advergame on caloric intake, but only among low impulsive children. Interestingly, among impulsive children, exposure to the snack food advergame overrode their ability to control themselves, even when a reward was on offer for doing so.

A second experiment conducted by Folkvord, Anschütz, Wiers, & Buijzen (2015), revealed that the impact of playing a food advergame on snack intake was stronger among children who had a higher attentional bias for the food cues in the advergame. This demonstrates that increased attention for embedded food cues in advertising results in an increased appetite and higher snack intake. The findings of these studies provide support for the supposition of the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord et al., 2016) and the *Differential Susceptibility to Media Effects Model* (Valkenburg & Peter, 2013) that children's responsiveness to embedded food cues in advertising is indeed moderated by individual susceptibility factors such as attentional bias for food cues, reward sensitivity and inhibitory control.

However, these studies were limited to only one type of marketing (food-promoting advergame) and focused on children from a narrow age interval (age 7-10). During early adolescence impulsiveness typically increases (Romer, 2010; Steinberg, 2010; Shulman et al., 2016), hence the potential moderating effect of reward sensitivity and inhibitory control might play a larger role among teenagers. Moreover, these studies did not measure children's trait inhibitory control and reward sensitivity (for instance by using the BIS and BAS scales). Hence, more insight is needed on how inhibitory control and reward sensitivity moderate the influence of food marketing exposure on children's food intake. The current dissertation therefore aims to contribute to the literature by exploring the potential moderating roles of inhibitory control and reward sensitivity in child-targeted food marketing effects.

The evidence presented in this section suggests that inhibitory control is key to the ability to resist tempting food marketing effects. Therefore, researchers have recently designed new intervention strategies that aim to strengthen people's abilities to inhibit their impulsive approach reactions towards food (Kemps, Tiggemann, Orr, & Grear, 2014; Sheeran, Gollwitzer, & Bargh, 2013). Examples of these interventions are Go/No-Go and Stop-Signal training tasks that pair visual food images with No-Go or Stop cues (Houben & Jansen, 2011). Such inhibitory control training procedures have already been shown to effectively reduce food intake and overeating in adults (cf. Haynes et al., 2015; Houben & Jansen, 2015; Jones et al., 2016; Lawrence, Verbruggen, Morrison, Adams, & Chambers, 2015). Hence, we can wonder whether inhibitory control training might also help children cope with advertising induced food cravings. The following section will describe these inhibitory control interventions and their importance to the field of child-targeted food marketing in more detail.

Can Inhibitory-Control Training Reduce the Impact of Food Marketing on Children's Eating Behavior?

It has previously been observed that mere perception of palatable foods can evoke automatic approach responses towards these foods that are difficult to counter (e.g., Seibt, Häfner, & Deutsch, 2007; Harvey, Kemps, & Tiggeman, 2005; Papies, Stroebe, & Aarts, 2008; Strack & Deutsch, 2004; Veenstra & de Jong, 2010). In theory, strengthening people's inhibitory-control will better enable them to resist impulsive approach tendencies towards tempting food stimuli. Therefore, researchers have developed and tested *inhibitory-control interventions* that immediately target these impulsive approach behaviors towards energy-dense foods (Hofmann et al., 2008).

One recent method to strengthen inhibitory-control is to learn to associate Stop Signals or No-Go cues with appetitive cues (e.g., Houben & Jansen, 2011; van Koningsbruggen, Veling, Stroebe, & Aarts, 2014; Veling & Aarts, 2009; Veling, Holland, & Van Knippenberg, 2008). These Stop-Signal (Logan et al., 1984) and Go/No-Go training procedures are typically computerized tasks in which Stop or No-Go cues are associated with pictures of tasty foods or non-food items (Jones et al., 2016). The Go/No-Go task instructs participants to inhibit a habitual behavioral response whenever a No-Go cue is offered, and these No-Go cues are consistently paired with the experimental stimuli, e.g. appetitive food cues. In other words, participants are exposed to food and non-food related images and are instructed to either respond (press a key) or withhold their response (Verbruggen & Logan, 2008). In the experimental group, the task to inhibit their response is always paired with unhealthy food cues such that over time inhibiting reactivity to unhealthy foods is a 'trained' response.

The Stop Signal task, by contrast, offers a Go signal before a Stop signal, and instructs participants to cancel their initial action response (Go response) upon perceiving a Stop signal. Moreover, the Stop Signal is not consistently paired with the experimental cue (Verbruggen & Logan, 2008). For example, participants are instructed to respond to food and non-food images by pressing a key. During the Stop trials a Stop signal (symbol or sound) appears immediately after the image which signifies that they must stop or cancel their motor response.

Meta-analyses have shown that consistently pairing food cues with either Stop or No-Go signals significantly decreases adults' intake of energy-dense foods, and that Go/No-Go tasks have a stronger inhibitory effect than Stop-Signal tasks (Allom et al., 2015; Jones et al., 2016; Stice et al., 2016). Houben and Jansen (2015), for instance, found that associating chocolate with a No-Go cue resulted in automatic inhibition associations with chocolate, a reduced desire to eat and a significantly lower chocolate intake among female students. Similarly, Veling, Aarts, and Stroebe (2013) conducted two experiments in which Stop Signals were either consistently presented

immediately after exposure to snack food images or not. They found that participants in the Stop-Signal conditions were significantly less likely to choose unhealthy foods compared to those in the control conditions.

However, very little is known about the potential of inhibitory control interventions to reduce the impact of food marketing on children's food intake. Thus far, only one study has addressed this topic. Folkvord, Veling, and Hoeken (2016) recently examined whether a Go/No-Go training task would diminish the impact of playing a food advergame on children's food intake. In this experiment, children (N = 133, age 7 to 10) were randomly assigned to either play a snack food advergame or a nonfood advergame, after which a Go/No-Go food or control task was performed. The Go/No-Go task consisted of 132 trials, of which 66 were go trials. Children in the food condition were presented with three sets of 22 images of cute animals on go trials, and three sets of 22 images of jelly candy on no-go trials. Children in the control condition were presented with three sets of 22 images of cute animals on go trials, and three sets of 22 images of colored circles on no-go trials. Each image was shown for 1000 ms (or until children responded). A colored border appeared around the image 100 ms after image onset and remained visible during the trial. Children were instructed to respond to images as fast as possible by pressing the space bar when a blue border appeared around the image (go trial), and to refrain from responding when a gray border appeared around the image (no-go trail). The findings showed that children's caloric intake was significantly lower in the food condition compared to the control condition.

However, since Folkvord et al. (2016) focused on the influence of food advergames on children between 7 and 10 years old, it is still unclear whether Go/No-go training may also be effective among older children and teenagers, and other types of advertising. On the one hand, children's inhibitory control system becomes more strongly developed as they grow older (Sowell, Thompson, Holmes, Jernigan, & Toga, 1999; Casey, Jones, & Hare, 2008; Vara, Pang, Vidal, Anagnostou, & Taylor, 2014). On the other hand, it is well-documented that impulsivity and risk-taking peak during adolescence (Romer, 2010; Steinberg, 2007; Dir, Coskunpinar, Cyder, 2014). Furthermore, it is unclear whether the effectiveness of inhibitory control training differs depending on individual factors such as impulsiveness. Therefore, a final objective of this dissertation is to examine whether a Go/No-go training might also be effective among a broader age category of children ranging between 9 and 14 years old, and in the context of TV food advertising, and to explore whether this effectiveness depends upon individual factors such as impulsiveness. Due to the pervasiveness of food marketing and the rising rates of childhood obesity, it is crucial to further explore this new line of research.

Dissertation Outline

In sum, this introduction first highlighted the societal impact of child-targeted food marketing and then identified the research plan for this dissertation. Despite extensive empirical evidence for the *direct effects* of food marketing on children, it is still unclear: a) how exactly food marketing persuades children, b) whether the underpinning persuasive mechanisms differ between traditional and subtle marketing tactics, c) who is more vulnerable to food marketing effects, and d) whether the promising effectiveness of inhibitory control interventions can be generalized to other age-groups and types of marketing. Therefore, it is crucial to gain more insight into the mechanisms that explain food marketing effects on children, and into the potential moderating roles of individual susceptibility factors such as age, inhibitory control and reward sensitivity. The current dissertation aims to contribute to the literature in a multitude of ways.

Part 1: How does food marketing affect children's brand responses? Do the underpinning mechanisms differ between traditional and subtle marketing tactics? (RQ1)

The first part of this dissertation focuses on *how* food marketing influences children's brand responses (brand attitudes and purchase request intentions). The first Chapter of this dissertation draws upon the PCMC-model (Buijzen, van Reijmersdal, & Owen, 2010) to examine and compare the persuasion mechanisms that may underpin both traditional and subtle food marketing tactics. More specifically, Chapter 1 examines the mediating roles of cognitive advertising literacy and affective responses towards advertising in the influence of the advertising format (TV advertisement vs advergame) on children's brand outcomes (brand attitude and purchase request intentions). Using a large data-set (N = 940), with children ranging between 6 and 14 years old, a first study has compared the influence of passive exposure to TV food advertising to active exposure to a food promoting advergame. In addition, the potential moderating effect of age was explored.

Chapter 2 describes which online food marketing tactics are currently used to target children on Belgian and Dutch food brand websites, and discusses the nutrient profile of these marketed foods and beverages. In addition, this chapter discusses the regulatory framework on child-targeted food marketing practices and addresses the extent to which Belgian and Dutch food brands abide to the guidelines of the EU Pledge. This first part of this dissertation shows that the mere presence of a marketing stimulus can have an influence through affect-based mechanisms. Furthermore, it shows that marketing stimuli on child-targeted branded food websites are pervasive and diverse.

Part 2: How does food marketing affect children's eating behavior? (RQ2)

The second part of this dissertation focuses on how food cues in advertising can have a direct impact on children's eating behavior. In line with the REFCAM (Folkvord et al., 2016), prior research has shown that visual food cues in advertising can directly induce food cravings and increase food intake. The general approach to examine the impact of food cues in advertising on eating behavior has been to randomly expose children to either a food advertisement, a non-food advertisement or no advertising, and then compare how much food children consumed during or immediately after exposure. However, using this approach it remains unclear why food advertising has an effect. Are the effects explained by the specific advertising tactics that are used (i.e., endorsement), or by merely seeing the palatable food cues that are typically embedded into advertising? Moreover, in the current media landscape, children are also frequently exposed to food cues and portion-size suggestions outside of a marketing context, for example through popular media such as TV cooking shows.

Chapter 3 therefore looks into the effects of exposure to a visual food cue in a non-advertising context (TV cooking program) on children's food intake, as well as the effects of observing a descriptive portion-size norm on the amount of a specific food ingredient that children select and use. Building upon the REFCAM (Folkvord et al., 2016) and descriptive norm theory (Cialdini, Reno, & Kallgren, 1990), the primary aim of this study was to examine whether observing foods being prepared in a popular TV cooking show will affect how much food children choose and consume. The second aim was to verify whether exposure to portion-size cues in a TV cooking program affects the amount of a specific food ingredient that children select. This second part shows that food cues are omnipresent and have the ability to influence children even outside of a marketing context.

Part 3: How effective are inhibitory-control interventions at diminishing the impact of food marketing on children's eating behavior? Who is more vulnerable to food marketing effects? (RQ3)

The third part of this dissertation centers on the effectiveness of inhibitory-control intervention tasks to reduce the influence of food marketing exposure on children's food intake. Additionally, it explores whether individual susceptibility factors such as reward sensitivity and inhibitory control moderate the influence of food marketing exposure on children's eating behavior, and whether these factors might moderate the effectiveness of inhibitory control procedures. More specifically, Chapter 4 examines whether a Go/No-Go training procedure, developed to strengthen

children's inhibitory control, may diminish the influence of food advertising exposure on children's actual food intake. In addition, it explores whether individual characteristics, such as reward sensitivity (behavioral approach system (BAS)) and inhibitory control (behavioral inhibition system (BIS)), function as moderators of the effects of food advertising on children's food intake. Furthermore, chapter 4 explores the moderating roles of age, rewards sensitivity and inhibitory control in the effectiveness of a Go/No-Go training task. Chapter 4 contributes to the literature by examining whether Go/No-go training tasks are also effective among a broader age category of children ranging between 9 and 14 years old, and another marketing tactic (TV advertising) than has been studied so far. Another contribution of Chapter 4 is that is explores the potential moderating roles of inhibitory control and reward sensitivity in the influence of food marketing on children's actual eating behavior.

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PART 1

Chapter 1. Transferring Game Attitudes to the Brand: Persuasion from Age 6 to 14[1]

Abstract

This paper aims to replicate previous findings regarding the differential impact of TV advertising and advergames on children's brand attitudes and pester intentions. Using a large data-set ($N = 940$, $M_{age} = 9.8$, $SD = 2.4$), with children ranging between 6 and 14 years old, the influence of passive exposure to TV advertising is compared to active exposure to an advergame. In addition, the potential moderating effect of age is explored. In a between-participants experiment, Flemish children were randomly assigned to watch a TV ad, play an advergame, or a no marketing control condition. Results revealed that children who had played the advergame reported significantly more positive brand attitudes compared to children who had watched the TV ad and children in the no advertising exposure control group. Children's pester intent was significantly higher for the advergame compared to the TV ad, but not compared to the no advertising exposure control group. The findings further showed that children's attitudes towards the ad format mediate the impact of the advertising format on pester intent. The advergame was indirectly more persuasive than the TV ad since children reported more positive attitudes towards the advergame compared to the TV advertisement. Moreover, this mediation effect did not differ by children's age. Persuasion knowledge did not mediate the influence of the advertising format on pester intent since children's persuasion knowledge was not significantly related to pester intentions regardless of children's age.

Introduction

Food marketers have recently developed more subtle and interactive advertising tactics to target children, such as advergames. Advergames are online games in which advertising messages, brand logos, brand mascots, and product images are incorporated into the game-play (Mallinckrodt & Mizerski, 2007; Rifon et al., 2014). These games are designed to promote a single brand, and can be played on a company's branded website or third-party websites (Lee et al., 2009). The main purpose of advergames is to enhance children's attitudes towards the brand(s) featured in the game (Waiguny, Nelson, & Terlutter, 2014). In recent years, an increasing proportion of the marketing

[1] Based on Neyens, E., Smits, T., & Boyland, E.(2017). Transferring game attitudes to the brand: persuasion from age 6 to 14, *International Journal of Advertising, 36*(5), 724-742.

budget has been spent on subtle, online forms of advertising (WHO, 2013). Content analyses have shown that advergames are present at an estimated 85% of child-targeted websites (Henry & Story, 2009).

Advergames differ from traditional TV advertising in a number of ways. First, contrary to TV advertising, advergames integrate advertising messages within the entertaining media format of an online game. This tactic purposely fades the distinction between advertising and entertainment which impedes children's abilities to unravel these games commercial intentions (Panic, Cauberghe, & De Pelsmacker, 2013). Second, advergames are more interactive and immersive than TV advertising (Panic, Cauberghe, & De Pelsmacker, 2013). In contrast to passive exposure to TV advertising, advergames are designed to be highly entertaining by incorporating game components such as competition, thereby engaging consumers with the brand in the game (Hudders, Cauberghe, & Panic, 2015). For instance, children may be required to collect branded items as part of the game-play in order to achieve a high score (Panic, Cauberghe, & De Pelsmacker, 2013; Van Reijmersdal, Rozendaal, & Buijzen, 2012). Moreover, since advergames mainly aim to influence children by generating positive affect towards the game, it has been argued that children process advergames at a less elaborate, more automatic level than TV ads (Nairn & Fine, 2008; Buijzen, Van Reijmersdal, & Owen, 2010).

Prior studies comparing the effects of TV advertising and advergames on children have primarily focused on attitudinal responses such as brand attitudes and behavioural intentions such as purchase and pester intentions (cf. Hudders, Cauberghe, & Panic, 2015; Owen et al., 2013; Panic, Cauberghe, & De Pelsmacker, 2013; Rifon et al., 2014; Waiguny & Terlutter, 2011). These previous studies have shown that advergames have a stronger influence on children's brand attitudes and pester intentions compared to TV advertising (cf. Hudders et al., 2015; Owen et al., 2013; Panic et al., 2013; Rifon et al., 2014; Waiguny & Terlutter, 2011). However, it remains unclear how to explain this advertising format effect. The literature provides two explanations for the persuasive advantage of an advergame over a TV ad. First, due to the embedded nature of advergames, children have more trouble understanding that an advergame is a form of advertising, and are less aware of the selling and persuasive motivations of such games compared to TV advertising (Hudders et al., 2015; Owen et al., 2013). As a consequence, children do not possess enough persuasion knowledge about advergames in order to critically process its embedded commercial messages and cognitively defend against its influence. Prior research has indeed shown that children are less likely to activate and use their persuasion knowledge as a filter to process advertising while playing an advergame compared to watching a TV advertisement (Panic et al., 2013). Second, prior studies suggest that playing an advergame evokes more positive affective

responses in children than watching a TV advertisement (Waiguny & Terlutter, 2011). Playing an advergame affects children's brand attitudes and pester intentions by evoking positive attitudes towards the game which subsequently get associated with the advertised brand or product through an affect transference process (Rifon et al., 2014).

However, prior studies have mainly focused on children of specific age groups, often between 7 and 10 years old, and paid little attention to the potential moderating effect of age. Children's age is expected to moderate advertising effects, since age-related differences in cognitive skills, persuasion knowledge, advertising literacy, and consumer experience are likely to influence how children react to advertising messages (Buijzen, Van Reijmersdal, & Owen, 2010; Van Reijmersdal et al., 2010). According to the *Processing of Commercial Media Content Model* (PCMC, Buijzen et al., 2010) advertising effects are influenced by children's age-related developmental stage. Although previous studies found no moderating effect of age, these studies only covered rather narrow age intervals and only compared age differences among children from the same developmental stage. Hence, it is possible that age differences do exist when comparing advertising effects on children from different developmental stages, thus using a broad age interval that incorporates children from successive developmental stages. Moreover, recent developments in experimental research methodology suggest that the results of individual studies with relatively small sample sizes, should be confirmed by replicating these effects using a large data-set (Sakaluk, 2016). Therefore, the present study contributes to the literature by replicating these findings using a large data-set of children ranging between 6 and 14 years old, including the analysis of the moderating role of age in these processes.

Limited capacity model of mediated processing

The limited capacity model of mediated processing (LCMP, Lang, 2000) states that consumers' cognitive resources to process advertising information are limited. This has implications for the comparison of the effects of advergames and TV advertisements. Watching a TV advertisement is considered to be a passive type of brand exposure, whereas playing an advergame involves active exposure to the brand. Since brand identifiers are often key game-components, children actually engage with the brand in the game (Rifon et al., 2014). Moreover, actively playing an advergame requires more cognitive resources than merely passively watching a TV ad, because children have to divide their limited attention and processing capacities over two separate tasks. Playing the game can be considered the primary task, and processing the embedded advertising messages can be considered to be the secondary task (Lang, 2000; Buijzen et al., 2010).

Hence, playing an advergame may require most of children's processing capacities, resulting in sparse resources to both process the branded message and activate coping mechanisms such as persuasion knowledge or advertising literacy. Thus, when children get immersed into the game, this might distract them, and inhibit the activation of persuasion knowledge (Nairn & Fine, 2008). Children are therefore likely to process advergames in a less elaborate, more implicit manner compared to TV advertising (Nairn & Fine, 2008; Buijzen et al., 2010). This implicit effect of playing an advergame on brand outcomes might be even stronger among young children who are very unlikely to apply conscious coping mechanisms such as persuasion knowledge (Buijzen et al., 2010; Nairn & Fine, 2008).

TV advertising versus advergames

Prior research has shown that advergames are more persuasive than TV advertising (cf. Hudders et al., 2015; Owen et al., 2013; Waiguny & Terlutter, 2011). Waiguny and Terlutter (2011) showed that an advergame has a more positive impact on children's (age 8–10) brand attitudes compared to a TV ad. Likewise, Hudders, Cauberghe, and Panic (2015) found that playing an advergame resulted in higher purchase requests than watching a TV advertisement among children between 5 and 8 years old. Rifon et al. (2014) compared children's active brand exposure to passive brand exposure by comparing children (age 5–10) who played an advergame with those who merely watched the advergame being played. Results showed that playing versus watching the game did not affect brand attitude, although purchase requests were significantly higher among children who played the game compared to children who watched the game being played, even after controlling for game attitude. However, it is still unknown whether and how children's age moderates advertising format effects. In addition, watching a TV ad should result in more positive brand attitudes compared to no advertising exposure (e.g. Borzekowski & Robinson, 2001).

With regard to brand memory, a few studies reported that children's brand recall is lower for an advergame than a TV ad (Verhellen et al., 2014; Waiguny & Terlutter, 2011). However, this is likely to depend on the prominence of the brand placements in the advergame and the TV ad. One study showed that prominent brand placements in advergames result in a higher brand recall than less prominent brand placements (Van Reijmersdal, Rozendaal, & Buijzen, 2012). Based on these findings, it was expected that

Hypothesis 1: (a) Brand attitudes and pester intentions will be significantly higher after playing an advergame, compared to exposure to a TV ad or no marketing. (b) Brand attitudes and pester intentions will be significantly higher after exposure to a TV ad compared to no marketing.

Hypothesis 2: Brand recognition will be significantly higher after watching a TV ad compared to playing an advergame.

The role of persuasion knowledge

Persuasion knowledge plays an important role within the research on child-targeted marketing effects. The persuasion knowledge model (PKM) defines persuasion knowledge as: 'knowledge about the tactics and intentions of advertising' (Friestad & Wright, 1995; Panic et al., 2013, p. 265). This knowledge incorporates the abilities to recognize and understand the persuasive intentions of advertising and employ effective coping tactics (Ham, Nelson, & Das, 2015). According to the PKM (Friestad & Wright, 1994), consumers first need to recognize and understand the tactics and intentions of advertising in order to be able to cognitively defend themselves against it. Since persuasion knowledge cultivates with overall cognitive development and consumer experience, younger children are expected to be more susceptible to advertising compared to older children and adolescents (Brucks, Armstrong, & Goldberg, 1988; John, 1999; Moses & Baldwin, 2005; Panic et al., 2013).

Most studies have conceptualized and measured children's persuasion knowledge as the abilities to (1) recognize advertising, and (2) understand advertising's selling and persuasive intentions (Ham et al., 2015; Mallinckrodt & Mizerski, 2007; Panic et al., 2013). This corresponds to the concept of cognitive advertising literacy, another common and frequently used measuring scale within the literature on child-targeted advertising (Rozendaal, Opree, & Buijzen, 2016). Cognitive advertising literacy involves the skills to recognize commercial content, identify its commercial source, and understand its tactics and selling and persuasive intentions (Rozendaal et al., 2016). Some researchers also measure the attitudinal dimension of advertising literacy which addresses children's skepticism towards advertising or disliking of advertising (Hudders et al., 2015; Rozendaal et al., 2016).

It has been argued that the integration of advertising within an online game makes it more difficult for children to consciously notice the advergame's hidden commercial purpose (Moore & Rideout, 2007; An, Jin, & Park, 2014; Owen et al., 2013; Rifon et al., 2014). An, Jin, and Park (2014) found that about 75% of the children (age 7–11) in their study did not consider an

advergame as advertising. Another study showed that even adding an 'ad break' – a warning that the game features advertising – to an advergame did not enhance children's understanding of the game's selling intent (An & Stern, 2011). Comparative research has shown that children are less aware of the commercial function and persuasive intent of an advergame compared to a TV ad (cf. Hudders et al., 2015; Owen et al., 2013; Panic et al., 2013). Owen et al. (2013), for instance, confirmed that children (age 6 –10) have significantly less understanding of non-traditional (e.g. movie and in-game brand placement, advergames) compared to traditional advertising formats. In a study conducted by Panic, Cauberghe, and De Pelsmacker (2013), children's persuasion knowledge was significantly higher for a TV ad than an advergame. Hudders, Cauberghe, and Panic (2015) observed that both children's cognitive (understanding the commercial source and selling intent) and affective advertising literacy (disliking the ad) were lower for an advergame compared to a TV commercial. Children's lack of awareness of advertising's intents may inhibit the activation of cognitive defence from persuasion knowledge (cf. Hudders et al., 2015; Owen et al., 2013; Panic et al., 2013; Waiguny & Terlutter, 2011).

Furthermore, prior studies found that persuasion knowledge only appears to diminish the impact of TV advertising, but not advergames (Mallinckrodt & Mizerski, 2007; Van Reijmersdal et al., 2012; Panic et al., 2013). Panic, Cauberghe, and De Pelsmacker (2013) showed that persuasion knowledge only negatively influenced children's (7–10 years) purchase requests for a TV advertisement but not for an advergame. Waiguny and Terlutter (2011) also found that activated persuasion knowledge only resulted in more sceptical attitudes towards the brand after watching a TV ad but not after playing an advergame. Similarly, persuasion knowledge did not mediate the effects of the advergame in a study conducted by Rifon et al. (2014). Verhellen et al. (2014) did not find a moderating effect of persuasion knowledge on the impact of the advertising format on brand attitude. These findings seem to suggest that the dampening effect of persuasion knowledge or advertising literacy only works for TV advertising but not for advergames.

Hypothesis 3: (a) The impact of the advertising format on pester intent is mediated by persuasion knowledge (source recognition and understanding persuasive intent). More specifically, it is expected that persuasion knowledge for the advergame will be significantly lower than for the TV advertisement, resulting in higher pester intentions. (b) Persuasion knowledge is only negatively related to pester intent in the TV ad condition, but not in the advergame condition.

Affect transference

Previous research has shown that children like advergames more than TV advertising (Panic et al., 2013; Waiguny & Terlutter, 2011). Several studies found that advergames persuade through affect transfer from the game to the brand (cf. Hudders et al., 2015; Owen et al., 2013; Panic et al., 2013; Waiguny & Terlutter, 2011). Panic, Cauberghe, and De Pelsmacker (2013) showed that children's attitudes towards the advergame were positively associated with purchase requests. Hudders, Cauberghe, and Panic (2015) found that children's overall positive attitudes towards the advergame advertising format explained the persuasive advantage of the advergame over the TV ad. Similarly, Rifon et al. (2014), reported that children's (age 5–10) attitudes towards the advergame were positively associated with brand attitudes and taste perceptions. Therefore, it is expected that an advergame will evoke more positive attitudes towards the advertising format than TV advertising. In turn, these attitudes will at least partially transfer to attitudes towards the brand and pester intentions. Together, this implies a mediation where the effects of advertising format on brand attitudes and pester intentions are mediated by attitudes towards the ad.

Hypothesis 4: The impact of the advertising format on pester intent is mediated by attitudes towards the advertising format.

The moderating role of age

Age plays an important role in how consumers react to advertising (Van Reijmersdal et al., 2010). The influence of advertising partially depends on age-related differences in cognitive development, persuasion knowledge, advertising literacy, and consumer experience (Friestad & Wright, 1994; John, 1999; Valkenburg, 2004). As they mature, children gradually develop the skills to critically reflect on advertising like adult consumers can (John, 1999). Prior studies have shown that persuasion knowledge and cognitive and affective advertising literacy increase with age. From age 5, children start to recognize advertising, and by age 10 most children understand advertising's commercial and persuasive intentions (Oates, Blades, & Gunter, 2002; Rozendaal, Buijzen, & Valkenburg, 2011; Valkenburg, 2004).

However, studies show that even during late childhood (10–12 years old), children still have not perfected the recognition of advertising, certainly for non-traditional forms of advertising (Blades, Oates, & Li, 2013). Moreover, these children's recognition could be improved with a cue warning them about the persuasive intent of advertising in order to employ their advertising literacy (Brucks et al., 1988; Cai & Zhao, 2010). Child development theories assume that children acquire a mature capacity for cognitive and affective advertising literacy from age 12

(John, 1999). From that age, children learn hypothetical reasoning skills, and become able to autonomously process advertising critically and systematically (Buijzen et al., 2010; John, 1999; Pechmann et al., 2005). Adolescents' more mature level of cognitive and affective advertising literacy might thus enable them to overrule the affect transfer induced by playing an advergame.

However, few studies have investigated the moderating role of age on interactive advertising effects. Most of these studies found no significant age differences. Auty and Lewis (2004), for instance, showed that children's memory of a brand that was placed in a movie did not differ between the 6-year olds and the 12-year olds in their study. Mallinckrodt and Mizerski (2007) reported that children's age (5–8 years) did not moderate the impact of an advergame on their affective and conative brand responses, although older children displayed higher levels of persuasion knowledge (source and intent of the advergame). In a study conducted by Van Reijmersdal et al. (2010), age did not moderate the effects of in-game brand placement on teenage girls (age 11–17).

However, other studies did find significant age differences. Waiguny, Terlutter, and Zaglia (2011) found that young children (age 9–10) were significantly more positive towards an advergame compared to older children (age 11–12). In a food brand placement experiment among children aged 9, 12, and 15 years old, Uribe and Fuentes-Garcia (2015) observed that teenagers (age 12 and 15) were more aware of the brand, and they were less likely than the 9-year olds to prefer fast food in general, and McDonald's in particular after exposure to the brand placement. Rifon et al. (2014) reported that younger children (age 5–7) were more strongly affected by the influence of playing an advergame, and a stronger brand integration in the advergame, on the perception that cereal is healthy, compared to older children (age 8–10). However, the effects of playing versus watching an advergame on brand attitude, purchase request and taste expectations were not moderated by children's age. Taste expectations were higher among the youngest group, but not when taking game attitude into account.

Although most studies found differential effects for TV ads and advergames among children between 5 and 10 years old (cf. Hudders et al., 2015; Owen et al., 2013; Waiguny & Terlutter, 2011), Verhellen et al. (2014) found no differential effects of a TV ad, an advergame, a trailer, or a trailer followed by an advergame, on teenager's (11–14 years) brand attitude and brand choice. Hence, the findings regarding the potential moderating role of age are inconsistent. It is also important to note that most prior studies that examined the moderating role of age, only compared children within rather narrow age intervals, usually up to age 10 or 12. It is imperative to compare children younger than 12 years old with those who are older since the latter are expected to have

acquired mature levels of persuasion knowledge and ad processing skills (Buijzen et al., 2010; John, 1999; Pechmann et al., 2005). This results in the following research question:

Research question 1: Does the impact of the advertising format, via persuasion knowledge and attitudes towards the advertising format, on pester intent differ by age?

Method

Participants and procedure

A three-level (type of advertising) between-subjects experiment was conducted. The type of advertising was manipulated by selecting a TV ad and an advergame promoting the same product: Kellogg's Coco-Pops™ sugared breakfast cereals. This product category was selected because it appeals to young as well as older children and adolescents. The TV ad and advergame were part of the same Kellogg's Coco-Pops™ *Mission Jungle 2* advertising campaign (2013). Both featured the same product, the same narrative, the same branded colours and etc. A no advertising exposure control group was added to assess the absolute effects of advertising.

Five primary schools and nine secondary schools throughout Flanders (viz. Bruges, Vilvoorde, Sint-Truiden, Antwerp, Lier, Heist-op-den berg) were selected on the basis of a convenience sample. This yielded a sample of 940 Flemish children, ranging between 6 and 14 years old (M_{age} = 9.8, *SD* = 2.4, 53.5% girls; age 6-8: *N* = 260; age 9-11: *N* = 490; age 12-14: *N* = 190). The children were randomly assigned to either watch a TV ad (*N* = 342), play an advergame (*N* = 286), or a no advertising exposure control group (*N* = 312). The standard approach in the literature to compare advertising format effects was followed (cf. Hudders et al., 2015; Verhellen et al., 2014; Waiguny & Terlutter, 2011; Panic et al., 2013). Ethical approval for the study was obtained from the university's Social and Societal Ethics Committee (SMEC). The children were told that the researcher was interested in children's overall television viewing or online gaming. In the informed consent letter, we asked the parents not to brief the children on the true purpose of the study.

In the TV ad condition, children watched a 10-minute TV fragment featuring a popular youth series: Gogogo from Ketnet (public child-targeted Television channel in Flanders, Belgium). This TV programme centres around seven teenagers in a boarding school. Although the programme was originally targeted at teenagers and preteens, it is well liked among children from a broad age range. After 2 minutes and 45 seconds, the TV series was interrupted by a 19-second Kellogg's Coco-Pops™ *Mission Jungle 2* (2013) commercial. The commercial shows the brand character Coco experiencing an adventure with his friends in the jungle. Since advertising format effects are

difficult to compare due to inherent differences in the length of exposure -typically 30 seconds for a TV ad compared to a couple of minutes for an advergame- the brand exposure time was kept constant in both experimental conditions by editing the Kellogg's Coco-Pops™ brand logo into the top left corner of the TV fragment, were it remained visible during the ten minute exposure.

In the advergame condition, children played the Mission Jungle 2 (2013) advergame on the Kellogg's Coco-Pops™ website. For 10 minutes, children had to collect as many Coco Pops as possible while avoiding obstacles in the jungle. This game's degree of difficulty was very low thus children did not require prior experience with online gaming or particular skills. Adolescents (age 12–14) found the advergame significantly less challenging compared to the other two groups (age 6–8; age 9–11) ($F(2, 283) = 4.14$, $p = .017$). The Kellogg's Coco-Pops™ brand logo was prominently visible in the top left corner during the 10 minute gameplay, and children were required to actively engage with the brand by collecting the Kellogg's Coco-Pops™ cereal flakes as part of the game.

Afterwards, brand attitude, pester intent, brand preference, brand recognition, persuasion knowledge, and attitudes towards the specific advertising format were measured using a standardized, online questionnaire. The youngest children (6–8 years) individually watched the TV fragment or played the advergame, after which they were interviewed face-to-face so the researcher could first explain and practice the use of smiley-scales. Older children watched the TV ad or played the advergame individually in small groups of ten children (from the same experimental condition) in the same classroom, before individually completing the online survey. Children in the control condition were not exposed to any advertising, but merely completed a shorter online survey.

Measures

First, children's brand attitude, pester intentions and brand preferences were measured. To measure children's attitude towards Kellogg's Coco- Pops™, they were asked to indicate how much they liked the brand on a one-item, 5-point Likert smiley-scale ranging from 'not at all' to 'very much' (Pecheux & Derbaix, 1999; Van Reijmersdal, Rozendaal, & Buijzen, 2012). Pester intentions were assessed using a one item, 4-point Likert scale "Will you ask your parents to buy Kellogg's Coco Pops?"; 'No definitely not', 'No, I don't think so', 'Yes, I think so', and 'Yes, definitely' (Van Reijmersdal et al., 2012). To assess brand preferences, the children were asked to imagine that they could choose a box of sugared breakfast cereal between four brands: Nestlé's Crunch, Kellogg's Coco-Pops, Golden Bridges' Choco Chips, or Crownfields' 'Choco Rice'. Then, brand recognition, persuasion knowledge and attitudes towards the advertising format were measured.

Persuasion knowledge was measured after the main dependent variables (brand attitude and pester intent) to prevent that these questions would actually activate children's persuasion knowledge and thus bias their responses to the main dependent variables. To measure brand recognition, the children were asked to indicate which brand(s) they recognized from the game/TV ad choosing from a list of four sugared breakfast cereal brand logos: Nestlé, Kellogg's, Golden Bridge, and Crownfield. Persuasion knowledge was measured using the two-item scale following Van Reijmersdal, Rozendaal, and Buijzen (2012, p. 38). Source recognition was measured by asking the children: 'Who created the TV ad/advergame?' (Kellogg's Coco Pops, the teacher, the researcher, the supermarket, 'I don't know'). Understanding advertising's selling intent was measured by asking: 'What does the TV ad/advergame want you to do?' (play, be a good pupil, buy Kellogg's Coco Pops, be happy). The scores on these two questions were summed to obtain one measure of persuasion knowledge. Attitudes towards the specific advertising format were assessed using a three-item, 5-point Likert scale (cf. 'How much did you like the game/TV ad?', Derbaix & Pecheux, 2003). Finally, children's feelings of hunger were measured using Birch and Fisher's Cartoon Hunger Scale (2000, p. 1343).

Results

Descriptive statistics

Participant's age did not differ significantly between the experimental conditions ($F(2, 937) = .68$, $p = .508$). A correlational table (Table 1) shows significant negative relations between age on the one hand, and attitudes towards the advertising format ($r = -.36$, $p < .001$), attitudes towards the endorser Coco ($r = -.35$, $p < .001$), attitude towards the brand ($r = -.25$, $p < .0001$), and pester intent ($r = -.21$, $p < .001$) on the other hand. However, age was significantly positively related to persuasion knowledge ($r = .41$, $p < .001$).

The impact of the ad format on brand attitude and pester intent

Visual inspection of the data showed a normal distribution which could also be assumed based on the central limit theorem. To test the first hypothesis a one-way ANOVA was conducted. Levene's test was significant ($F(2, 935) = 6.16$, $p = .002$). To correct for unequality of variances across groups, Welch 's F was used which showed that the impact of the advertising format on brand attitude was significant (*Welch* $F(2, 621, 882) = 6.60$, $p = .001$). Children who had played the advergame reported significantly more positive brand attitudes ($M = 3.99$, $SD = .96$) compared to children who had watched the TV ad ($M = 3.68$, $SD = 1.13$) (see Table 2, $t(623{,}766) = 3.71$,

p <.001), and children in the no advertising exposure control group (M = 3.81, SD = 1.08; (t(593,578) = -2.26, p = .024). For pester intent, a separate one-way ANOVA was conducted. Levene's test was nonsignificant (F(2, 935) = 2.53, p = .08). The results showed that the impact of the advertising format on pester intent was significant (F(2, 935) = 3.14, p = .044). Pester intent was significantly higher for the advergame (M = 2.90, SD = 1.0) than the TV ad (M = 2.70, SD = 1.03) (Table 2, t(935) = 2.46, p = .014), but not compared to the control group (M = 2.83, SD = .97; t(935) = .91, p = .363). Thus, Hypothesis 1a was partially confirmed.

Brand attitudes and pester intentions did not differ significantly between the TV ad and the control condition ($t_{\text{Brand attitude}}$(650, 614) = -1.39, p = .164; ($t_{\text{Pester intent}}$(935) = 1.57, p = .118). Hence, Hypothesis 1b was not confirmed. When controlling for the influence of children's feelings of hunger, the main effects of the advertising format on brand attitude (F(1, 930) = 6.24, p = .002), and pester intent (F(1, 930) = 3.10, p = .046) remained significant. Hunger levels were significantly related to brand attitude (F(1, 930) = 7.55, p = .006, B = .14), but not to pester intent (F(1, 930) = 2.81, p = .094, B = .08). However, after controlling for children's feelings of hunger, and attitudes towards the advertising format, the main effects of the advertising format on brand attitude (F(1, 619) = .04, p = .844), and pester intent (F(1, 618) = .48, p = .490) were not significant anymore. Children's attitudes towards the advertising format did have a significant effect on both brand attitude (F(1, 619) = 212.89, p <.001, B = .61), and pester intent (F(1, 619) = 129.36, p < .001, B = .48).

Table 1. Correlations

		Brand attitude	Pester intent	Age	Hunger	Attitude towards endorser	Persuasion knowledge	Attitude towards ad format
Brand attitude	Pearson Correlation	1						
	N	938						
Pester intent	Pearson Correlation	,544	1					
	Sig. (2-tailed)	,000						
	N	936	938					
Age	Pearson Correlation	-,247	-,209	1				
	Sig. (2-tailed)	,000	,000					
	N	938	938	940				
Hunger	Pearson Correlation	,094	,058	-,091	1			
	Sig. (2-tailed)	,004	,077	,005				
	N	934	934	936	936			
Attitude towards endorser	Pearson Correlation	,497	,341	-,352	,119	1		
	Sig. (2-tailed)	,000	,000	,000	,003			
	N	624	624	626	623	626		
Persuasion knowledge	Pearson Correlation	-,089	-,090	,405	-,106	-,129	1	
	Sig. (2-tailed)	,028	,026	,000	,009	,001		
	N	613	613	615	612	614	615	
Attitude towards ad format	Pearson Correlation	,521	,425	-,363	,043	,463	-,193	1
	Sig. (2-tailed)	,000	,000	,000	,281	,000	,000	
	N	626	626	628	625	626	615	628

Table 2. Descriptive statistics

	M(SD)		
	Advergame	TV ad	Control group
Attitude towards Kellogg's Coco Pops	3.99 (.96)	3.68 (1.13)	3.81 (1.08)
Pester Intent	2.90 (1.0)	2.70 (1.03)	2.83 (.97)
Preference for Kellogg's Coco Pops	75%	66%	67%
Attitude towards the advertising format	4.06 (.84)	3.54 (.89)	/
Persuasion Knowledge	1.17 (.77)	1.28 (.76)	/
Brand recognition	88%	93%	/

To assess whether brand recognition was higher for the TV ad than the advergame, a chi-square analysis was conducted. The advertising format significantly influenced brand recognition (X^2 (1) = 4.4, p = .048). Significantly less children remembered seeing the brand in the advergame (88%) compared to the TV ad condition (93%) (Table 2). Hence, the second hypothesis was confirmed.

The mediating effect of persuasion knowledge and attitudes towards the advertising format

First, a multiple mediation analysis was conducted to examine the mediating impact of persuasion knowledge and attitudes towards the advertising format on the effect of the advertising format (0 = advergame, 1 = TV ad) on pester intent (Hypotheses 3 and 4) (PROCESS macro, Hayes 2013, Model 4). The analysis showed that the advertising format influences both children's persuasion knowledge (a_1 = .93, SE = .16, t = 5.77, p < .001), and attitudes towards the ad format (a_2 = -.55, SE = .07, t = -7.75, p < .001, Figure 1). As expected, these results indicate that children's persuasion knowledge was significantly higher for the TV ad than the advergame, whereas their attitudes towards the advertising format were significantly higher for the advergame than the TV ad.

However, only children's attitudes towards the ad format significantly influenced pester intent (b_2 = .49, SE = .05, t = 10.65, p < .001), while persuasion knowledge did not (b_1 = -.007, SE = .53, t = -.14, p = .891). Consequently, the indirect effect of the advertising format on pester intent via attitudes towards the ad was significant (a_2 x b_2 = -.27, SE = .04, 95% CI = [-.36, -.19]), whereas the indirect effect via persuasion knowledge was non-significant (a_1 x b_1 = -.001, SE = .007, 95% CI = [-.018, -.012]). Furthermore, the direct effect of the advertising format on pester intent was non-significant after controlling for persuasion knowledge and attitudes towards

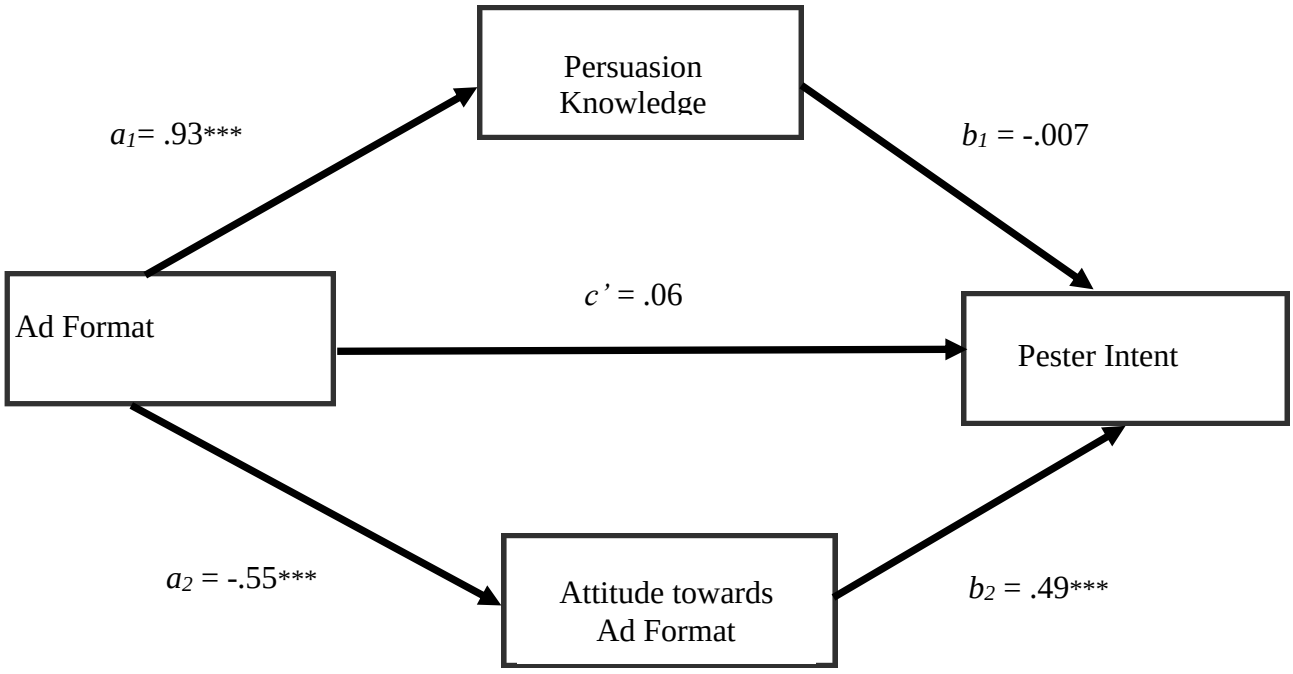


Figure 1. Multiple mediation analysis of ad format on pester intent via persuasion knowledge and attitudes towards the ad format

the advertising format (*c'* = .06, = *SE* = .08, *t* = .73, *p* = .470). Hence, these findings disconfirm Hypothesis 3a and confirm Hypothesis 4.

To examine the link between persuasion knowledge and pester intent for the TV ad and the advergame separately (H3b), two multiple regression analyses were conducted with pester intent as the dependent variable, and persuasion knowledge, attitudes towards the ad format, age, and their interactions as independent variables. These analyses showed that for the advergame, persuasion knowledge did not significantly affect pester intent ($F(6, 267) = 12.5$, $p < .001$; $B = .06$, $SE = .09$, $t = .63$, $p = .529$), and this did not differ by age ($B = -.02$, $SE = .04$, $t = -.69$, $p = .493$). Children's attitudes towards the advergame were significantly and positively related to pester intent ($B = .16$, $SE = .02$, $t = 6.66$, $p < .001$), and this did not differ by age ($B = -04$, $SE = .03$, $t = -1.41$, $p = .161$), or persuasion knowledge ($B = -.01$, $SE = .11$, $t = -.09$, $p = .931$). The effect of age was non-significant ($B = -.05$, SE = .03, $t = -1.76$, $p = .079$).

For the TV ad, persuasion knowledge did not significantly affect pester intent either ($F(6, 330) = 15.02$, $p < .0001$; $B = .10$, $SE = .08$, $t = 1.29$, $p = .197$), and this did not differ by

age (*B* = -.03, *SE* = .03, *t* = -.87, *p* = .383). Children's attitudes towards the TV ad were significantly positively related to pester intent (*B* = .14, *SE* = .02, *t* = 7.15, *p* <.001), and this did not differ by age (*B* = .04, *SE* = .02, *t* = 1.66, *p* = .097). The interaction between attitudes towards the TV ad and persuasion knowledge almost reached significance (*B* = .15, *SE* = .08, *t* = 1.94, *p* = .053). Visual inspection of the interaction effect showed that the slopes differed by persuasion knowledge. At a low level of persuasion knowledge, pester intentions were even rather high when attitudes towards the TV ad were low, and an increase in these attitudes resulted in a moderate increase in pester intent (Figure 2). At a medium and high level of persuasion knowledge, however, pester intentions were very low when attitudes towards the TV ad were low, and an increase in these attitudes resulted in a sharp increase in pester intentions. Children's age was significantly negatively related to pester intent even after controlling for persuasion knowledge and attitudes towards the ad (*B* = -06, *SE* = .03, *t* = -2.17, *p* = .031). Thus, Hypothesis 3b was not confirmed.

The moderating effect of age

Second, to explore whether these effects are moderated by age, a moderated mediation analysis was conducted with the ad format as the independent variable, persuasion knowledge and attitudes towards the ad format as mediators, age as a moderator, and pester intent as the dependent variable (RQ1) (PROCESS macro, Hayes 2013, Model 8, Figure 3). Age differences were compared conform the standard approach of the PROCESS macro, at one standard deviation below and above the mean age *(M_{age}* = 9.8). Spotlight analyses further explored significant interactions at specific ages of 7, 10, and 14 years old. These ages are chosen on the basis of the PCMC-model (Buijzen et al., 2010) in order to compare children from middle childhood, late childhood and early adolescence.

The PROCESS analysis showed a significant interaction effect between ad format and age to predict persuasion knowledge (a_3 = -0.05, *SE* = .02, *t* = -2.14, *p* = .032, Figure 3). The conditional effect of the ad format on persuasion knowledge was only significant among young children (age 7.5 at 1 SD below the mean age, *b* = .22, *SE* = .08; *t* = 2.77, *p* = .006, 95% CI [.06, .38]). More specifically, a spotlight analysis at age 7, 10, and 14 showed that persuasion knowledge was only significantly higher for the TV ad compared to the advergame among seven year old children ($M_{advergame}$ = .73, *SE* = .06, M_{TV} ad = .98, *SE* = .06, *Mdiff* = -.25, *SE* = .09, *p* = .005, 95% CI [-.417, -.074]), but not among ten and fourteen year olds.

The PROCESS analysis further showed that the impact of the ad format on attitudes towards the advertising format (TV ad/advergame) (a_4 = .03, *SE* = .03, *t* = 1.16, *p* = .245, Figure 3) and pester intent did not differ significantly by age (a_5 = .00, *SE* = .03, *t* = -.01, *p* = .996).

Finally, the analysis showed that the conditional indirect effects of the ad format via persuasion knowledge and attitudes towards the ad format did not differ by age. The conditional indirect effect of the advertising format on pester intent via persuasion knowledge was non-significant for children with an average age (9.8 years, *b* = .01, *SE* = .01; 95% CI [.00, .03]), as well as for children with an age below (7.5 years, *b* = .01, *SE* = .01; 95% CI [.00, .05]) and above the average (12.2 years, *b* = .00, SE = .01; 95% CI [-.02, .01]). Hence, persuasion knowledge did not mediate the impact of the ad format on pester intent regardless of children's age.

The conditional indirect effect of the advertising format on pester intent via attitude towards the ad format was significant for children with an average age (*b* = -.26, *SE* = .05; 95% CI [-.37, -.18]), as well as for children with an age below (*b* = -.023, *SE* = .04; 95% CI [-.32, -.15]) and above the average (*b* = -.19, *SE* = .05; 95% CI [-.31, -.10]). Hence, attitudes towards the ad format mediate the impact of the ad format on pester intent regardless of children's age.

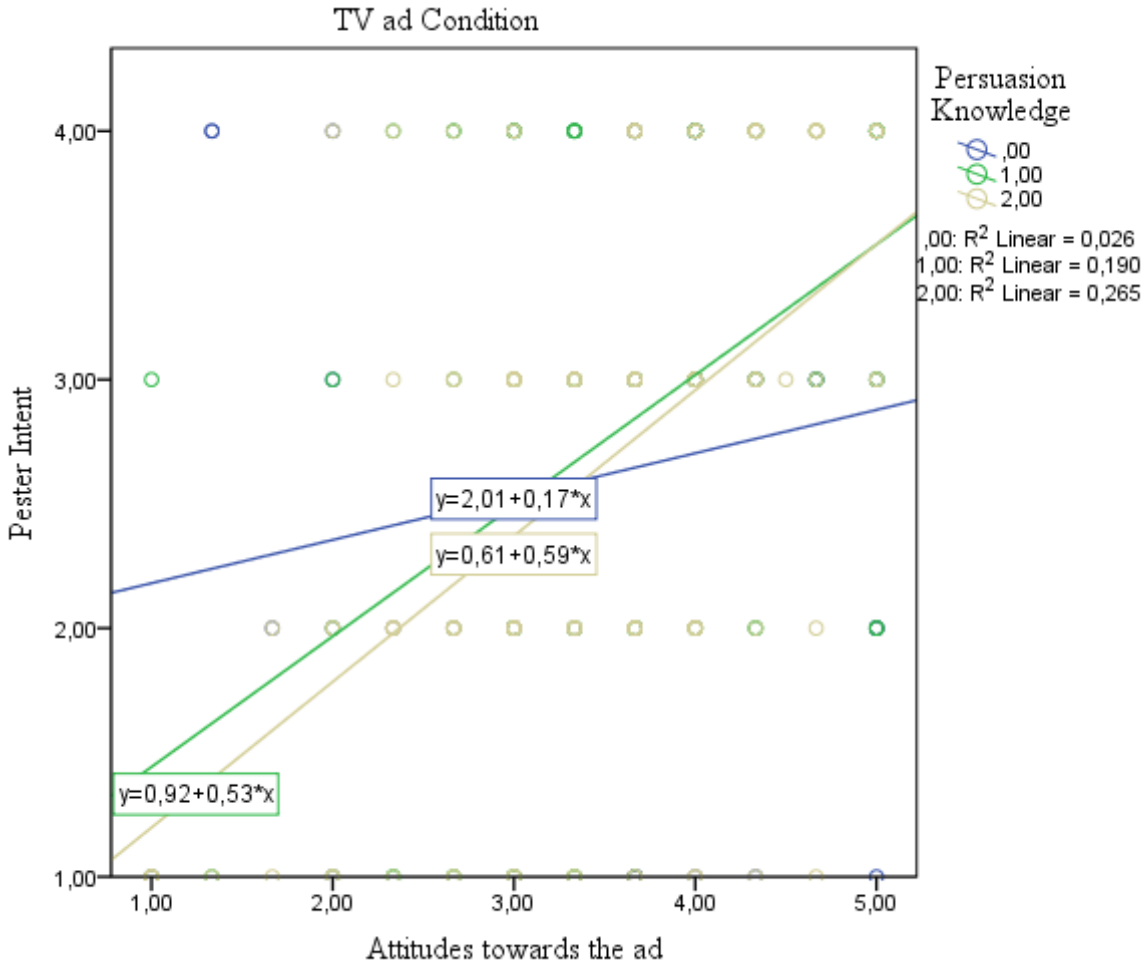


Figure 2. Pester intent by attitudes towards the ad format and persuasion knowledge in the TV ad condition

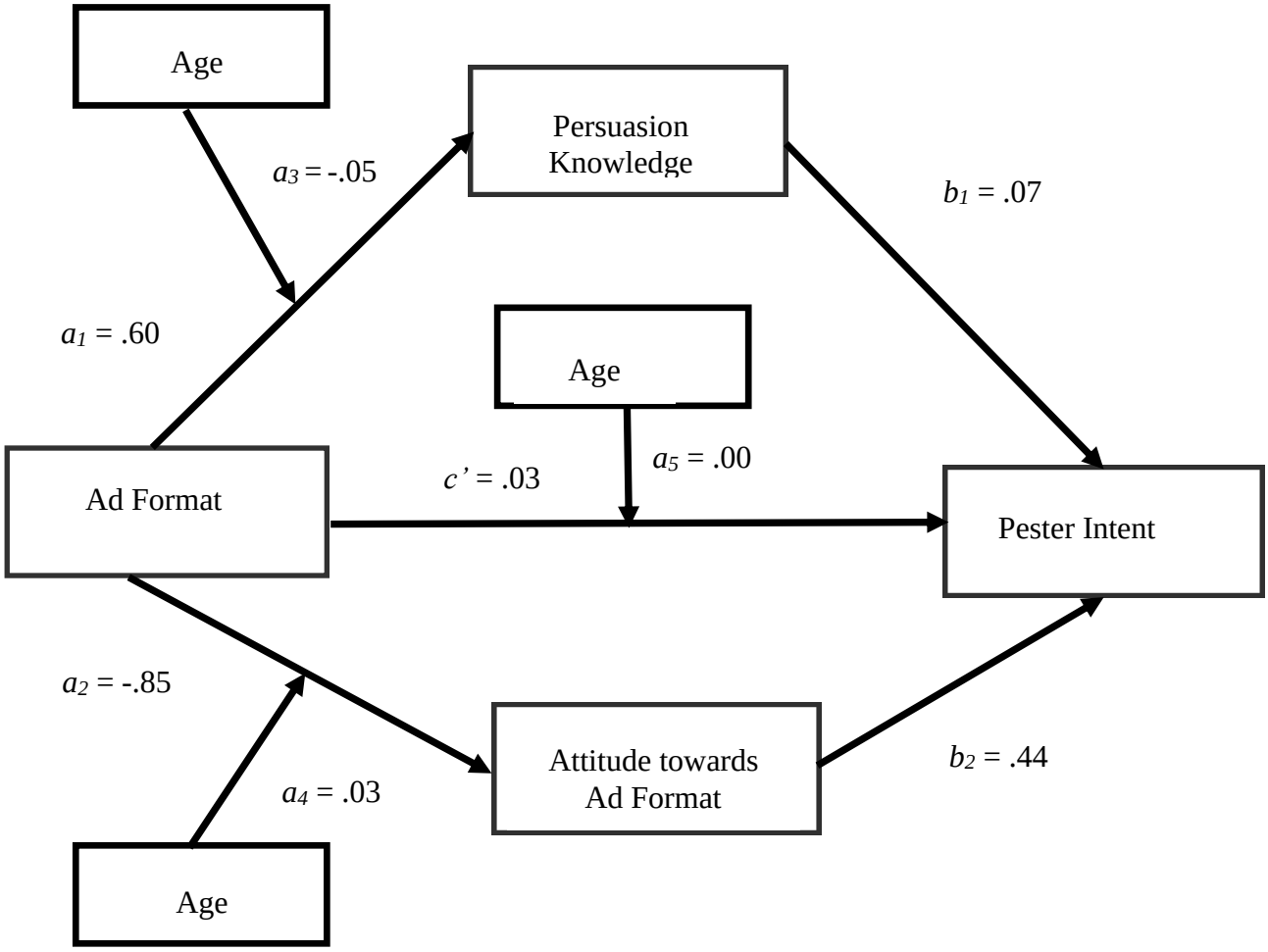


Figure 3. Moderated mediation analysis of ad format on pester intent via persuasion knowledge and attitudes towards the ad format

Discussion

The current study aimed to replicate previous findings regarding the differential impact of TV advertising and advergames on children while including age as a moderator. Corresponding to prior studies, the results indicate that an advergame is more effective than a TV advertisement in terms of brand attitude and pester intent (Hudders et al., 2015; Verhellen et al., 2014; Waiguny & Terlutter, 2011). However, similar to previous studies (cf. Rifon et al., 2014) these effects disappeared when taking children's attitudes towards the advertising format into account. Thus, suggesting that this is a very important variable.

Moreover, watching the TV ad did not enhance children's brand attitude and pester intent compared to a no advertising exposure control group. Brand attitudes, pester intent, and brand

preferences were lower among children who had watched the TV ad compared to children who were not exposed to any advertising. It is unclear how to explain this finding since children's overall attitudes towards the TV ad were positive, although all children found the advergame more enjoyable. However, this might also indicate that children are better able to defend against a TV ad than an advergame, since they have less experience with the latter. Although persuasion knowledge was not related to pester intent in this study, watching the TV ad may have evoked advertising scepticism or disliking. Children in the TV ad condition were actually exposed to two types of brand exposure: a passive brand placement during the TV series (brand logo) and a TV ad featuring the brand name and brand logo. This double brand exposure may have activated children's advertising scepticism resulting in less positive advertising outcomes. Unfortunately, advertising scepticism was not measured in this study.

Moreover, apart from the attitude effect, marketing also aims for brand recall, for which the repetitive showing of even disliked advertisements is a viable means (see Schmidt & Eisend, 2015). In line with the literature, children's brand recognition was lower for the advergame than the TV ad (Waiguny & Terlutter, 2011; Verhellen et al., 2014). As explained by the LCMP (Lang 2000), playing the advergame might have distracted children from consciously noticing the brand logo in the game. The higher level of brand recognition in the TV ad condition may partially explain why persuasion knowledge was higher for the TV ad than the advergame. Brand recognition can also be seen as an element of persuasion knowledge. If one recognizes the brand, one might also recognize the fact that the message has a commercial nature. In this study, persuasion knowledge was significantly higher among those who had recognized the brand. However, it should be noted that brand recognition as an element of persuasion knowledge occurs rather post hoc instead of an 'online' recognition of persuasion, and there are several other reasons why a brand can be recognized. Moreover, this finding indicates that an advergame persuades via positive affect evoked by the game-play, rather than via the prominence of the brand placement in the game (Nairn & Fine, 2008).

Similar to previous studies, the impact of the advertising format on pester intent was not mediated by persuasion knowledge (Hudders et al., 2015; Rifon et al., 2014). Moreover, the absence of this mediation effect was independent of age. Although persuasion knowledge was higher for the TV ad than the advergame, children did not appear to use their persuasion knowledge as a cognitive defence for neither advertising format. This corresponds to the cued processors theory (Brucks et al., 1988) stating that children up until age 12 still need a warning cue in order to be able to process advertising critically. Children above 12 years old, however, should be able to

employ their persuasion knowledge autonomously. Nevertheless, in this study, persuasion knowledge was not related to pester intent, regardless of the ad format and children's age. These findings support the view that even teenagers do not actively use their persuasion knowledge to reflect on commercial messages. Further analyses revealed that persuasion knowledge was only higher for the TV ad than the advergame among the youngest children in this sample. This further contrasts the expectation that an advergame is more persuasive than a TV ad due to lower levels of persuasion knowledge for the advergame.

The impact of the advertising format on pester intent was only mediated by children's attitudes towards the advertising format, and this mediation effect did not differ by age. Children's attitudes towards the advertising format were significantly higher for the advergame than the TV ad, regardless of children's age. In turn, higher attitudes towards the advertising format resulted in higher pester intentions. This corresponds to previous studies that found that children's positive attitudes towards an advergame explain the persuasive advantage of an advergame over a TV ad (Panic et al., 2013; Hudders et al., 2015).

These findings suggest that children's attitudes towards the advertising format are key to understand the persuasive advantage of an advergame. According to the PCMC-model, the type of advertising influences how children respond to advertising (Buijzen et al., 2010). Conform the PCMC-model, advergames appear to automatically evoke positive affect which transfers to the brand, thereby overruling cognitive defenses, even among teenagers.

We found no empirical evidence that an advergame persuades through a different pathway compared to a TV ad. The findings suggest that persuasion knowledge is not related to pester intent for neither advertising format and regardless of children's age. Instead, for both the TV ad and the advergame, children's attitudes towards the advertising format affected pester intent even after controlling for children's age and level of persuasion knowledge.

However, the data showed that the influence of attitudes towards the TV ad on pester intent differ by persuasion knowledge. At a low level of persuasion knowledge, pester intentions were already moderate when attitudes towards the TV ad were low, thus showing a moderate positive relationship. However, the positive relationship between attitudes towards the TV ad and pester intent was much steeper at a medium and high level of persuasion knowledge. This suggests that attitudes towards the TV ad play an even more important role when persuasion knowledge is moderate to high.

In conclusion, the current study showed that the persuasive advantage of an advergame over a TV ad could not be explained by differences in the activation of persuasion knowledge, regardless of children's age. Instead the answer lies in an affect transference from children's

attitudes towards the advergame. This affect transfer mechanism was observed for the entire age range of the sample. Children between 6 and 14 years old found the advergame far more enjoyable than the TV ad, which resulted in an affect transfer from the game to the brand.

The contribution of this study is that we showed that this is even the case for teenagers, although the literature assumed that children above 12 years old would be able to override the affect transfer by using their persuasion knowledge (Friestad & Wright, 1994). Furthermore, the findings of this study suggest that age-differences in advertising susceptibility are partially due to underlying age-related differences in attitudes towards the advertising format. Additional analyses showed that attitudes towards the ad format partially mediate the link between age and pester intent.

However, this study also has a few limitations. A first limitation of this study is that one might wonder whether we have actually compared the impact of a TV ad with that of an advergame or did we compare passive brand placement in a TV series with active brand placement in an advergame? In our TV ad condition, the brand logo was visible during the whole 10 minute TV series fragment. In every-day life, it is not realistic to have the brand logo featured on the TV screen during a TV programme. This methodological decision might have biased the results regarding brand recognition. A better approach might be to compare passive and active brand exposure within the same advertising format.

Second, we can wonder whether similar effects will be found when using advertising stimuli that are targeted predominantly to teenagers. The personal relevance of the advertisement for the receiver is important since it affects the amount of attention the receiver will pay to the ad, as well as the motivation to process advertising messages. Children's attitudes towards the endorser Coco, the TV ad, and the advergame decreased with increasing age, hence younger children were more positive towards these advertisements than older children.

Third, in this study, we only measured the conceptual dimension of persuasion knowledge using two items (source recognition and understanding selling intent). Hence, it is possible that persuasion knowledge does mediate advertising format effects when other dimensions of this concept are taking into account, such as advertising scepticism.

Future studies should aim to explain age differences in advertising responsiveness, by taking into account age-related differences in perceived relevance of advertising, cognitive attention, processing motivation, attitudinal responses, physiological responses such as galvanic skin responses, and self-regulation abilities such as impulse-control. Furthermore, future studies should examine whether these findings also hold with affective advertising literacy and children's actual critical processing of advertising as mediators (Hudders et al., 2015; Rozendaal, Opree, & Buijzen, 2016).

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Appendix 1

Additional analyses were performed on the data discussed in Chapter 1. First, the moderated mediation analysis discusses at page 61 was repeated with brand attitude as the main dependent variable. Hence, a moderated mediation analysis was conducted with the ad format as the independent variable, persuasion knowledge (cognitive advertising literacy) and attitudes towards the advertising format as mediators, age as a moderator, and brand attitude as the dependent variable (RQ1) (PROCESS macro, Hayes 2013, Model 8).

The PROCESS analysis showed a significant interaction effect between ad format and age to predict persuasion knowledge (a_3 = -0.05, *SE* = .03, *t* = -2.08, *p* = .038, Figure 3). The PROCESS analysis further showed that the impact of the ad format on attitudes towards the advertising format (TV ad/advergame) (a_4 = .03, *SE* = .03, *t* = 1.03, *p* = .304, Figure 3) and brand attitude did not differ significantly by age (a_5 = .01, *SE* = .03, *t* = .29, *p* = .769).

The analysis showed that the conditional indirect effects of the ad format on brand attitude via persuasion knowledge and attitudes towards the ad format did not differ by age. The conditional indirect effect of the advertising format on brand attitude via persuasion knowledge was nonsignificant for children with an average age (9.8 years, *b* = .01, *SE* = .01; 95% CI [-.00, .03]), as well as for children with an age below (7.5 years, *b* = .02, *SE* = .02; 95% CI [.00, .06]) and above the average (12.2 years, *b* = .00, SE = .01; 95% CI [-.03, .01]). Hence, persuasion knowledge did not moderate the impact of the ad format on brand attitude regardless of children's age.

The conditional indirect effect of the advertising format on brand attitude via attitude towards the ad format was significant for children with an average age (*b* = -.29, *SE* = .05; 95% CI [-.39, -.20]), as well as for children with an age below (*b* = -.33, *SE* = .06; 95% CI [-.46, -.22]) and above the average (*b* = -.25, *SE* = .06; 95% CI [-.37, -.15]). Hence, attitudes towards the ad format mediate the impact of the ad format on brand attitude for young as well as older children and adolescents, regardless of children's age.

Second, it was explored whether children's age moderates the direct influence of the ad format on brand attitude and pester intentions. Two separate univariate ANCOVAS showed a significant interaction term between age and ad format to predict brand attitude (*F* (2, 932) = 4.43, *p* = .012, (ηp^2) = .009), and to predict pester intentions (*F* (2, 932) = 4.92, *p* = .008, (ηp^2) = .010).

Then, three separate age-groups were created based on the developmental stages described in the PCMC-model: middle childhood (age 6-8); late childhood (age 9-11); and early adolescence (age 12-14). Subsequently, two separate two-way factorial ANOVAs were conducted to test the impact of the advertising format and age-group on children's attitudes towards the brand and pester intentions. For brand attitude, there was a significant interaction between the advertising format and

age group (F (4, 929) = 4.32, p = .002, (ηp^2) = .018). A simple effects analysis showed that the impact of the advertising format on brand attitude was only significant for young children in middle childhood (F (2, 162.94) = 12.86, p < .001) and early adolescence (F (2, 929) = 3.99, p = .019), but not for children in late childhood (F (2, 929) = 1.65, p = .193).

For children from middle childhood, brand attitudes were significantly higher in the advergame condition compared to both the television ($M_{Advergame}$ = 4.59, SD = .72; M_{TV} = 4.07, SD = 1.24; t(150.07) = -3.49, p = .005), and control condition ($M_{control}$ = 3.92, SD = 1.16; t(138.27) = 4.51, p = .001). Brand attitudes did not differ significantly between the TV ad and control condition (t(174.74) = .82, p = .425).

For adolescents, brand attitudes did not differ significantly between the advergame and control condition ($M_{Advergame}$ = 3.45, SD = 1.02; $M_{control}$ = 3.71, SD = .99; t(187) = -1.33, p = .178), nor between the advergame and TV ad condition (M_{TV} = 3.19, SD = 1.15; t(187) = -1.38, p = .205). However, brand attitudes were significantly lower in the TV ad condition compared to the control condition (t(187) = -2.73, p = .008).

For pester intent, the expected interaction between the advertising format and age-group was also significant (F (4, 929) = 3.45, p = .008, (ηp^2) = .015). Pester intentions differed significantly according to the advertising format among children from middle childhood (F (2, 929) = 5.41, p = .005), and early adolescence (F (2, 929) = 3.89, p = .021), but not among children from late childhood (F (2, 929) = .78, p = .458).

For children from middle childhood, pester intentions were significantly higher in the advergame condition compared to both the television ($M_{Advergame}$ = 3.39, SD = .89; M_{TV} = 3.05, SD = 1.09; t(172.69) = 2.29, p = .027), and control condition ($M_{control}$ = 2.92, SD = 1.23; t(151.55) = 2.88, p = .006). Pester intentions did not differ significantly between the TV ad and control condition (t(167.01) = .78, p = .456).

For adolescents, pester intentions did not differ significantly between the advergame and control condition ($M_{Advergame}$ = 2.53, SD = .96; $M_{control}$ = 2.77, SD = .87; t(185) = -1.47, p = .112), nor between the advergame and TV ad condition (M_{TV} = 2.29, SD = .94; t(187) = -1.44, p = .142). However, pester intentions were significantly lower in the TV ad condition compared to the control condition (t(187) = -2.95, p = .003).

Chapter 2. Empty pledges: a content analysis of Belgian and Dutch child-targeting food websites[2]

Abstract

In the EU Pledge, food and beverage companies voluntarily engage themselves to stop marketing unhealthy foods and beverages to children under age 12. However, children are increasingly exposed to online marketing promoting unhealthy foods and beverages. The main purpose of this paper was to verify whether Belgian and Dutch pledge members' child-targeting food websites actually comply to the guidelines of the EU Pledge. First, this paper describes the prominence of online marketing on 49 Belgian and Dutch child-targeting food websites and evaluates the nutrient content of the advertised foods and beverages. Second, it checks for the degree to which Belgian and Dutch food brands abide the EU Pledge. Results indicated that about 88.5% of the online-promoted products were unhealthy, whereas marketing features were still present at every website. The nutrient profile of the online-promoted foods and beverages did not differ significantly between pledge and non-pledge members. Only 8.2% of the websites used age blocks, whereas ad-break reminders were completely absent. We conclude that the food and beverage companies do not abide their vows: Children still have unlimited access to websites promoting unhealthy food.

Introduction

Over the past few years, a series of reviews have highlighted that the marketing of unhealthy foods and beverages plays a crucial role in the development of childhood obesity (Institute of Medicine (IOM) 2006; World Health Organization (WHO) 2013). Nowadays, food marketers increasingly invest in online marketing to appeal to children (WHO, 2013). Moore and Rideout (2007) estimated that about 85% of child-targeting food brands own a website. Similarly, about 70% of popular children's websites contain food marketing (Alvy & Calvert, 2008; Sandberg, 2011). Most children between 9 and 16 years old surf the web almost every day (Haddon, Livingstone, & the EU Kids Online Network, 2012). Moreover, a survey among 7- to 13-year-old Canadian children (N = 83) showed that more than one-third claimed to visit websites after seeing TV commercials or packaging (Brady et al., 2008) and about 20% reported to request food products after online exposure to marketing.

[2] Based on Neyens, E., & Smits, T. (2017). Empty pledges: a content analysis of Belgian and Dutch child-targeting food websites. *International Journal of Health Promotion and Education*, *55*(1), 42-52.

Branded food websites immerse children in digital playgrounds (Chung & Grimes, 2005) packed with spokes-characters, tie-ins, advergames, social media, etc. to engage children with food and beverage brands (e.g. Kelly et al., 2008; Henry & Story, 2009; WHO, 2013; Paek et al., 2014). Because web-based marketing practices typically blend commercial communication with entertainment, children face difficulties to discern advertising from entertainment (Calvert, 2008; Paek et al., 2014). In one survey, only 24% of 7- to 8-year-old kids were aware of online marketing (Brady et al., 2008).

A major concern is that most online child-promoted products contain too much fat, sugar, and salt (cf. Moore & Rideout, 2007; Henry & Story, 2009; Kelly et al., 2008; Sandberg, 2011; Federal Trade Commission (FTC), 2012). Sandberg (2011), for instance, observed an Unhealthy Food Index of 50% on child-targeting websites in 2005, rising to 70% in 2007. Moreover, a recent series of studies have demonstrated that online marketing strategies, such as advergames, influence children's food preferences and consumption (Mallinckrodt & Mizerski, 2007; Pempek & Calvert, 2009; An & Stern, 2011; Dias & Agante, 2011; van Reijmersdal, Rozendaal & Buijzen, 2012).

Government laws are not adapted to new media advertising yet (FTC, 2012; WHO, 2013), but instead have urged the food industry to impose self-restrictions. In the EU Pledge (2013) (www.eu-pledge.eu), food and beverage companies vow to restrain from unhealthy food advertising to audiences including at least 35% children under twelve years old. The Belgian and Dutch food industry responded with guidelines that prohibited the marketing of unhealthy foods and beverages to children under twelve and seven years old, respectively. Nevertheless, such self-regulating guidelines already proved ineffective in the USA (Batada & Wootan, 2009; Quilliam et al., 2011; Paek et al., 2014). Age blocks, ad-break warnings, and parental information also provide means to protect children, although websites seldom use age blocks (Moore & Rideout, 2007; Kelly et al., 2008). Ad-break warnings, designed to make children attentive of the games' commercial intent, are more common: between 18 and 35% of children's websites use them and they appear in 71% of advergames (Weber, Story, & Harnack, 2006; Henry & Story, 2009; Paek et al., 2014).

Despite the EU Pledge, no study has examined the prevalence of online food marketing on Belgian and Dutch child-targeted food brand websites. Therefore, the first objective of this study was to map the use of online marketing techniques on Belgian and Dutch children's food websites. Second, since most studies showed that online child-targeting foods fail nutritional criteria (e.g. Moore & Rideout, 2007; Henry & Story, 2009; Paek et al., 2014), we expected that the food and beverage products promoted on Belgian and Dutch children's websites would not meet the nutrition guidelines of the Nutrient Profile Model (UK Food Standards Agency; Lobstein & Davies, 2007).

Hence, the nutritional quality of the online advertised foods will be evaluated against the Nutrient Profile Model developed by the UK Food Standards Agency (Lobstein & Davies, 2007).

Although the European Advertising Standards Alliance (EASA) detected only 6% violations against the EU Pledge on member websites in 2013, their reports are not very trustworthy since the food and advertising industry performed them. To date, no European academic study investigated whether EU Pledge members' online food marketing conforms to the pledge's code of conduct. Therefore, the third objective of this study was to examine to what extent these food and beverage brands abide to their own self-regulations in terms of the quality of the advertised foods and the presence of age blocks and ad-break reminders.

Method

Sample and procedure

Two major local supermarkets were selected: Carrefour is a typical Belgian supermarket, whereas Albert Heijn has an explicit Dutch origin and selection. First, we gathered a list of children's food brands sold both online and offline by Carrefour and Albert Heijn. This list was limited to the twelve food categories that are most often advertised to kids according to the FTC (2012): breakfast cereal, cookies, chocolate, chips, candy, dairy, desserts, sweetened beverages, cocoa powder, pastries, bread, and bread-spread.

In addition, only child-targeted food brands were considered to be included in the analysis. A food brand was considered to primarily target children when the brand positions itself as a kids' brand, uses special shapes, colors, images, games, endorsers, claims, or promotions, such as premiums and contests (Elliott, 2008, p. 369). In a second step, these food brands were Googled and this resulted in a sample of 49 child-targeting websites with 440 food products (Table 1). Twenty-four websites were Dutch, twenty were Belgian (Flemish), and five were online in both countries. Altogether, this yielded 244 webpages.

Measures

To identify the prevalence of online marketing tactics, a coding instrument was developed based on previous research on online food marketing practices targeted at children (Weber, Story, & Harnack, 2006; Henry & Story, 2009; Kelly et al., 2008). This coding form (Table 2) incorporates 10 categories, adopted from previous content analyses on online food marketing (cf. Henry & Story, 2009; Kelly et al., 2008), including brand identifiers, product benefit claims, advergames, endorsement advertising, tie-ins, incentives, viral marketing, branded items, online protection, and

advercation. The use of these marketing tactics was kept by scoring the presence of the indicators of these tactics (Table 2).

Table 1. *Overview sampled websites*

Dutch sites	Belgian sites	Both countries online
smoeltjes.nl	bn.be	cocopops.be/nl
smarties.nl	lulu-lu.be	max-adventures.nl/be
pauladekoe.nl	zagazoe.be	haribo.com
melky.nl	luprince.be	croky.be/nl
fristi.nl	nesquik.be	maoam.com
danoontje.nl	danonino.be	
smiths.nl	paula.be	
redband.nl	dewereldvanmelk.be	
katja.nl	yoghoyogho.be	
lookolook.nl	fristi.be	
frisiasnoep.nl	chocochoco.be	
candymansnoep.nl	lactel.be	
heksehyl.nl/	smiths.be	
pombar.nl/website	lutti.be	
venz.nl	kwatta.be	
fredened.nl	meli.be/maya	
sisi.nl	www.oasisfun.be	
raakkindercola.nl	twistanddrink.be	
taksi.nl	kidibul.be	
wicky.nl	fanta.be/nl	
karvancevitam.nl		
slurpfruit.nl		
slimpie.nl		
yeau.com		

The endorsement marketing strategy was subdivided into five common categories of promotional characters, similar to the study conducted by Kelly et al. (2008): branded characters such as the Coco-Pops monkey, licensed characters such as SpongeBob Squarepants™, real-life celebrities (i.e. Justin Bieber), images of children, and sports celebrity endorsers. The presence of tie-ins was kept by recording the partnerships with the entertainment industry, such as

popular child-targeted TV series, movies, and leisure parks. Advercations were scored by noting all websites and pages in which advertising was integrated into educational content, such as pages on the history or origin of the product or brand (i.e. history of chocolate).

Table 2. *Coding instrument*

Variables	Presence/amount
Brand identifiers	Brand logo, branded food images, product packaging
Product benefit claims	Brand-, .nutrition-, and healthclaims
Advergames	Online games embedded with advertising
Promotional characters	Branded characters, licensed characters, celebrities, sports celebrities, children.
Tie-ins	Partnerships with TV series, movies, games, entertainment industry
Incentives	Sweepstakes, contests, premiums, collectables
Viral marketing	Social sharing and media button functions
Branded items	Downloads, wallpapers, screensavers
Online protection	Parental information, ad break warnings, cookies, age blocks, privacy information etc.
Advercations	History and/or origin of the brand/product, production process

The coding form identified the presence of the above outlined characteristics within the pages by coding these categories as either present (1) or absent (0). The exact number of occurrences was noted when a certain feature came about more than once on a page. Measures were kept per page and then summed per website. Two coders each analyzed five websites to improve internal consistency and reliability and reached an agreement of 93.8% on average.

The UK's Nutrient Profiling Model provided a standardized procedure to evaluate the healthiness of the 440 food and beverage products (UK Food Standards Agency, Lobstein & Davies, 2007, p. 337). The Nutrient Profiling Model is a scientific model to distinguish healthy from less healthy foods and beverages based on their nutritional quality. This model was developed by the UK Food Standards Agency in 2004 in order to guide the UK media regulator Ofcom in restricting TV advertising for high fat, sugar, and salt foods targeted at children (Lobstein & Davies, 2007).

This model calculates a score per product based on the scores on negative and positive nutrients per 100 g. Negative points were calculated based on the amount of energy, fat, sugar, and salt, whereas positive points were calculated based on the amounts of fruits, vegetables, nuts, fiber, and protein. Subsequently, the positive points were subtracted from the negative ones to create the total score. Foods were considered less healthy when they scored four points or more, whereas beverages were coded as less healthy when they scored one point or more. Websites of which food nutrition scores could not be inferred were excluded from this analysis.

Results

Descriptive Statistics

Our sample includes thirty-nine branded websites, six company websites, and four action sites. The forty-nine websites represented twelve food categories. Beverages made up the largest category (22.6%), followed by dairy (21%), candy (16%), and cookies (9.7%). From all Dutch websites, the majority promoted beverages and candy, whereas Belgian websites mostly promoted dairy and cookies.

Prominence of online marketing features

Our first research question aimed to explore the nature of online marketing on Belgian and Dutch websites. A detailed overview of the marketing features used on children's websites is presented in Table 3.

The first thing children see when surfing to a food brand's website are various types of *brand identifiers*. These brand identifiers, such as brand logo's (98%), product-package images (95.9%), and pictures of food (61.2%) appeared on the majority of the websites, with an average amount of four brand identifiers per site (M = 3.93, SD = .79).

A second popular online marketing tactic is the use of claims highlighting the benefits of the product. In total, 1856 *product benefit claims* were identified. Brand benefit claims made up the majority of these claims (67%) and occurred on 98% of the sites. The most common brand benefit was taste. Candy brands used the most brand benefit claims, with a mean of 51 claims (M = 51.30, SD = 47.08) per brand. Nutrition claims were found at 77.6% of the websites. Beverages and dairy used the most nutrition claims (44.1 and 27.8% of all nutrition claims). Health claims – such as 'contributes to the development of healthy bones and teeth' - were less common (N = 47, 28.6%) with on average 1 health claim per site (SD = 2.15, *range* = 1 – 10). In this sample health claims were exclusively used by food brands from the categories: dairy, sweetened beverages and cocoa

powder. However, more than half of the sites published food profiles and health and food information online, such as daily recommended quantities and ingredients.

Advergames were available at 40% of the sites with a mean amount of one game per website (*M* = 1.2, *SD* = 2.59, range = 1–15). Advergames are online games embedded with commercial messages and logo's, designed to engage children with the food brand (Mallinckrodt & Mizerski, 2007). These games ranged from simple memory games to more complex adventure games challenging kids to collect branded items (for instance, bags of Lay's™ potato chips) and achieve high scores.

Promotional characters were featured at 79.2% of all websites, with a mean of three endorsers per site (*M* = 2.51, *SD* = 3.45). Branded characters, such as the Oasis™ fruit family, were the most popular type and were present at more than half of the sites (63.3%, range = 1–16 per site). The licensed characters gained a second place and were spotted at about 14.2% of the sites. These are media cartoon characters such as Maya the bee™ from Studio 100, a Belgian company that produces popular children's television series. Other types of promotional characters were celebrities (6.1%) and images of children (16.2%). Remarkably, sports celebrities were completely absent in this sample.

The sampled food brands often engaged in tie-ins with other popular children's media such as TV series, movies and sports events. Tie-ins were observed on 40.8% of the sites (range = 1–17 per site). This occurred most often in the form of webisodes: online commercials in which the food brand gets associated with, for instance, favorite TV characters (44.9%). Partnerships with amusement parks, schools, etc. occurred on 25% of the sites. Sports event tie-ins were observed at about ten percent of the sites. TV tie-ins, such as partnerships with Nickelodeon™, a popular children's TV station, were found on 8% of the websites. Finally, movie tie-ins only appeared on Dutch websites (8.3%).

Table 3. *Online marketing features*

Marketing features	Belgium (%)	Netherlands (%)	Both (%)	Total (%)	Mean
Brand identifiers					*M* = 3.93; *SD* = 0.79
Brand logo	100.0 %	95.8%	100.0 %	98.0 %	
Product-package images	100.0%	95.8%	80.0%	95.9%	*range* = 1-145
Food pictures	55.0%	66.7%	60.0%	61.2%	*range* = 1-46
Product benefit claims					*N* = 1856
Brand benefit claim	100.0%	100.0%	80.0%	98.0%	
Nutrition claim	75.0%	87.5%	40.0%	77.6%	*N* = 565
Health claim	40.0%	25.0%	0.0%	28.6%	*N* = 47
Food profile	55.0%	70.8%	20.0%	59.2%	
Food information	65.0%	66.7%	40.0%	63.3%	
Advergames	40.0%	29.2%	60.0%	36.7%	*M* =1.16; *SD* = 2.59

Promotional characters				79.2%	*M* = 2.51; *SD* = 3.4
Branded characters	65.0%	58.3%	80.0%	63.3%	*range* = 1-16
Licensed characters	20.0%	4.2%	40.0%	14.2%	
Celebrities	5.0%	4.2%	20.0%	6.1%	
Images of children	20%	16.7%	0%	16.2%	
Sports celebrities	0%	0%	0%	0%	
Tie-ins				40.8%	*range* = 1-17
Tie-in TV series	10.0%	12.5%	20.0%	8.2%	
Tie-in movies	0.0%	8.3%	0.0%	4.1%	
Tie -in sports-events	10.0%	12.5%	0.0%	10.2%	
Partnerships	30.0%	20.8%	20.0%	24.5%	
Webisodes	55.0%	37.5%	40.0%	44.9%	*range*= 1-10
Incentives				37%	*range* = 1-6
Contests	20.0%	25.0%	20.0%	22.4%	*range* = 1-3
Premiums	5.0%	8.4%	60.0%	12.2%	

Collectable items	5.0%	0.0%	20.0%	4.1%	
Saving programs	10.0%	4.2%	0.0%	6.1%	
Viral marketing					
Social media	70.0%	50.0%	60.0%	59.2%	
Mail	20.0%	20.8%	0.0%	18.4%	
Registration & accounts					
Registration	20.0%	8.3%	80.0%	20.4%	
Online store & sales references	10.0%	16.7%	40.0%	16.3%	
Branded items					
				57%	M = 4.04. SD = 8.38.
Wallpapers	30.0%	8.3%	20.0%	18.4%	
Screensavers	15.0%	0.0%	20.0%	8.2%	
Branded coloring pages	20.0%	4.2%	20.0%	12.2%	
Handicrafts & color plates	35.0%	33.3%	40.0%	34.7%	
Recipes	5.0%	25.0%	20.0%	16.3%	
Online Protection					

Ad-break warnings	0.0%	0.0%	0.0%	0.0%
Age-blocks	15.0%	4.2%	0.0%	8.2%
Cookie-reports	10.0%	25.0%	40.0%	20.4%
Parental info	100.0%	100.0%	100.0%	100.0%
Advercation	25.0%	37.5%	20.0%	36.7%

Viral marketing activity was registered at 67% of the websites, especially social media (59.2%), and email buttons (18.4%). This implies that the children were encouraged to promote the food brand using Facebook (55%) and Twitter (20.4%). Children were also given the opportunity to create a personal account and become part of an online community on about 20% of the sites. Furthermore, children could buy branded items via online stores and sales references at about 16% of the sites, of which 66.6% offered the possibility to order foods.

The food and beverage websites in this sample used various promotions to tempt children to request products and to gather personal information. About 37% of all sites used incentives ranging from 1 to 6 per site. Contests (22.4%) and premiums (conditional gifts) (12.2%) were the most popular. For instance, children can win prizes by participating in quizzes, crafting – or coloring contests, or they are informed that they will receive a gift when they buy the product in the store or order it online.

The majority of the food brand websites in our sample (57%) featured brand-related items such as wallpapers, screensavers, recipes, handicrafts, and coloring pages, to stimulate children to engage with the product at the home. The average amount of brand-related items was 4.04 per site (*SD* = 8.38, range = 1–41). Coloring and handicraft pages were the most popular (34.7%), followed by wallpapers (18.4%) and recipes (16.3%).

Kids could enjoy advercation – a mix of advertising and education – at about 37% of the sites. Examples of this subtle marketing tactic are information topics on the history and origin of a brand or product (i.e. origin of cocoa), or the production process (i.e. ‘How are potato chips made?’).

Finally, the sampled websites employed a variety of online techniques to protect young children against commercialism. The most common one is parental information, which was present

on every site. This includes information on the use of cookies and privacy policy specifically targeted at parents. Cookie reports warning children that the site uses cookies – small files that are stored on the visitor's computer – to track their online behavior were active on about twenty percent of the sites. These cookies are used for marketing purposes, for instance, to store client profiles and design personalized messages. In the Netherlands, all websites are obliged to ask permission from visitors to place cookies (Telecomwet, 1998). However, only eight percent used age blocks requiring children to provide their age before entering the website (children may enter from age 12 when advertising is present). Obviously children can type in any age they want making this protection tool obsolete. In addition, none of the sites used ad-break warnings to make kids aware of the persuasive intents of branded websites.

The nutrient profile of the online advertised foods

In total, 440 food products and beverages were identified on the forty-nine websites: 270 products came from Dutch sites (N = 17), 94 products originated from Belgian sites (N = 11), and 76 items were found on a site for both countries (N = 1). As expected, these online marketed foods and beverages failed to meet the criteria of the Nutrient Profile Model (UK Food Standards Agency; Lobstein & Davies, 2007, p. 337). To recapitulate, the Nutrient Profile Model categorizes foods as unhealthy when they score four points or more, whereas beverages are categorized as unhealthy when they score one point or more. The nutrition scores of the online-promoted foods and beverages varied between 3 and 27 with a mean of 13 (SD = 7.85). According to the nutrient-profiling model, 88.5% of the foods and beverages promoted on the websites in our sample were unhealthy. Split by country it appeared that about 86.5% of the foods and beverages promoted on Belgian food brand websites were unhealthy, compared to 84% of the foods and beverages promoted on sites from Dutch food brands. The mean nutritional value was twelve on Belgian sites (M = 11.80, SD = 10.51) and thirteen on Dutch sites (M = 12.98, SD = 7.75). These mean values are way above the cutoff points of four for food and one for drinks as defined by the Nutrient Profile Model, thus they indicate unhealthy scores (UK Food Standards Agency; Lobstein & Davies 2007, p. 337). Bread-spread (23.6) and cookies (21.2) appeared to be the unhealthiest food categories, whereas dairy (1.4) and beverages (1.6) were the healthiest.

Impact of self-regulation

Only 30.6% (N = 15) of the 49 food brand websites employed self-regulating criteria. Of the 20 Belgian websites, only 8 (40%) were pledge members. From the 24 Dutch websites, only 5 signed a pledge (20.8%). Two of the five websites that were online in both countries signed a

pledge (40%). The pledge forbids the promotion of unhealthy foods and beverages to children under 12, still the foods marketed on pledge member sites are very unhealthy according to the standards of the Nutrient Profile Model (UK Food Standards Agency; Lobstein & Davies 2007, p. 337). The average nutrition score did not differ significantly between food brands that did (Mean rank = 16.36) and did not sign a pledge (Mean rank = 15) (U = 114, z = .41, p = .703, r = .075; Table 4).

Although a major goal of the pledge is to protect children from online marketing of junk food, only a minority (8.2%) of the food pledge member companies, deploy age blocks to forbid children younger than 12 to enter the websites. The few sites that used age-screening (N = 4) all signed a pledge. Notably, ad-break warnings to enhance children's awareness of websites persuasive aims were completely lacking on all websites. In addition, pledge members (Mean rank = 25.43) did not display more parental information than non-members (Mean rank = 24.81) (U = 261.5, z = .15, p = .885, r = .003).

With regard to the use of marketing tactics, few differences were found between pledge and non-pledge members. Brand benefit claims were significantly more present on non-member (Mean rank = 28.26) compared to pledge-member websites (Mean rank = 17.60) (U = 144, z = –2.41, p = .016, r = .34), whereas pledge member's websites deployed significantly more spokes-characters (U = 359, z = 2.39, p < .017, r = .34, Mean rank = 31.93) than non-members' sites (Mean rank = 21.94). Hence, despite the European Commission's self-regulating framework, children are still exposed to branded environments promoting unhealthy foods and drinks.

Table 4. *Chi-square analysis pledge membership and age-blocks*

Pledge-membership		Age-blocks		
		Not present	present	Total
Non-member	Count	34_a	0_b	34
	Expected Count	31,2	2,8	34,0
	% within pledge membership	100,0%	0,0%	100,0%
	% within age blocks	75,6%	0,0%	69,4%
	% of total	69,4%	0,0%	69,4%
	Std. Residual	,5	-1,7	
Member	Count	11_a	4_b	15
	Expected Count	13,8	1,2	15,0
	% within pledge membership	73,3%	26,7%	100,0%
	% within age blocks	24,4%	100,0%	30,6%
	% of total	22,4%	8,2%	30,6%
	Std. Residual	-,7	2,5	
Total	Count	45	4	49
	Expected Count	45,0	4,0	49,0
	% within pledge membership	91,8%	8,2%	100,0%
	% within age blocks	100,0%	100,0%	100,0%
	% of total	91,8%	8,2%	100,0%

Note. Each subscript letter denotes a subset of age block categories whose column proportions do not differ significantly from each other at the ,05 level.

Discussion

This study verified whether Belgian and Dutch child-targeting food and beverage websites actually adapt their online marketing efforts to protect young children from unhealthy food promotions, as specified in the EU Pledge. This study shows that industry self-regulation has failed. First, with regard to pledge membership, it appeared that few Belgian and Dutch food brands actually signed the pledge. In this sample of 49 websites, only 15 food brands (30.6%) were tied to the pledge. This is in sharp contrast with the food industry claiming their pledge members to represent about 80% of the food companies.

Second, Belgian and Dutch child-targeting food brand websites are still stuffed with numerous marketing tactics to engage children with the brand, such as favorite cartoon characters, celebrities, and advergames. Moreover, these marketing tactics are primarily employed to promote unhealthy foods and beverages. The online promoted foods and beverages did not meet the Nutrient Profile Model's nutritional criteria: About 88.5% were labeled as unhealthy. This supports previous findings stating that the majority of onlinefood marketing pertains to foods and beverages high in fat, sugar, and salt (e.g. Henry & Story, 2009; Kelly et al., 2008; Sandberg, 2011; FTC, 2012; Paek et al., 2014).

Third, the nutrient profile of the online-promoted foods and beverages did not differ significantly between pledge member and non-member websites. Further, almost no differences were observed with regard to the use of marketing tactics. Interestingly, most pledge members made no efforts whatsoever to protect young children from the online promotion of unhealthy foods and beverages. Online protection tools, such as age-screening and advertising warnings, are rarely or never used.

Overall, the findings of this study challenge the evaluation report of the EASA, claiming only 6% violations against the EU Pledge on member websites in 2013. Hence, we can conclude that the food and beverage companies do not abide their vows: Children still have unlimited access to branded food websites promoting unhealthy foods and beverages. Food companies can and should do better.

This study also has a few limitations. Because of our small sample size (N = 49), the inferential statistics have to be interpreted with caution. Further, the sample is not representative because non-food-related popular children's websites, such as gaming sites, market foods and drinks as well. In the future, longitudinal designs should verify the impact of new industry guidelines. Internet traffic data should also be collected to control for the popularity of these websites. Future studies should examine whether the combination of various ad-breaks, with counter-advertisements, healthy lifestyle motivation, etc. can stimulate children's cognitive and emotional shields. Policy-makers should either require the presence of ad-break warnings and counter-ads on websites with child visitors, or only allow websites that promote healthy foods.

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PART 2

Chapter 3. Seeing is doing. The implicit effect of TV cooking shows on children's use of ingredients[3]

Abstract

Prior research has established that TV viewing and food marketing influence children's eating behavior. However, the potential impact of popular TV cooking shows has received far less attention. TV cooking shows may equally affect children's food selection and consumption by distributing both food cues and portion-size cues. In an experimental study, elementary school children were randomly exposed to a cooking show, that either did or did not display a portion-size cue, or a non-food TV show. Results showed that children used significantly more sugar on their pancakes, and consumed significantly more of the pancakes after watching a TV cooking show compared to a non-food TV show. However, observing a portion-size cue in a TV cooking show only influenced sugar selection in older children (5th grade), but not in younger children (1st grade). The findings suggest that food cues in TV cooking shows stimulate consumption by inducing food cravings in children. Actual portion-size cues only appeared to affect older children's food selection.

Introduction

TV cooking shows such as Masterchef, Cake Boss, or shows from celebrity TV chefs, such as Jamie Oliver, Gordon Ramsay or Nigella Lawson, are very popular nowadays (Collins, 2009; De Backer & Hudders, 2016; Pollan, 2009; Sitwell, 2016). However, the meals that are prepared in these shows contain too much sugar, fat, and/ or salt according to World Health Organization guidelines (WHO) (Jones, Freeth, Hennessy-Priest, & Costa, 2013; Silva, Di Bonaventura, Byrnes, & Herbold, 2010). TV cooking shows have been shown to affect adult's eating behavior (Bodenlos & Wormuth, 2013; De Backer & Hudders, 2016). Bodenlos and Wormuth (2013), for example, randomly exposed their participants to either a cooking show or a nature show and found that adults consumed significantly more chocolates when they were exposed to a cooking show. Similarly, a cross-sectional study found a positive association betweenwatching TV cooking shows and increased snack consumption in women (De Backer & Hudders, 2016).

Although children are not the primary target audience, TV cooking shows are broadcast in prime-time when most children are watching TV (Kostyrka-Allchorne, Cooper, & Simpson, 2017).

[3] Based on Neyens, E., & Smits, T. (2017). Seeing is doing. The implicit effect of TV cooking shows on children's use of ingredients. *Appetite*, *116*, 559-567.

Increasingly, we also see children's versions of these cooking shows popping up, such as Masterchef Junior. Prior research has already demonstrated that food advertisements affect food choice and food intake in both children and adults (cf. Boyland et al., 2016; Folkvord, Anschütz, Boyland, Kelly, & Buijzen, 2016; Norman, Kelly, Boyland, & McMahon, 2016). Celebrity endorsers, popular cartoon characters and brand mascots have been shown to influence children's food choices and eating behavior (e.g. Boyland & Halford, 2013; Kraak & Story, 2015; Smits, Vandebosch, Boyland, & Neyens, 2015; Zeinstra, Kooijman, & Kremer, 2016). In addition, joint cooking of parents and children has been reported to increase children's vegetable consumption (van der Horst, Ferrage & Rytz, 2014). However, little attention has been paid to the impact of TV cooking shows on children's food selection and consumption. Therefore, the primary aim of the current study was to examine whether observing foods being prepared in a popular TV cooking show will affect how much food children choose and consume.

TV cooking shows display visual food cues and clearly communicate and zoom in on the palatable foods and food portions that are used. According to the literature, two types of theories explain how watching a TV cooking show may affect children's food selection and consumption. First, the visual food cues that are distributed by TV cooking shows may affect children's food consumption by triggering food cravings. There is increasing evidence that environmental cues such as the sight or scent of food play a crucial role in human eating behavior (cf. Boyland et al., 2016; McCrickerd & Forde, 2016; Spence, Okajima, Cheok, Petit & Michel, 2015; Wadhera & Capaldi-Phillips, 2014; Wansink, Hanks & Kaipainen, 2015). The visual salience of food has been shown to increase food consumption (McCrickerd & Forde, 2016; Wadhera & Capaldi-Phillips, 2014). According to cue reactivity theory, food cues, such as images of palatable foods, activate food cravings (Jansen, 1998). Previous studies have demonstrated that food cues attract attention, and prompt thoughts about food (Nijs, Muris, Euser, & Franken, 2010) and trigger physiological responses such as increased heart rate, salivation, blood pressure, skin conductance and gastric activity (cf. Alonso-Alonso et al., 2015; Castellanos et al., 2009; Folkvord et al., 2016; Nederkoorn, Smulders, & Jansen, 2000). Experimental research has shown that merely seeing images of palatable foods in food advertising increases food intake in both children and adults (Boyland et al., 2016; Harris, Brownell, & Bargh, 2009).

Second, the food portions that are shown in TV cooking shows may affect the amount of food that children select. These food portions can be viewed as descriptive norms on eating behavior which have been shown to influence people's dietary decisions and eating behavior (Cialdini, Reno, & Kallgren, 1990). A descriptive norm is a social norm that describes which behaviors are considered to be typical or normal (Cialdini et al., 1990; Cialdini, Kallgren, & Reno,

1991). Such descriptive norms differ from so-called injunctive norms (i.e., what we "know" is best) in that these norms are communicated by what we see others do, or what we believe they do (Cialdini et al., 1990). According to social modeling theory, the amount of food people eat is influenced by the amount we see other people eat (Herman, Roth, & Polivy, 2003; Pedersen, Gronhoj, & Thogersen, 2015). In this paper, we will study whether media can also suggest such norms and influence children's consumption.

Messages or environmental cues that convey information on the eating behavior of other people have already been shown to affect food choice and intake (cf. Prinsen, de Ridder, & de Vet, 2013; Robinson et al., 2014; Stok, de Ridder, de Vet, & de Wit, 2014a; Stok et al., 2015; Stok, Verkooijen, de Ridder, de Wit, & de Vet, 2014b). Prinsen et al. (2013), for instance, exposed their participants to a bowl of individually wrapped chocolates, and manipulated the presence or absence of empty chocolate wrappers between the conditions. The findings showed that participants were 3 times more likely to take chocolates when the empty wrappers were present. In the same vein, standard portion-sizes and portion-size suggestions have been shown to affect eating behavior by influencing people's perceptions of what portion-sizes are normal (e.g. Burger, Fisher, & Johnson, 2011; Fisher, Rolls, & Birch, 2003; Neyens, Aerts, & Smits, 2015; Robinson et al., 2014; Rolls, Roe, Kral, Meengs, & Wall, 2004; Wansink & Kim, 2005; Wansink, Painter & North, 2005). Prior studies revealed that children eat more when they are offered larger portions (Fisher, Liu, Birch, & Rolls, 2007; Fisher et al., 2003; Marchiori, Waroquier, & Klein, 2012), and when larger serving-sizes are suggested on food packaging (Neyens et al., 2015).

Based on descriptive norm theory (Cialdini, 2009) and prior research on the impact of descriptive norms on food intake, we expect that TV cooking shows will affect children's use of ingredients. More specifically, it was hypothesized (Hypothesis 1) that observing descriptive portion-size norms in a cooking show will affect how much of a specific food ingredient children will select. Furthermore, food cue reactivity theory states that merely seeing palatable foods can prime food cravings. Prior studies have indeed established that children eat more after seeing images of palatable foods in food advertising (Harris, Bargh, & Brownell, 2009; Harris, Brownell et al., 2009). Hence, it was hypothesized (Hypothesis 2) that children would eat significantly more after exposure to a cooking show compared to exposure to a non-food TV show. In addition, it was hypothesized (Hypothesis 3) that children's BMI would moderate the impact of watching a TV cooking show on children's food intake. It is well-documented that people with a higher BMI are more susceptible to food cues (Birch, 1999; Halford et al., 2008; Kaur, Choi, Mayo & Harris, 2003). Finally, we wondered whether the impact of observing descriptive portionsize norms depends on age (RQ1). Previous research has shown that social norm susceptibility increases with

age as children move to adolescence (Chan, Prendergast, Gronhoy, & Bech-Larsen, 2010). When children get older, they tend to rely more on social peer norms and tend to compare their behavior more to others (Arnett, 1995; Lally, Bartle, & Wardle, 2011; Stok et al., 2014a). Therefore, older children and teenagers might be more vulnerable to descriptive portion-size norms communicated through TV cooking shows than younger children.

Method

Participants and procedure

A sample of 111 Flemish children from the first and fifth grade (typical age groups of 6-7 versus 10-11 year olds, respectively) of elementary school were recruited from four Flemish elementary schools during March and April 2016 (52% female, M_{age} = 8.8, SD = 2.1). Ethical approval for the study was obtained from the authors' university ethical committee, and the parents provided their informed consent.

The hypotheses were addressed using a one-way between-participants experiment. We manipulated the type of TV show that the children saw. This was either a cooking show or a non-food TV show. Further, we manipulated whether the cooking show displayed a sugar portion-size norm or not. This resulted in a 2 (first vs fifth grade) by 3 (cooking show with and without depiction of sugar portion-size norm, non-food TV show) between-participants experiment. The children were randomly assigned to one of the three conditions.

The educational cooking show 'Dagelijkse Kost' (Daily Meal) was selected as the main experimental stimulus. This popular show airs every weekday at 6:15 p.m. at the national public channel, which is around dinner time. An episode lasts about 15 min and is not interrupted by any advertising (De Backer & Hudders, 2016). The show has been very popular ever since it aired in September 2010 and attracts about 1 287 088 viewers per episode on average (CIM, 2015; De Backer & Hudders, 2016). The show is hosted by Jeroen Meus, a young, amiable cook who is well-known among the Flemish. For this experiment, we selected an episode in which the chef prepares pancakes and spreads them with a copious amount of brown sugar, a traditional Flemish dish. This episode lasts 3 min and 36 s. Two versions of this episode were created: one version that shows how much sugar the chef sprinkles on his pancakes, and an edited version without the display of the sugar portion-size norm. In this edited version, the final scene in which the chef eats the pancake roll is kept so that viewers get the impression that the pancake is eaten without any garniture. In the control condition, the children were shown an episode of Greenland that was similar in length. This program is about nature and gardening and is produced by the same team as the Daily Meal show

such that it has a similar atmosphere. In the specific episode, the host paddles across the fauna and flora of a river on a surfing plank.

To hide the true purpose of the experiment, the children were told that the producers of the TV show they were about to watch were looking to make a children's version of the show. Therefore, they would like the children to evaluate the show and its host. Then, the children randomly watched one of these episodes at class level. After exposure to one of the three episodes, the children completed a survey assessing their recognition and liking of the show and its host, and tips to make the show more interesting for kids. This survey was administered orally for the youngest children. Then, the children were 'rewarded' with pancakes. The children were invited to eat as much pancakes with brown sugar as they liked. The children gathered around a large table in the dining room of the school right before the first break (10 a.m.). Each child was provided with a plate with two pre-baked pancakes (each pancake weighed 70 g on average), and an individual, pre-weighed cup containing 50 g of brown sugar. The children were allowed to ask for additional sugar and extra pancakes. After the children finished eating, they were asked to complete a second survey measuring their eating habits and post-hoc level of hunger. Finally, all children were weighed and measured. In total, the experiment lasted about 50 min.

Measures

The amount of sugar that the children used on their pancakes was measured by weighing the individual cups of brown sugar (containing 50 g each) to the nearest gram prior to the experiment, and weigh them again after the meal. The researcher kept score of which children asked for additional sugar and how much extra sugar they received. The amount of pancakes that each child ate was carefully observed by the researcher by filming the whole process. The camera was placed at the edge of the table so that only the process of preparing and eating the pancakes was filmed but not the children's faces. Each child was served two prebaked pancakes (70 g per pancake on average). The amount of pancakes the children ate was measured in grams by subtracting the remaining amount that was left on the plate from the amount they were initially served.

Children's BMI was calculated by dividing the children's body weight by the square of their height (Quetelet, 1835). Then, children's BMI was recalculated into percentiles. Children are considered to be overweight from the 85th percentile (Barlow & committee, 2007). The children were asked whether they recognized the show and the host (Yes, No, I don't know), and whether they liked the TV show on a 5-point Likert scale (ranging from not at all to very much). To measure children's habitual sugar use, the children were asked to indicate on a visual scale how much sugar they usually use at home when eating pancakes (Smits & Vandebosch, 2012). The children were

shown five images of pancakes with different amounts of sugar, and were asked to choose the image that best represents how much sugar they usually eat at home (Appendix 1). Children's level of hunger was measured using Birch and Fisher's Cartoon Hunger Scale (2000) which consists of three cartoon drawings that display the level of hunger ranging from ‘not hungry’ to ‘very hungry’ (1-3).

Analyses

To examine the effects of watching a TV cooking show on children's sugar usage and pancake consumption, two separate one-way ANOVA analyses were performed (without covariates). Then, further analyses were conducted with children's level of hunger, habitual sugar usage and attitude towards the TV programme as covariates. To assess the potential moderating role of children's BMI, an ANCOVA analysis was performed with level of hunger as a covariate and BMI percentile as a moderator. Finally, separate age-group analyses were conducted to examine whether the impact of a portion-size norm differs by age.

Results

Descriptive statistics

Table 1 presents an overview of the main variables per condition. In this sample children had a mean BMI of 16.8 (SD = 1.9). About 7.3% of the children were overweight based on their BMI percentile (N = 9) (Barlow & committee, 2007). Children's level of hunger did not differ significantly between the conditions ($F(2, 105) = 0.3$, $p = 0.741$). Habitual sugar use (how much sugar children usually eat with their pancakes at home, see Appendix 2) was significantly and positively related to total sugar use ($r = 0.42$, $p < 0.001$) and pancake consumption ($r = 0.24$, $p = 0.019$). However, children's habitual sugar use was significantly higher among children who had watched the cooking show with the sugar scene compared to children from the other two conditions ($F(2, 92) = 6.42$, $p = 0.002$), which might affect the interpretation of the results.

Effects of watching a TV cooking show on children's sugar usage and pancake consumption

To examine the first hypothesis, a one-way ANOVA was conducted with the type of TV show as the independent variable and sugar usage as the dependent variable. Since Levene’s test was significant ($F(2, 106) = 8.91$, $p < .001$) Welch ‘s F was used which showed that the main effect of the experimental condition on sugar usage was significant (Welch $F(2, 66.710) = 8.09$, $p < 0.001$).

Table 1. *Descriptive statistics*

Variables	Sugar-display cooking show *M(SD) range*	No sugar-display cooking show *M(SD) range*	Non-food TV show *M(SD)*
Age	8.5 (2.1)	9.0 (2.0)	8.9 (2.3)
Recognizing TV show	90.3%	79.6%	50%
Liking TV show	2.3 (0.07) (1-5)	2.2 (0.08)	2.7 (0.09)
Sugar usage at home	2.9 (0.7) (1-5)	2.1 (1.1)	2.0 (0.9)
Hunger	1 (0.7) (1-2)	1.1 (0.8)	1.1 (0.7)
BMI	16.4 (1.9)	16.5 (1.7)	17.9 (2.3)
Grams of sugar used	34.1 (16.7)	28.4 (21.4)	18.8 (12.5)
Pancakes eaten in grams	124.4 (41.3)	101.3 (37.7)	88.7 (28.9)

Bootstrapped planned contrasts revealed that children who watched the cooking show that displayed the sugar portion-size sprinkled significantly more sugar (gram) on their pancakes (M = 34.10, SD = 16.65) compared to children who watched the non-food TV show (M = 18.77, SD = 12.53), t(54.416) = 3.96, SE = 3.87, p = 0.002, 95% CI [7.57, 23.09], d = 1.05, see Figure 1. Children who watched the cooking show without the sugar portion-size norm (M = 28.44, SD = 21.41), also used significantly more sugar compared to the non-food TV show (t(73.995) = 2.51, SE = 3.85, p = 0.012, CI [1.99-17.35], d = 0.52). However, the difference between the cooking show episode that did and did not display the sugar portion-size was nonsignificant (t(75.284) = 1.34, SE = 4.21, p = 0.179, CI [-2.73, 14.05], d = 0.29). Hence, the first hypothesis was not confirmed.

We also explored whether these effects changed when controlling for level of hunger, habitual sugar use and liking the programme. Indeed, including these variables rendered the main effect of the experimental condition nonsignificant (F(2, 86) = 2.29, p = 0.108, ηp^2 = 0.051). Children's habitual sugar usage (F(1, 86) = 8.00, p = 0.007, B = 5.18, ηp^2 = 0.085), and their level of hunger (F(1, 86) = 17.33, p = 0.001, B = 10.44, ηp^2 = 0.17) were significantly and positively related to sugar usage. However, when comparing only the sugar display condition and the non-food condition the difference in sugar usage was still significant (F(1,37) = 6.29, p = 0.017, ηp^2 = 0.15). Children used significantly more sugar on their pancakes in the sugar display condition compared to the non-food condition ($Mdiff$ = 10.29, SD = 4.1, p = 0.017, CI [1.97, 18.61], d = 1.29).

The main effect of habitual sugar usage was also significant ($F(1, 37) = 11.32$, $p = 0.002$, $B = 8.00$, $\eta p^2 = 0.23$). The difference in sugar usage between the no-sugar display condition and the non-food condition was nonsignificant when controlling for level of hunger, habitual sugar use and liking the TV programme ($F(1, 64) = 1.25$, $p = 0.267$, $\eta p^2 = 0.02$). Children's level of hunger ($F(1, 64) = 19.50$, $p < 0.0001$, $B = 12.8$, $\eta p^2 = 0.23$), and habitual sugar usage were ($F(1, 64) = 4.05$, $p = 0.048$, $B = 4.05$, $\eta p^2 = 0.06$) significantly and positively related to children's sugar selection.

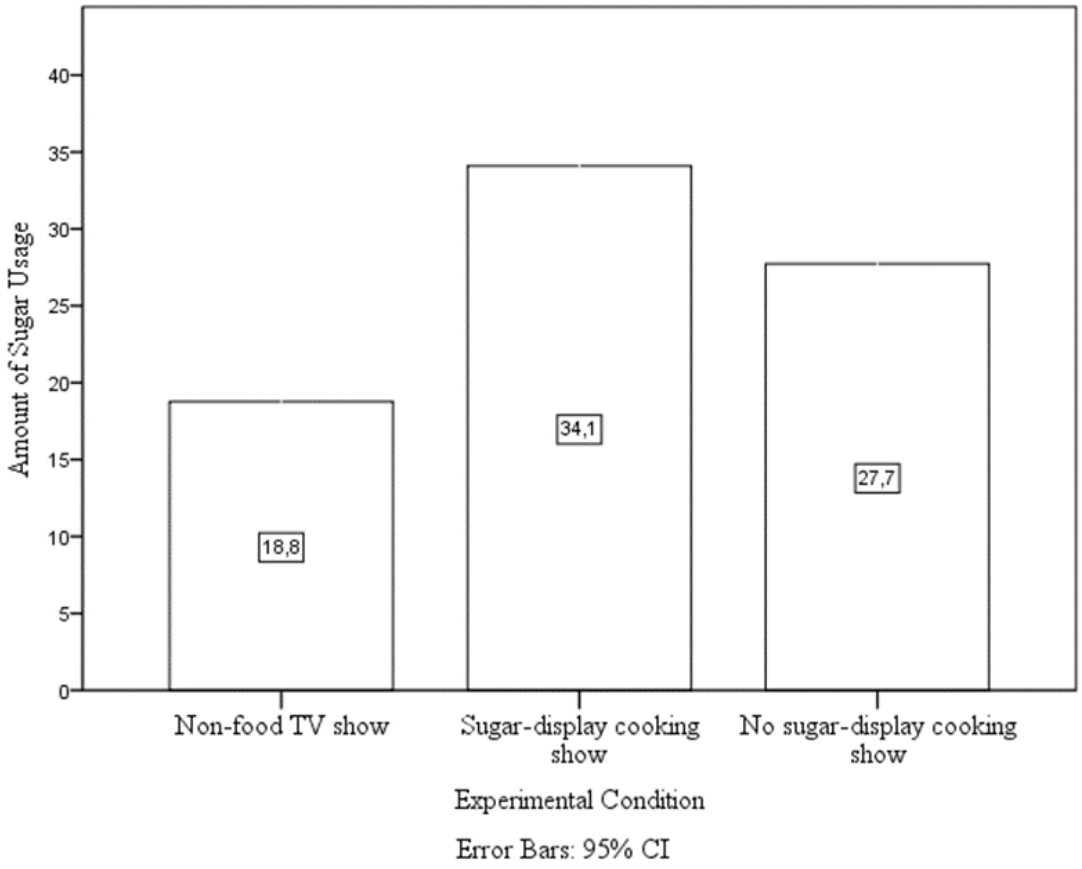


Figure 1. Amount of sugar use (grams) by experimental condition

To examine the second hypothesis, a one-way ANOVA was conducted with the type of TV show as the independent variable and pancake consumption as the dependent variable. Levene's test was significant ($F(2, 106) = 4.37$, $p = .015$). The main effect of the experimental condition on pancake consumption was also significant (Welch $F(2, 61.381) = 7.25$, $p = 0.001$). Figure 2 shows that children who watched a TV cooking show ate significantly more of the pancakes compared to children who watched a non-food TV show ($t(57.348) = 3.33$, $SE = 14.51$, $p = 0.004$, CI [-35.67, -6.88], $d = 0.61$). Hence, the second hypothesis was confirmed. Children who watched the cooking

episode in which the sugar portion-size was shown ate significantly more pancakes (M = 124.39, SD = 41.32) than children who watched the same episode without the scene displaying the sugar portion-size (M = 101.31, SD = 37.67) (t(58.627) = 2.54, SE = 9.08, p = 0.019, CI [5.02, 41.14], d = 0.59).

After controlling for level of hunger, habitual sugar use and liking the TV programme, the main effect of the experimental condition on pancake consumption remained significant (F(2, 84) = 4.36, p = 0.016, ηp^2 = 0.09). Children's level of hunger was significantly positively related to pancake consumption (F(2, 84) = 5.57, p = 0.029; ηp^2 = 0.06, B = 12.73), whereas these children's attitudes towards the TV programme (F(2, 84) = 6.25, p = 0.017, ηp^2 = 0.07, B = -11.50) were significantly negatively related to pancake consumption. The main effect of habitual sugar use was nonsignificant (F(2, 84) = 0.29, p = 0.593, ηp^2 = 0.003).

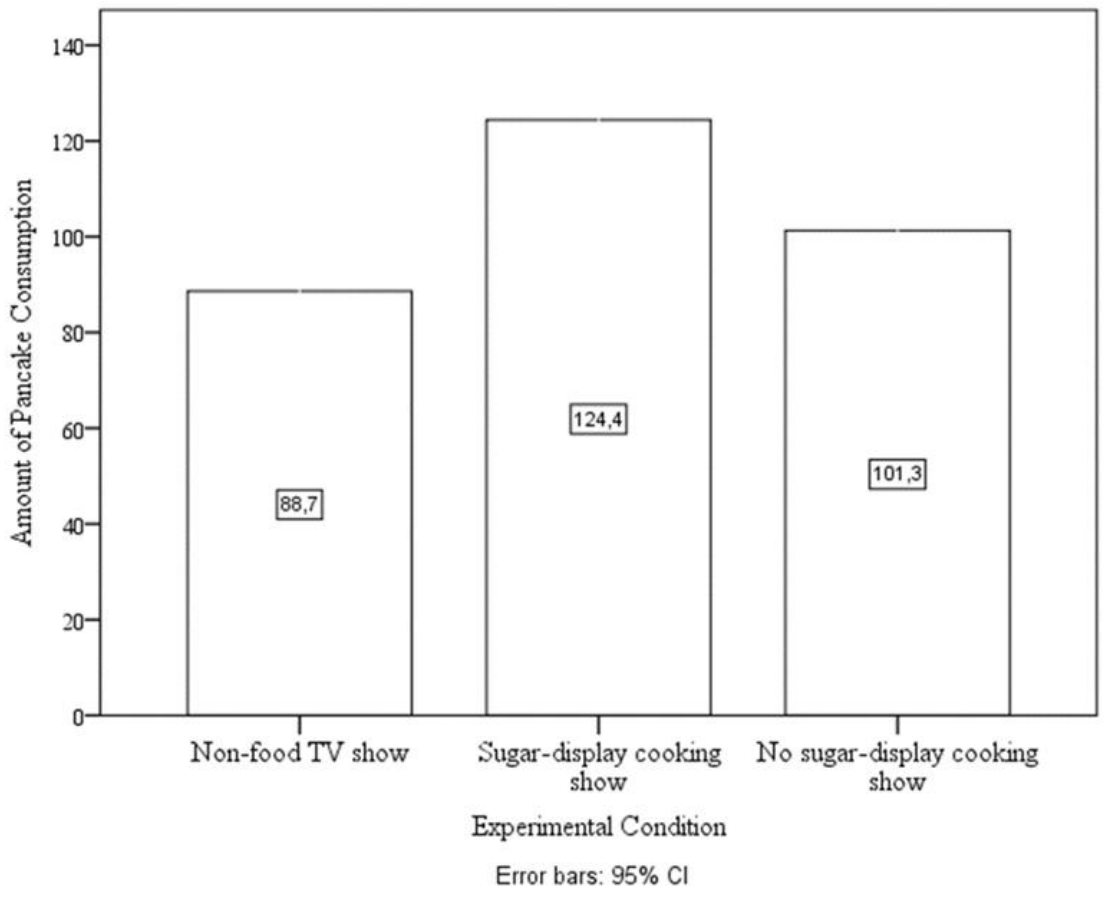


Figure 2. Amount of pancake consumption (grams) by experimental condition

The moderating effect of BMI

To assess whether children's BMI would moderate the impact of watching a TV cooking show on sugar usage and pancake consumption (Hypothesis 3), two separate ANOVA's were conducted with level of hunger as a covariate and BMI percentile as a moderator. Levene's test was nonsignificant for sugar usage ($F(2, 61) = 1.40$, $p = .253$) and significant for pancake consumption ($F(2, 60 = 4.29$, $p = .018$). No interaction-effect was found between the experimental condition and BMI percentile to predict sugar usage ($F(2, 57) = 0.005$, $p = 0.995$, $\eta p^2 = 0.00$). The main effect of BMI percentile was also nonsignificant ($F(1, 57) = 0.790$, $p = 0.378$, $\eta p^2 = 0.014$). However, the main effect of level of hunger was significant ($F(1, 57) = 11.18$, $p = 0.001$, $\eta p^2 = 0.164$). No interaction effect was found between the experimental condition and BMI percentile to predict pancake consumption ($F(2, 56) = 1.05$, $p = 0.357$, $\eta p^2 = 0.036$).

The effect of age

To examine whether the impact of observing descriptive portion-size norms in a TV cooking show depends on age (RQ1), a factorial ANOVA was conducted with the experimental condition and age-group (1st grade vs 5th grade) as independent variables and sugar usage as the dependent variable. Since Levene's test was significant ($F(5, 104) = 4.42$, $p = .001$) robust methods were used (BCa bootstrapping). The analysis yielded significant main effects for the experimental condition ($F(2, 104) = 5.19$, $p = 0.007$, $\eta p^2 = 0.091$) and age-group ($F(1, 104) = 24.44$, $p < 0.001$, $\eta p^2 = 0.19$). However, the interaction effect was nonsignificant ($F(2, 104) = 1.63$, $p = 0.201$, $\eta p^2 = 0.03$). Simple effects analysis showed that the experimental condition only had a significant effect among children from the oldest age-group ($F(2, 104) = 5.84$, $p = 0.004$), but not among younger children (see Figure 3) ($F(2, 104) = 1.68$, $p = 0.191$). Bootstrapped planned contrasts showed that children from the 5th grade used significantly more sugar on their pancakes in the sugar-display condition compared to children in the no-sugar display condition ($t(38.819) = 2.54$, $SE = 4.13$, $p = 0.016$, CI [2.21, 18.80], $d = 0.72$, see Figure 4) and the non-food condition ($t(21.503) = 5.58$, $SE = 3.40$, $p = 0.001$, CI [12.07, 25.94], $d = 1.89$). Further, children in the no sugar-display condition used significantly more sugar on their pancakes than children in the non-food condition ($t(44.983) = 2.96$, $SE = 2.88$, $p = 0.008$, CI [2.72, 14.28], $d = 0.66$).

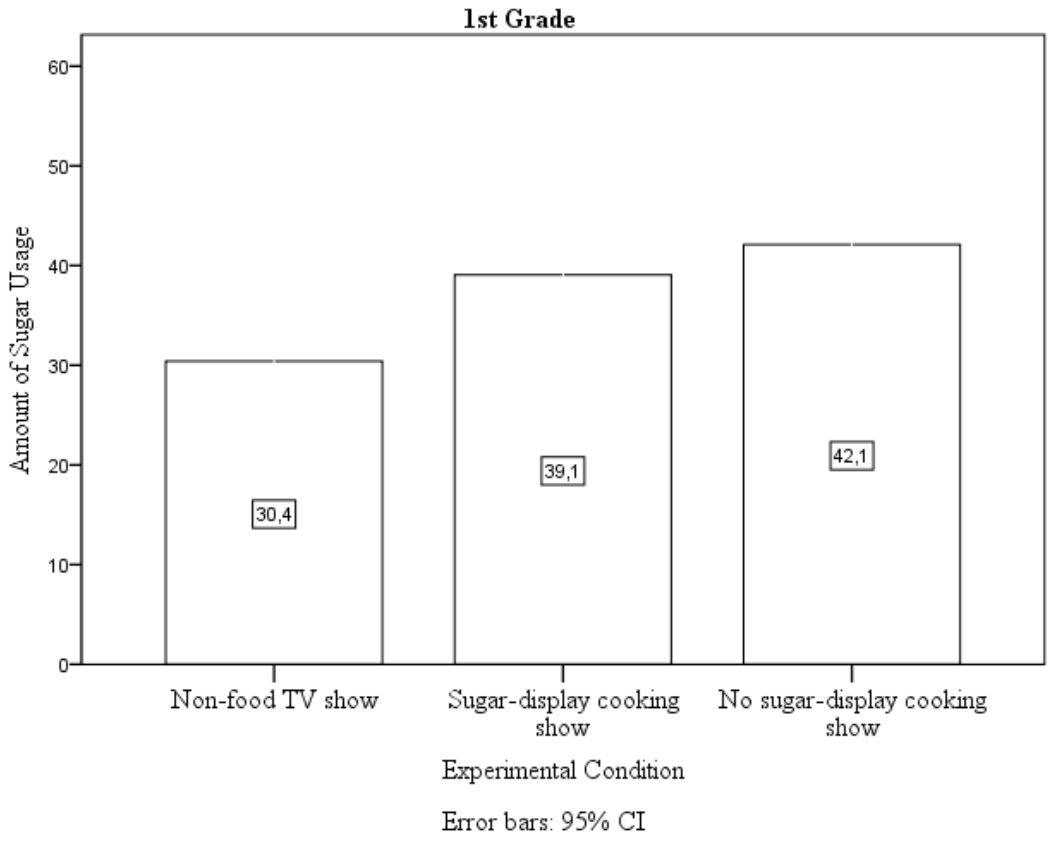


Figure 3. Amount of sugar use (grams) by experimental condition (1st grade)

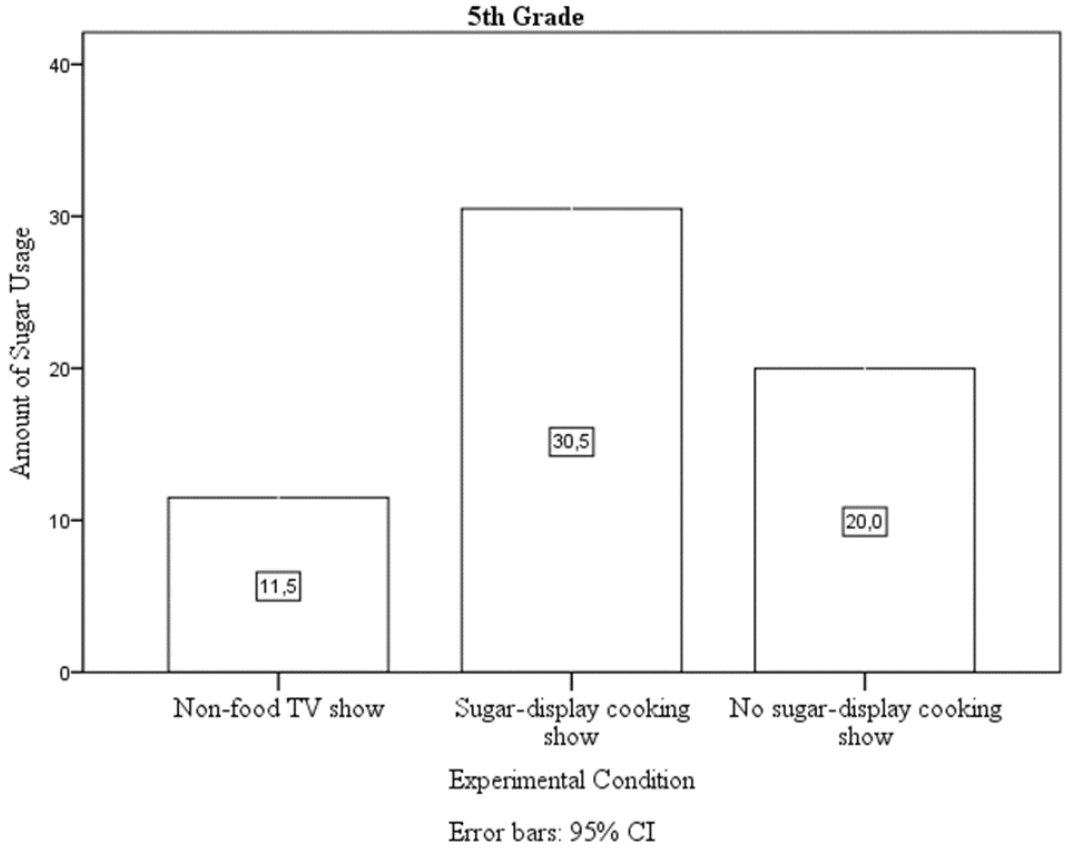


Figure 4. Amount of sugar use (grams) by experimental condition (5th grade)

Discussion

The main purpose of the current study was to examine the impact of watching a TV cooking show on children's food preparation and consumption. Several studies have shown that descriptive norms on typical food portions influence the amount of food consumption in both children and adults (e.g. Fisher et al., 2003; Robinson et al., 2014; Rolls et al., 2004). Therefore, the first aim of the present study was to evaluate the impact of observing descriptive portion-size norms in a TV cooking show on the amount of sugar children used on their pancakes. Children were either shown an episode of a TV cooking show that clearly showed the sugar portion-size that was used, or the same episode without the scene communicating the sugar portion-size, or an episode of a non-food TV programme. An advantage of this study was the use of a popular TV cooking show where children are actually exposed to, which improves the external validity of the results.

The results showed that children sprinkled significantly more sugar on their pancakes after watching (one of the versions of) a cooking show episode compared to watching a non-food TV show. However, children's sugar selection did not differ significantly between the cooking episode that did and did not show how much sugar the chef sprinkled on his pancakes. Hence, it seems that the amount of sugar that the children sprinkled on their pancakes was influenced by observing the food cues (pancakes, sugar) in the TV cooking show rather than by observing the actual sugar portion-size that was used. This finding corresponds to cue reactivity theory (Boyland et al., 2016; Jansen, 1998). According to cue reactivity theory, merely seeing palatable foods may activate food cravings and thus indirectly increase the amount of food that is selected and consumed (Boyland et al., 2016; Jansen, 1998). An alternative explanation for the lack of a portion-size norm effect might be that the children did not pay conscious attention to the sugar portion-size that was communicated in the TV cooking episode, thereby diminishing the difference between the experimental condition that did and did not display the sugar portion-size that was used.

In addition, further analyses showed that the impact of our experimental manipulation was non-significant after controlling for children's level of hunger; habitual sugar usage and attitudes towards the TV programme. Further inspection showed that, when comparing only the no-sugar display condition and the non-food condition, the amount of sugar the children sprinkled on their pancakes was explained by their level of hunger and habitual sugar usage rather than by the experimental manipulation. However, children did sprinkle significantly more sugar on their pancakes in the sugar-display condition compared to the non-food condition, even after controlling for habitual sugar usage, level of hunger, and liking the TV programme. This finding suggests that

watching a TV cooking show only influences children's sugar usage when a sugar portion-size is displayed. It further indicates that observing descriptive portion-size norms in media may affect the amount of ingredients children select regardless of their level of hunger and eating habits. Overall, the data thus suggest that although controlling for children's level of hunger and habitual sugar usage reduces the effects of the experimental manipulation, these effects do not completely disappear.

A secondary aim of this study was to assess whether children would consume more pancakes after watching a TV cooking show compared to a non-food TV show, as suggested by cue reactivity theory (Boyland et al., 2016; Jansen, 1998). We found that children who had watched a cooking episode consumed significantly more of the pancakes than children who had watched the non-food TV show. This is consistent with previous research that found that adults ate more chocolate after exposure to a cooking program compared to an adventure programme (Bodenlos & Wormuth, 2013). Further, our results showed that children who watched the TV cooking show that displayed the sugar portion-size norm also ate a larger amount of the pancakes on average compared to children who had watched the cooking show that did not display the sugar portion-size norm. These findings provide further support for the food cue reactivity theory, stating that food cues can activate the urge to snack (Boyland et al., 2016; Jansen, 1998), since children ate the largest amount of pancakes on average in the condition in which two food cues, pancakes and sugar, were prominently featured. A possible explanation might be that observing two palatable food cues has a greater impact on eating behavior than observing only one food cue. Although this effect might also depend on the degree to which two food cues match well together (strawberry's & chocolate versus strawberry's and mustard).

A third aim of this study was to examine the potential moderating role of children's BMI. Surprisingly, children's BMI percentile (Barlow & committee, 2007) did not moderate the influence of exposure to a TV cooking show on sugar selection and pancake consumption. This is in contrast with prior studies that found that children with a higher BMI were more susceptible to food advertising and food cues in general (Francis, Lee, & Birch, 2003; Halford et al., 2008; Kaur et al., 2003). One explanation for the lack of this interaction effect might be that the variation in BMI was rather small in this sample: all BMI scores were situated between 14 and 22 and only 7% of the children were overweight.

A final aim of this study was to explore whether older children would be more susceptible to viewing a portion-size norm in a TV cooking show. Separate age-group analyses yielded an interesting finding. Observing descriptive portion-size norms in a TV cooking show only appeared to influence food preparation in older (5^{th} grade) but not younger children (1st grade). This finding

may be explained by socialization theory stating that the susceptibility to social norms is stronger during adolescence (Coleman, 2011). The oldest age-group in this sample are children from late childhood who are almost reaching adolescence. Adolescence is a developmental phase in which conforming to (peer) social norms is perceived to be of crucial importance (Brown et al., 2008; Coleman, 2011). Subjective peer norms have already been shown to strongly influence food intake in (pre)adolescents aged 10 to 17 (Stok et al., 2015).

To conclude, this study shows that watching a TV cooking episode that displays portion-size norms influences children's selection of ingredients even beyond the effects of hunger and (sugar) eating habits. However, separate analyses per age-group suggest that this effect only holds for the older children in this sample (5^{th} grade). Furthermore, the results showed that watching a TV cooking episode affects children's food consumption even after controlling for children's hunger level and attitudes towards the TV programme. Moreover, children who watched the cooking episode in which the sugar portion-size was shown ate significantly more pancakes than children who watched the same episode without the scene displaying the sugar portion-size. This effect might be explained by the fact that children were exposed to two (matching) food cues (pancakes and sugar) instead of one in the sugar-display condition. In line with food cue reactivity theory, it can be expected that observing two matching food cues evoke stronger behavioral effects than observing only one food cue (Boyland et al., 2016). In addition, it was found that the more the children liked the TV show, the less pancakes they consumed. Children who liked the TV show might have paid less attention to the food cues and portion-size cues, while paying more attention to the content (learning how to cook versus learning about nature). Finally, in this study, the impact of watching a TV cooking episode on children's selection of ingredients and food consumption did not differ by children's BMI.

The results of this study are consistent with prior research which showed that food advertising affects eating behavior in both children and adults (Boyland et al., 2016; Folkvord et al., 2016), as well as previous studies that showed that watching cooking shows increases adults' consumption of sweet snacks (Bodenlos & Wormuth, 2013). Within the literature these effects are usually explained by cue reactivity theory, which is part of priming theory (Bodenlos & Wormuth, 2013; Harris et al., 2009). Exposure to food cues can prime mental representations which subsequently induce cravings thereby influencing behavioral responses (Bodenlos & Wormuth, 2013; Harris et al., 2009; Jansen, 1998). Since food cues are ubiquitous and have been shown to exert strong, automatic behavioral effects beyond the effects of hunger and eating habits (Boyland et al., 2016; Harris et al., 2009; Norman et al., 2016), future research should further explore the role of children's level of impulsivity and attentional bias. Previous research has shown that these are

important variables that influence individual susceptibility to advertising and media exposure (Folkvord, Anschütz, Nederkoorn, Westerik, & Buijzen, 2014; Folkvord, Anschütz, Wiers, & Buijzen, 2015). In an obesogenic world where children are constantly exposed to and seduced by palatable food cues, their abilities to control their impulses and regulate their behaviors might be their most powerful tool to cope with these temptations. Hence, future research should explore whether impulse-control training and education might empower children against media messages that promote an unhealthy diet and overconsumption.

In line with previous research, this study has also shown that portion-size cues affect the amount of ingredients (older) children select (e.g. Neyens et al., 2015). This may be problematic because TV chefs typically tend to prepare rather large portions of palatable, energy-dense meals. Since eating habits that are learned as a child will continue to exert an influence during adult life (Birch & Fisher, 1998; Birch, 1999; Lake et al., 2004; Skinner, Carruth, Bounds, & Ziegler, 2002), it is important to develop guidelines for such TV cooking shows. For instance, TV cooking shows may function as a tool to actually teach viewers how to cook healthy meals and adopt a healthy diet. Such initiatives already exist, for example, the famous British TV chef Jamie Oliver has started ‘a crusade to save Britain's health’ (Boseley, 2015).

Appendix 2.

Figure 5. Visual analogue scale: habitual sugar usage (adapted from Smits & Vandebosch, 2012)



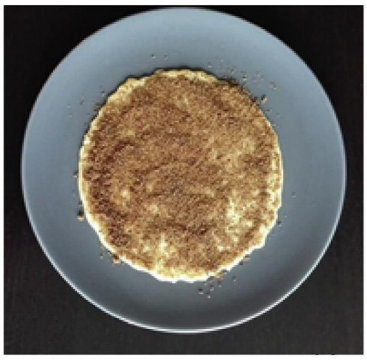
No Sugar



Very few sugar



Few sugar



Much sugar



Very much sugar



I don't know

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PART 3

Chapter 4. Candy-Specific Cognitive Training Only Attenuates the Effects of TV Food Advertising on Children's Candy Intake in High Consumers[4]

Abstract

The effects of food marketing on children's food intake and body weight are well documented as a global public health concern. Emerging evidence suggests that interventions that modify children's automatic approach responses towards palatable food cues in advertising reduce the impact of playing a food advergame on children's snack intake. However, these results remain to be validated by further research. This study examined whether a Go/No-Go training procedure diminishes the influence of TV food advertising exposure on children's food intake. It also explores the potential moderating roles of impulsiveness, taste preferences, brand attitudes and habitual consumption of the test item (candy). Four hundred and forty-nine children (aged 9 to 14 years, M_{age}= 10.82, SD = .79, 55.5 % boys) were randomly assigned to be exposed to either food or non-food TV advertising following completion of a candy-specific Go/No-Go task or a Go/No-Go control task. Children were exposed to a TV fragment containing either a series of three TV commercials, one of which was for Haribo jelly candy (experimental group), or a series of three non-food TV commercials (control group). The children were allowed to snack from an individual bowl of jelly candy (42 grams) during TV exposure. Total amount of candy intake was measured after TV exposure. There were no main effects of the Go/No-Go task and food advertising exposure on children's candy intake. However, there was a significant main effect of the Go/No-Go task on candy intake for both food and non-food advertising among children who reported above average scores on habitual candy consumption, taste appreciation and brand attitudes. Hence, performing a Go/No-Go food task prior to advertising exposure only appears to diminish candy intake among high candy consumers. Future studies should further examine whether individual susceptibility factors such as eating habits, taste preferences and impulsiveness moderate the ability of a Go/No-Go food task to mitigate the influence of food advertising exposure on children's ad libitum snack intake.

Introduction

The number of children with overweight and obesity has reached alarming levels over the last decade, and continues to rise (World Health Organization, 2016; Ogden et al., 2015; Gisle &

[4] Based on Neyens, E., Smits, T, & Boyland, E. (submitted).Candy-specific cognitive training only attenuates the effects of TV food advertising on children's candy intake in high consumers, submitted to Pediatric Obesity.

Demarest, 2013). One contributing factor in this phenomenon is the obesogenic environment in which children are living today, which is characterized by the ubiquity of unhealthy foods (De Ridder, De Vet, Stok, Adriaanse, & De Wit, 2013) that are continually marketed (Galbraith-Emami & Lobstein, 2013; Powell, Harris, & Fox, 2013). Food marketing contributes to the development of obesity in children by stimulating an unhealthy, high-caloric diet and overconsumption (Boyland et al., 2016; Folkvord, Anschütz, Boyland, Kelly, & Buijzen, 2016; Norman, Kelly, Boyland, McMahon, 2016; WHO, 2016) that is not compensated for at later eating occasions (Norman et al., 2018).

Policy progress to reduce children's exposure to unhealthy food marketing has been slow (WHO, 2016) and therefore it is important to identify and evaluate other methods through which young people may be protected against the harmful impacts. To date, researchers have mainly focused on advertising literacy interventions that train children how to recognize advertising's persuasive intentions and have critical views of marketing material. However, evidence for the efficacy of these interventions is mixed and inconclusive (e.g. Hudders, Cauberghe, & Panic, 2015; Neyens, Smits, & Boyland, 2017; Rozendaal, Buijs, & van Reijmersdal, 2016; van Reijmersdal, Boerman, Buijzen, & Rozendaal, 2017). Moreover, advertising literacy interventions only address conscious decision-making, but marketing increasingly operates at a subconscious, emotional level that subverts more rational processes (WHO, 2016) and thus it is very unlikely that such interventions will suffice to counter the automatic influence of food advertising on youngsters' actual eating behavior (Büttner, Florack, & Serfas, 2014; Harris, Brownell, & Bargh, 2009; Nairn & Fine, 2008).

Dual-process models of behavior state that eating behavior is not only driven by reflexive processes, but also by impulsive drivers, such as external food cues, which stimulate automatic approach behaviors towards palatable foods (Bruce et al., 2015; Hoffman, Friese, & Wiers, 2008; Strack & Deutsch, 2004). Food-related cues, such as the mere sight or scent of palatable foods, are known to evoke a motivation to seek and indulge in rewarding foods, even where the conscious intention is to refrain from eating (Appelhans, 2009; Cohen, 2008; Hoffman et al., 2008; Strack & Deutsch, 2004). Consistent with the *Food Cue Reactivity Theory* (Jansen, 1998), studies have shown that exposure to food-related stimuli can stimulate eating behavior by triggering thoughts about food (Jansen, 1998; Nijs, Muris, & Franken, 2010), a hedonic desire for food (Nederkoorn, Smulders & Jansen, 2000), and physiological reactions such as increased saliva production and gastric activity (Nederkoorn et al., 2000; McCrickerd & Forde, 2016; Spence, Okajima, Cheok, Petit, Michel, 2015). Therefore, the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord, Anschütz, Boyland, Kelly, Buijzen, 2016), predicts that images of palatable

foods in advertising can influence people's eating behavior by automatically inducing eating-related motivations. Several experiments have shown that children consume significantly more food after watching TV food advertising compared to non-food or no advertising, even in the absence of hunger (Halford et al., 2004; 2007; 2008; Harris, Bargh, & Brownell, 2009). Recent research also indicates that even perceiving food cues outside of a marketing context, for instance in TV cooking shows, influences children's food preferences and intake immediately after exposure (Neyens & Smits, 2017; Ngqangashe et al., 2018).

Furthermore, the REFCAM expects food cue reactivity, or the extent to which food cues trigger cravings and eating behavior, to be even stronger among highly impulsive people (Folkvord et al., 2016). Impulsive people typically have an increased tendency to seek and pursue rewards in response to environmental cues (reward sensitivity) and are less able to suppress unwanted behavior (inhibitory control) (Bickel, Jarmolowicz, Mueller, Gatchalian, & McClure, 2012; Jones et al., 2016; Nigg, 2000). Several studies have linked higher levels of reward sensitivity and lower levels of inhibitory control to overeating and being overweight (e.g., Houben & Jansen, 2014; Houben, Nederkoorn, & Jansen, 2014; Nederkoorn, Jansen, Mulkens, & Jansen, 2007; Nederkoorn, Guerrieri, Havermans, Roefs, & Jansen, 2009; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010; Nederkoorn, Coelho, Guerrieri, Houben, & Jansen, 2012). Moreover, a number of experiments have shown that food cue responsiveness is moderated by reward sensitivity and inhibitory control (e.g., Hofmann, Friese, & Roefs, 2009; Hofmann, Rauch, & Gawronski, 2007; Nederkoorn, Houben, Hofmann, Roefs, & Jansen, 2010). Tetley, Brunstrom, and Griffiths (2010), for example, found that highly impulsive women experienced a greater increase in appetite after exposure to a pizza cue compared to low impulsive women, regardless of being food deprived or not. Furthermore, Folkvord, Anschütz, Nederkoorn, Westerik, and Buijzen, (2014) found that highly impulsive children were less able to suppress the urge to snack while playing an advergame promoting sugary snacks than children with lower impulsiveness, even when they were promised a reward to refrain from eating.

Since food advertising can induce automatic eating behavior which is difficult to override by explicit, cognitive processes, that might be influenced by advertising literacy and health knowledge (Hoffman et al., 2008; Strack & Deutsch, 2004; Folkvord et al., 2016), it may be more effective for an intervention to intervene directly in young people's automatic approach responses towards food stimuli (Veling, Aarts, & Papies, 2011; Veling, Aarts, & Stroebe, 2013). Therefore, contemporary research is now focusing on inhibitory control interventions, such as the Stop Signal task and the Go/No-Go task, that aim to teach people to suppress their habitual responses towards appetitive cues (Folkvord, Veling, & Hoeken, 2016; Groppe & Elsner, 2014; Jones et al., 2016). Veling, Aarts

& Stroebe (2013), for example, successfully modified adult participants' impulsive choices of unhealthy foods using a Stop Signal task that repeatedly associated stop signals with images of these foods.

The Go/No-Go task and the Stop Signal task are developed to strengthen inhibitory control by teaching participants to associate (images of) palatable foods with a 'No-Go' or 'Stop' response during a computer task (Houben & Jansen, 2011). The Go/No-Go task requires participants to inhibit a habitual behavioral response whenever a No-Go cue is offered, and these No-Go cues are consistently paired with the experimental triggering stimuli, e.g. appetitive food cues. The Stop Signal task presents participants with repetitive trials of Go signals upon which they should act, but they are subsequently trained to inhibit this response whenever a Stop signal follows the Go signal (Verbruggen & Logan, 2008). Through repetition, the association will grow stronger, and a No-Go or Stop response will be generated automatically upon seeing an unhealthy food cue, thereby gradually developing response inhibition or automatic suppression of the urge to snack upon seeing unhealthy food cues (Houben & Jansen, 2011; Verbruggen & Logan, 2008).

Recent meta-analyses have shown that both Stop Signal and Go/No-Go interventions training young adults to suppress automatic behavioral responses towards food resulted in a decreased intake of energy-dense foods (Allom, Mullan, & Hagger, 2015; Jones et al., 2016; Stice et al., 2016). These meta-analyses further indicated that Go/No-go tasks have a stronger inhibitory effect than Stop-Signal tasks. Houben and Jansen (2015), for instance, showed that female students ate significantly less chocolate after being trained to suppress impulsive responses towards chocolate in a Go/No-Go task compared to students in the control group.

However, very little is known about the potential of Go/No-Go training interventions to reduce the impact of food advertising on children's eating behavior. To our knowledge, only Folkvord, Veling, and Hoeken (2016) have shown that teaching children (aged 7-10) to associate No-Go behaviors with unhealthy food in a Go/No-Go training task significantly decreased their caloric intake after exposure to both a food advergame and a non-food advergame (Cohen's $d = 0.44$).

However, since this prior study only focused on children between 7 and 10 years old, the effectiveness of a Go/No-Go task among older children and teenagers remains unclear. On the one hand, children's inhibitory control system becomes more strongly developed as they grow older (Sowell, Thompson, Holmes, Jernigan, & Toga, 1999; Casey, Jones, & Hare, 2008; Vara, Pang, Vidal, Anagnostou, & Taylor, 2014). On the other hand, it is well-documented that impulsivity and risk-taking peak during adolescence (Romer et al., 2009; Steinberg, 2007).

Therefore, a first aim of the current study was to examine whether a Go/No-Go task may also counteract the harmful effects of food marketing on the eating behavior of (pre)teens between 9 and 14 years old. Based on Folkvord et al. (2016), it was hypothesized that associating a No-Go cue with energy-dense snacks in a Go/No-Go task would decrease children's caloric intake (Hypothesis 1). Furthermore, since TV food advertising is known to stimulate children's eating behavior (Harris et al., 2009; Boyland et al., 2016), it was hypothesized that children would consume significantly more candy (kcal) after exposure to TV food advertising compared to exposure to non-food TV advertising (Hypothesis 2). Moreover, it was expected that performing a Go/No-Go training task would diminish the impact of TV food advertising exposure on children's food intake (Hypothesis 3).

A second aim of this study was to examine whether the influence of food marketing exposure on children's eating behavior is moderated by children's level of impulsiveness, as proposed by the REFCAM (Folkvord et al., 2016). More specifically, it was expected that children's level of impulsiveness, as measured via behavioral inhibition and approach systems (BIS/BAS scales), would moderate the impact of food advertising on food intake (Hypothesis 4).

A final aim of this study was to examine whether the ability of a Go/No-Go training task to diminish the impact of food advertising exposure on children's eating behavior was moderated by children's level of impulsiveness. Based on the study by Folkvord et al. (2014) it was predicted that a Go/No-Go task would be less effective among highly impulsive children (Hypothesis 5).

Method

Participants and design

An experiment was designed based on the work of Folkvord et al. (2016), using the same Go/No-Go task and food stimuli, yet focusing on TV food advertising instead of an advergame and (pre)teenagers instead of young children. To address the hypotheses, a between-subjects design was used in which the manipulations were the type of TV advertising (food or nonfood) and the type of training task (Go/No-Go or control) the children were exposed to. Data-collection occurred between March and May 2017. Four hundred and forty-nine children aged 9-14 years old (M_{age}= 10.82, *SD* = .79, 55.5 % boys) were recruited from nine elementary and secondary schools in Flanders. The experimental procedure was approved by the first author's Social and Societal Ethics Committee (SMEC). After approval by the school board, the parents of the children received an informed consent letter with comprehensive information about the study. Parents were asked to give permission for their child to participate in the study and to indicate whether their child was allergic to the test food. Those children who were allergic to the test food did not participate in the study.

Both the parents and the children were informed that the data collection would remain confidential and that children were free to cease participation at any time.

Manipulations and procedure

TV food advertising

The children were randomly assigned to watch either food or non-food TV advertising at class level. In the experimental group, children saw a series of three TV advertisements, one of which was a 30-second food advertisement for Haribo, a well-known candy brand. The other two advertisements promoted non-food products, one of which was a car commercial (42 seconds), the other a toy commercial (15 seconds). In the control group, children saw a series of three non-food advertisements. Here, the Haribo candy advertisement was replaced by a Kidizoom Action Cam toy advertisement (42 seconds). The other two advertisements were the same as in the experimental group.

Go/No-Go task

The Go/No-Go task exposed children to randomly alternating images of candy or cute animals on a computer screen which were presented for 1000 ms (or until a response was recorded). Colored borders appeared around the images exactly 100 ms after the image was shown. The children were instructed to press the spacebar when a blue border appeared around the image (go trials), and to refrain from responding when a gray border appeared (no-go trials). Children were told to respond as quickly as they could while making as few mistakes as possible. Whenever children made a mistake, a red cross appeared for 500 ms.

In total there were 132 trials, half of which (66) were go trials. In the experimental condition, children were instructed to respond to 3 series of 22 images of animals, around which a blue border appeared, and to refrain from responding to 3 series of 22 images of candy, around which a grey border appeared. In the control condition, children were either required to respond to 3 series of 22 images of animals, or refrain from responding to 3 series of 22 images of colored circles. On average the task lasted about 6 minutes.

Procedure

First, the children completed a Go/No-Go task on the computer using the Inquisit program (cf. Folkvord, Veling, & Hoeken, 2016; https://www.millisecond.com). This program randomly assigns the participants to either a Go/No-Go task or a control task. The children conducted this task at class level in the computer room of the school in small groups of about 10 children. Next, all participants were requested to watch a short TV fragment incorporating a series of three advertisements. All children were exposed to a fragment of the popular TV show *Ghost Rockers* (KetNet, Flemish Public Broadcast Channel for Youth) embedding a series of TV advertisements. This TV show is produced by Studio 100, a well-known Belgian producer of youth films and series, and is about a group of teenagers who play paranormal musical instruments and solve mysteries. The TV fragment lasted 13 minutes and 41 seconds and was interrupted by a block of advertising after approximately 7 minutes.

The cover story for the entire study was that the researcher was seeking children's opinions on this particular TV series. Then, they were told that they could snack during TV viewing as a reward for participating in the research. The children all got an individual bowl of jelly candy (42 grams) prior to exposure to the TV fragment. The researcher gave the instruction: "*This is your bowl of Haribo candy for today. You can eat as much or as little as you like*". Finally, the children were asked to complete an online questionnaire addressing their brand attitudes, attitudes towards the ad, habitual candy consumption, inhibitory control and reward sensitivity, and advertising literacy.

Measures

Each child received a bowl containing 30 pieces (42 grams) of a mixture of different types of Haribo candy[5]. The amount of Haribo candy was counted before and after exposure to the TV fragment. The difference between both was recalculated into calories consumed by each individual participant.

The participants were asked to evaluate the TV show on a 4-point Likert Scale ranging from "no fun at all" (1) to "very funny" (4). Children were also asked to give their opinion on the shows using an open question.

Children's level of hunger before viewing the TV show was measured using Birch and Fisher's Cartoon Hunger Scale (2000, p. 1343). Habitual candy consumption was assessed using a shortened version of the Food Frequency Questionnaire (FFQ) (cf. De Cock et al. (2016).

[5] Including Haribo Worldmix, Funny Mix, Happy Cherries, Sour Cherries, Happy Cola, & Dragibus Soft.

The children were asked to answer three items: 1) "How often do you eat sweets?"; 2) How often do you eat sweets like Haribo?", and 3) "How often do you eat sweets such as Coca-Cola bottles?". The response categories were: never, rarely, about once a month, several times a month, about once a week, several times a week, daily. Together these items formed a reliable scale (α = .79).
To measure children's general taste appreciation of Haribo candy they were asked to indicate how much they like Haribo candy ("I think Haribo Sweets are …") on a 4-point Likert scale ranging from "not at all tasty" (1) to "very tasty (4) with a "I don't know option.

Brand attitudes were measured on a seven-point semantic differential scale using five items (e.g. boring – interesting, α = .83) (Matthes, Schemer, & Wirth 2007). Attitudes towards the advertisement were addressed using 4 items such as "How much did you like the Haribo advertisement?" scored on a 5-point Likert scale with a 'I did not see any Haribo advertising" option (α = .44[6]); Derbaix, Blondeau & Pecheux, 1999; Derbaix & Pecheux, 2003).

Advertising literacy was assessed using the multidimensional scale developed by Rozendaal, Opree and Buijzen (2016). Participants' conceptual advertising literacy was measured using the Conceptual Advertising Literacy Scale for Children (CALS-c; Rozendaal et al., 2016). Advertising recognition was measured by asking: "Did you see any advertising during the TV fragment?" (Yes, for sure; Yes, I think so; No, I don't think so; No, certainly not). Participants' comprehension of selling intent was measured using 2 items such as: "Are commercials on television there to make you buy the advertised products? (Yes, for sure; Yes, I think so; No, I don't think so; No, certainly not). Comprehension of persuasive intent was measured using 3 items such as: "Are commercials on television there to make you think positively (i.e., happy thoughts) about the advertised products?" (Yes, for sure; Yes, I think so; No, I don't think so; No, certainly not; α = .61).
Source recognition was measured by asking: "Who do you think pays for the making of television commercials?" with the following options: The television network that shows the commercial; The people who created this questionnaire; The companies that make the products in the commercial; The actors in the commercial; Otherwise, namely ....

The degree of impulsiveness was measured using the BIS scale, the BAS-Drive, and the BAS-Reward Responsiveness subscales of the Dutch version of the BIS/BAS scale (Carver & White, 1994; Franken, Muris, & Rassin, 2005). These scales have been shown to be strongly related to adolescents' eating behavior (De Cock et al., 2016 (aged 12-14)) and an age-modified version has been validated in a child population (Muris, Meesters, de Kanter, Timmerman, & Eek, 2005).

[6] Removing an item (How interesting did you found the Haribo advertisement?) yielded a higher cronbach's alpha of .9, but even then, AAD had no significant impact on calorie intake.

The BIS scale contains seven items such as: "I worry about making mistakes" and is scored on a 4-point scale ranging from totally disagree to totally agree. However, this scale showed a very low reliability in this study (α = .38), and deleting items did not improve the scales' reliability. Hence this scale was not included in our analyses. The BAS-Drive consists of 4 items such as: "When I go after something I want, I move on it right away" (4-point scale totally disagree-totally agree) (α = .65). The BAS Reward responsiveness scale consists of 5 items such as " When good things happen to me, it affects me strongly" (4-point scale totally disagree-totally agree) (α = .67).

Finally, the children were asked about the purpose of the study ("What do you think the purpose of this study was?") (Haynes et al., 2015). Only .06% of the children understood that the purpose of the study was to investigate the influence of food advertising exposure on their candy intake (N= 27). None of the children mentioned the purpose of the Go/No-Go or control task.

Analyses

Randomization checks showed no significant differences between the experimental conditions for age, sex, liking the TV series, habitual candy consumption, Haribo taste appreciation, and hunger (all $p >$. 05). Children's BIS score (F(1, 447) = .62, p = .430, η^2 = .0014, 90% CI [.0000 - .00129]), BAS reward score (F(1, 447) = .09, p = .770, η^2 = .0002, 90% CI [.0000 - .0071]), and BAS drive score (F(1, 447) = .18, p = .671, η^2 = .0004, 90% CI [.0000 - .0088]), did not differ significantly between the Go/No-Go food training and Go/No-Go control training condition, which is not surprising given that these are trait measures that would not be expected to capture manipulated state differences. Habitual candy consumption (r = .15, p = .002), Haribo taste appreciation (r = .15, p = .002), level of hunger (r = .21, p < .001), brand attitude (r = .15, p = .001) and understanding persuasive intent (r = .09, p = .060, marginally significant) were significantly related to calorie intake (M = 87.07, SD = 51.29, range = 0-140.3).

To examine the first three hypotheses, a two-way between-participant ANOVA was conducted with the amount of Haribo consumption (kcal) as the dependent variable, and TV advertising exposure (food vs non-food) and impulse-control training (Go/No-Go: food vs control task) as the independent variables. To examine whether the influence of food advertising exposure on candy consumption differs depending on children's level of impulsiveness (hypothesis 4), a univariate ANCOVA was conducted with candy consumption as the dependent variable, food advertising exposure as the independent variable and hunger level, BAS Reward and BAS drive as covariates. To test the hypothesis that children's level of impulsiveness moderates the influence of a Go/No-Go task on candy consumption (hypothesis 5), a univariate ANCOVA was conducted with

candy consumption as the dependent variable, impulse-control training as the independent variable and hunger level, BAS Reward and BAS drive as covariates.

In addition to the main analyses, some explorative analyses were performed to investigate the potentially moderating roles of age, advertising literacy and eating habits.

Results

Descriptive statistics

About 97% of the sample reported that they had noticed advertising during the TV series. The majority (72.6%) of the children were aware of the commercial source of advertising in general. Children's understanding of advertising's commercial intent (M = 2.67, SD = .47, *range* = 4), and persuasive intent was rather high (M = 2.62, SD = .70, range = 3). The mean candy consumption (kcal) in this sample was rather low (M = 87.07, SD = 2.42, range = 0-140.3).

Impact of Advertising Exposure and Impulse-Control Training on Food Intake

The univariate ANOVA analysis yielded a nonsignificant Levene's test (F(3, 445) = .92, p = .431) indicating equal variances in candy intake across the experimental conditions. There was no significant main effect of training task on calorie intake (F(1, 445) = .11, p = .739, η^2 = .0002, 95% CI [.0000 - .0076]). Bootstrapped *post hoc* tests revealed that children who performed a Go/No-Go food task did not eat significantly less candy compared to children who performed a Go/No-Go control task (M_{food} = 86.50, SD = 3.46, $M_{control}$ = 88.15, SD = 3.52; $Mdiff$ = 1.65, SE= 4.83, p = .745, 95% CI [-7.76- 11.09]). Hence, the first hypothesis was not supported.

There was no main effect of food advertising exposure on calorie intake (F(1, 445) = .044, p = .834, η^2 = .0001, 95% CI [.0000 - .0042]). Children in the food advertising condition did not eat significantly more candy compared to children in the non-food advertising condition (M_{food} = 86.80, SD = 3.15, $M_{non\text{-}food}$ = 87.84, SD = 3.81, $Mdiff$ = 1.04, SE = 4.95, p = .842, 95% CI [-8.64 - 11.51]). Hence, the second hypothesis was not supported. There was also no interaction between food advertising exposure and impulse-control training (F(1, 445) = 1.54, p = .215, η^2 = .0034, 95% CI [.0000 - .0183]), thereby the third hypothesis was not supported.

When level of hunger, habitual candy consumption, Haribo taste appreciation, brand attitude, and understanding persuasive intent were included in the model, there were no main effects of the Go/No-Go task (p = .506]), food advertising exposure (p = .894) and their interaction (p = .263). Level of hunger did have a significant positive effect on calorie intake (F(1, 423) = 12.55, p <.001, B = 14.46).

The Moderating Role of Impulsivity: BAS Reward and BAS Drive

The main effects of BAS Reward ($F(1, 442) = .90$, $p = .343$, $\eta^2 = .002$, 90% CI[.0000 -.0187]), and BAS Drive on calorie intake were nonsignificant ($F(1, 442) = .21$, $p = .650$, $\eta^2 = .00$, 90% CI [.0000 - .0126]). Further, the interaction terms between food advertising exposure and BAS Reward ($F(1, 442) = 0.0$, $p = .992$, $\eta^2 = .00$, 95% CI [.0000 - .0000]). and BAS Drive ($F(1, 442) = .40$, $p = .526$, $\eta^2 = .001$, 95% CI [.0000 - .0148]) were also nonsignificant. Hence, the fourth hypothesis was not supported.

The impact of a Go/No-Go task on calorie intake did not differ significantly according to children's BAS Reward ($F(1, 442) = .1.42$ $p = .235$, $\eta^2 = .03$, 95% CI [.0000 - .0219]), or BAS Drive ($F(1, 442) = .55$, $p = .460$, $\eta^2 = .001$, 95% CI [.0000 - .0161]). Hence, the fifth hypothesis was also not supported.

Explorative analyses

Prior meta-analyses have found significantly stronger effects of food marketing exposure on food intake among young children (≤ age 8) compared to older children and adults (Boyland et al., 2016; Sadeghirad et al., 2016). Theoretical models such as the PCMC-model (Buijzen et al., 2010) and the REFCAM (Folkvord et al., 2016) also expect that individual dispositional factors such as age, advertising literacy, eating habits and (taste & brand) preferences might moderate food advertising effects on children's food behaviors. Similarly, the potential of a Go/No-Go task to reduce the influence of food advertising exposure on candy intake might also differ depending on individual dispositional factors such as eating habits. To explore these moderating effects a series of ANCOVA's were conducted.

Age and advertising literacy as a Moderator

To explore the moderating roles of age and advertising literacy, two separate univariate ANCOVA's were conducted with candy consumption as the dependent variable, food advertising exposure as the independent variable, hunger level and habitual candy consumption as covariates, and either age or understanding persuasive intent as moderators. The results showed that the influence of food advertising exposure on candy intake did not differ significantly depending on children's age ($F(1, 443) = .85$, $p = .356$). Likewise, children's level of understanding advertising's persuasive intent did not significantly moderate the impact of food advertising exposure on candy intake ($F(1, 443) = .24$, $p = .621$).

Habitual Haribo Consumption as a Moderator

The impact of the Go/No-Go task on candy intake differed significantly according to children's habitual candy consumption ($F(1, 441) = 7.03$, $p = .008$). Children's calorie intake did not differ significantly between the Go/No-Go food task and control task at a mean level of habitual candy consumption ($M = 3.67$, *range* = 7)($M_{control} = 88.93$, $SE = 3.49$, 95% CI [82.15 - 95.63]; $M_{food} = 84.48$, $SE = 3.42$, 95% CI [80.10 - 94.10]); *Mdiff* = 2.46; $SE = 4.89$; $p = .616$), nor at a below average level (2.3), ($M_{control} = 74.66$, $SE = 4.77$, 95% CI [65.28 - 84.04]; $M_{food} = 85.19$, $SE = 4.94$, 95% CI [75.48 - 94.91]); *Mdiff* = -10.53; $SE = 6.87$; $p = .126$).

However, when children's habitual candy consumption was above average (5.04), children's calorie intake was significantly lower in the Go/No-Go food task compared to the control task ($M_{control} = 103.19$, $SE = 5.16$, 95% CI [93.06 - 113.33]; $M_{food} = 87.76$, $SE = 4.68$, 95% CI [78.56 - 96.96]); *Mdiff* = 15.44; $SE = 6.97$; $p = .027$). The interaction between habitual candy consumption and the Go/No-Go task did not differ depending on the type of advertising ($F(1, 441) = .006$, $p = .940$).

To explore the role of habitual candy consumption further, two groups were created based on the percentiles (low and high habitual candy consumers). Among the group of habitual candy consumers, the main effect of the Go/No-Go task on candy consumption was significant ($F(1, 194) = 4.58$, $p = .034$, $\eta^2 = .023$, 95% CI [.0000 - .0793]). Bootstrapped *post hoc* tests revealed that children who performed a Go/No-Go food task ate significantly less candy compared to children who performed a control task ($M_{food} = 87.52$, *SD = 4.69*, $M_{control} = 102.31$, $SD = 5.08$; *Mdiff = -14.79, SE= 6.77*, $p = .025$, 95% CI [-27.82- -1.95]). This effect remained significant after controlling for children's hunger level ($p = .023$). Among the low candy consumers, only level of hunger had a significant main effect on candy intake ($F(1, 246) = 13.31$; $p = .001$; $\eta^2 = .051$, 95% CI [.0110 - .1134]).

Further, even when looking only at the high candy consumers, the interaction term between impulse-control training and BAS reward was nonsignificant ($F(1, 193) = 1.55$, $p = .215$, $\eta^2 = .008$, 90% CI []), as well as the interaction term between impulse-control training and BAS Drive ($F(1, 193) = 1.55$, $p = .215$, $\eta^2 = .008$, 95% CI [.0000 -.0501]).

Haribo Tastiness and Brand Attitudes as Moderators

The impact of the Go/No-Go task on candy intake differed significantly according to children's Haribo taste appreciation ($F(1, 424) = 12.03$, $p = .001$) and brand attitudes ($F(1, 441) = 8.37$, $p = .004$). Children's candy intake did not differ significantly between the Go/No-Go food task and the control task at an average level of Haribo tastiness and brand attitudes . The same result was found for a below average level of brand attitude (4.16). At a below average level of Haribo tastiness (2.85), however, children's calorie intake was significantly higher in the Go/No-Go food task compared to the control task ($M_{control} = 74.78$, $SE = 4.64$, 95% CI [65.66 - 83.90]; $M_{food} = 88.51$, $SE = 5.12$, 95% CI [78.46 - 98.57]); $Mdiff = -13.73$; $SE = 6.91$; $p = .047$).

Interestingly, the main effect of the Go/No-Go task on candy intake was significant at an above average level of both Haribo tastiness and brand attitudes. More specifically, at an above average level of Haribo tastiness (4.09), children's calorie intake was significantly lower in the Go/No-Go food task compared to the control task ($M_{control} = 105.67$, $SE = 4.97$, 95% CI [95.90 - 115.43]; $M_{food} = 85.05$, $SE = 4.98$, 95% CI [75.27 - 94.83]); $Mdiff = 20.62$; $SE = 7.03$; $p = .004$). Similar results were found when looking at the main effect of the Go/No-Go task on candy intake at an above average level of brand attitudes (6.56) ($M_{control} = 103.79$, $SE = 4.99$, 95% CI [93.97 - 113.61]; $M_{food} = 86.79$, $SE = 4.76$, 95% CI [77.44 - 96.14]); $Mdiff = 17.00$; $SE = 6.89$; $p = .014$). The interactions between Haribo tastiness and the Go/No-Go task and between brand attitudes and the Go/No-Go task did not differ significantly depending on the type of advertising.

Discussion

The present study examined whether a Go/No-Go task teaching children to associate energy-dense snacks with a no-go response would diminish the impact of TV food advertising on children's candy intake. The results of this study do not support the view that inhibitory control training, such as a Go/No-Go task, reduces the effects of TV food advertising on children's snacking behavior.

First, contrary to our expectation, completing a Go/No-Go task did not decrease children's candy intake. Overall, children did not consume significantly less candy after a Go/No-Go food task compared to a control task. Further, the Go/No-Go task did not reduce children's candy intake in either the food or non-food TV advertising condition. These results contradict the findings of a previous experiment that has shown that a Go/No-Go task significantly decreased children's

(age 7-10) caloric intake after exposure to both a food and a non-food advergame (Folkvord, Veling, & Hoeken, 2016).

Second, we did not find a main effect of watching TV food advertising on children's candy intake, nor an interaction effect with the Go/No-Go task. Corresponding to the study of Folkvord et al. (2016), children did not consume significantly more candy after exposure to food compared to non-food TV advertising regardless of the type of task the children had completed (Go/No-Go food vs control task). This finding contradicts previous studies in which both children and adults ate significantly more after exposure to food compared to non-food advertising (Folkvord et al., 2013; Halford et al., 2007; Harris et al., 2009; Boyland & Halford, 2013; Boyland et al., 2016). The lack of a significant direct effect of TV food advertising exposure on candy intake could be due to a ceiling effect since a lot of children ate the entire bowl of candy that was offered, and in this study children did not have the opportunity to ask for additional candy.

Third, against expectations, the impact of completing a Go/No-Go task and food advertising exposure on candy intake was not moderated by children's scores on the BAS reward and BAS drive subscales of the Dutch version of the BIS/BAS scale (Franken, Muris, Rassin, 2005). In contrast to earlier findings (Folkvord et al., 2014), more impulsive children did not appear to be more sensitive to the influence of food advertising on snacking behavior.

The most important finding was that completing a Go/No-Go task appeared only effective in reducing children's candy intake after both food and non-food advertising among children who reported above average scores on habitual candy consumption, Haribo taste appreciation, and Haribo brand attitudes. Children who reported a higher level of habitual candy consumption consumed significantly less candy after a Go/No-Go task compared to the control task in both the food and non-food advertising condition. Similarly, children who reported high scores on Haribo tastiness, and children who reported more positive attitude towards the brand Haribo, consumed significantly less candy after a Go/No-Go task compared to the control task in both the food and nonfood advertising condition. These findings indicate that a Go/No-Go task was only effective in reducing food intake in children who indicated that they frequently eat sweets at home, like the taste of sweet candy such as Haribo, and had above average positive attitudes towards the brand Haribo. The present study thus extends the previous findings of Folkvord and colleagues (2016) by showing that a Go/No-Go task is only effective among children who are already avid candy consumers.

A limitation of this study was that children watched the TV show and ate candy in group, hence social influences on candy consumption could not be ruled out. It is possible that children ate more or less candy than they would have eaten at home while individually watching TV. Such group effects may have reduced the internal validity of this experiment.

There are several likely causes for the discrepancies between the results of this study and the study of Folkvord et al. (2016). First, Folkvord et al. (2016), let children complete a Go/No-Go food task immediately *after* playing a food or non-food promoting advergame and prior to snacking, thereby affecting children's *state inhibitory control*. In this study, however, children completed a Go/No-Go food task *prior* to food advertising exposure thereby aiming to strengthen children's *trait inhibitory control* prior to food cue exposure. It is therefore possible that, performing a task after advertising exposure and prior to eating interrupts the activation of approach responses towards palatable foods induced by food marketing, whereas performing a task prior to food marketing exposure might not suffice to be able to inhibit the automatic approach tendencies towards snack foods evoked by advertising exposure.

Second, in contrast to Folkvord's study where children could snack without restrictions, children in this study were individually presented with a bowl of Haribo candy containing a prefixed amount of 42 grams of candy. A large percentage of the children (about 38%) ate the entire bowl of 42 grams (140 kcal) of sweets while watching TV, whereas about 12% did not eat any candy. This ceiling effect resulted in an extremely large variance in children's candy intake and therefore the findings of this study must be interpreted with caution. Although many children asked the experimenter for additional candy, the possibility to refill their bowl was not present in this study, thereby limiting the impact of the experimental manipulations on children's candy intake. Hence, future researchers should present children with a larger amount of candy while also giving them the opportunity to ask for additional candy.

Third, playing an advergame might have a stronger influence on impulsive snacking behavior compared to watching a TV advertisement. The REFCAM expects that children's reactivity to embedded food cues in advertising is stronger for integrated compared to traditional forms of food marketing since children are more likely to process highly embedded food cues automatically without much cognitive elaboration (Buijzen et al., 2010; Folkvord et al., 2016).

Nevertheless, this was the first study to show that completing a Go/No-Go task was only more effective to reduce candy consumption among a subset of children who were high candy consumers. Future studies should therefore further investigate whether and to what extent the effectiveness of a Go/No-Go task is moderated by individual factors such as eating habits, taste preferences, and impulsiveness. Such studies should be repeated in children of different ages, in different advertising settings, and for different types of (sweet and salty) snack foods. Furthermore, future researchers should look into the effects of multiple Go/No-Go training sessions using longitudinal designs in which children perform a Go/No-Go task multiple times over several weeks. In addition, future studies should incorporate other age-modified measures of children's inhibitory

control and reward sensitivity, such as the computerized door opening task (Matthys, Van Goozen, Snoek, & Van Engeland, 2004), food specific measures of reward sensitivity and inhibitory control abilities such as the Power of Food Scale (Cappelleri et al., 2009), or look at other behavioral manipulations of children's level of impulsivity (cf. Folkvord et al., 2014).

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CONCLUSION

Discussion and Concluding Remarks

There is extensive empirical support that food marketing exposure has a direct influence on children's brand attitudes, purchase intentions, and eating behavior (e.g. Boyland et al., 2016; Norman et al., 2016; Sadeghirad et al., 2016). However, little is known about the underpinning persuasive mechanisms that explain child-targeted food marketing effects, who is more sensitive to these effects, and which type of intervention strategies are most effective. The aim of this dissertation was to at least partially address these issues and provide empirical findings to further our theoretical insights and to add to a growing body of research necessary to understand the societally relevant issue of children in a environment that is dense with food marketing and other food cues.

First, up to now there has been a lot of uncertainty about the underlying *persuasive mechanisms* that explain food marketing effects on children. During the past few years, researchers have developed theoretical models, such as the PCMC-model (Buijzen et al., 2010) and the REFCAM (Folkvord et al., 2016), that explain how food marketing exposure influences children's brand responses and eating behavior. Nevertheless, only a limited amount of studies have actually investigated these mediating mechanisms. Moreover, it is largely unknown how children's age might moderate food advertising effects and their underpinning mediating mechanisms. Second, it is still unclear whether inhibitory control intervention strategies are effective to reduce the impact of food marketing exposure on children's unhealthy snacking behavior. Third, the potential moderating roles of individual susceptibility variables, such as reward sensitivity and inhibitory control, are poorly understood. Insight into these moderating variables contributes to our knowledge of when food marketing effects occur and which children are especially vulnerable to them.

The current dissertation aimed to address these gaps by a) drawing upon the *Processing of Commercialized Media Content Model* (PCMC, Buijzen et al., 2010) and the *Reactivity to Embedded Food Cues in Advertising Model* (REFCAM, Folkvord et al., 2016) as a framework to explain how food marketing exposure influences children's brand responses and eating behavior, b) examining the *effectiveness of inhibitory control interventions* to diminish food marketing effects among a broader age-group of children than has previously been examined, and c) exploring who is more susceptible to food marketing effects in terms of age and dispositional factors such as inhibitory control and reward sensitivity. Five major conclusions can be drawn from the empirical studies that are described in this dissertation.

Conclusion Chapter 1: a) Food Marketing Exposure Affects Children's Brand Responses Through an Affect Transfer Process (RQ1)

The first research aim of this dissertation was to establish *how* food marketing exposure influences children's brand attitudes and behavioral intentions (brand responses). More specifically, Chapter 1 aimed to establish the underpinning persuasive mechanisms that explain food marketing effects on children's brand outcomes and to compare them between traditional and non-traditional types of marketing. Drawing upon the PCMC-model as a theoretical frame, Chapter 1 compared the impact of active exposure to an advergame to passive exposure to a TV advertisement among children between 6 and 14 years old, while testing the mediating roles of children's cognitive advertising literacy and attitudes towards the advertising format. Children's level of cognitive advertising literacy (understanding of selling intent and source recognition) was considered to be an indicator of the depth of systematic processing, whereas children's attitudes towards the advertising format (ad liking) were considered to be an indicator of low-levels of cognitive advertising processing (heuristic or automatic processing) (Buijzen et al., 2010).

The results of Chapter 1 showed that children who played an advergame reported significantly more positive brand attitudes than children who watched the corresponding TV advertisement or who were not exposed to any advertising. Playing the advergame also resulted in significantly higher pester intentions (i.e., the intent to ask their parents to buy the advertised brand) compared to watching a TV ad but not compared to no advertising exposure. However, the influence of the advertising format (TV ad vs advergame) on children's brand responses was not significant anymore after controlling for children's attitudes towards the specific advertising format. Interestingly, children's brand responses did not differ significantly between the TV advertisement and the no advertising exposure control condition.

A mediation analysis showed that the impact of the advertising format (TV ad vs advergame) on children's brand responses (brand attitudes and pester intentions) was fully mediated by their attitudes towards the specific advertising format, but not by their level of cognitive advertising literacy. Playing an advergame resulted in significantly higher pester intentions and more positive brand attitudes than watching a TV advertisement because children liked the advergame more than the TV advertisement. Hence, the advertising format effect, in which playing an advergame was more persuasive compared to watching the corresponding TV advertisement, was fully explained by children's attitudes towards the advertising format rather than by their level of cognitive advertising literacy.

These findings are in line with previous studies that found that the persuasive advantage of nontraditional over traditional advertising formats on children's purchase request intentions is mediated by children's attitudes towards the advertising format or affective advertising literacy (measured as disliking the ad), and not by children's cognitive advertising literacy (cf. Hudders, Cauberghe, & Panic, 2015; Hudders, Cauberghe, Panic, & De Vos, 2016; van Reijmersdal, Rozendaal, Smink, van Noort, & Buijzen, 2017). The results of Chapter 1 also correspond to prior research that showed that children's attitudes towards the advergame are positively associated with their brand attitudes and purchase requests (Panic et al., 2013; Waiguny & Terlutter, 2011; Waiguny, Nelson, & Terlutter, 2012). The findings provide evidence for the assumption of the PCMC-model (Buijzen et al., 2010) that contemporary forms of food advertising influence young people's brand attitudes and purchase request intentions through an *affect transfer process* via attitudes towards the advertisement.

Interestingly, a moderated mediation analysis showed that these mediational effects were not moderated by children's age. This implies that even older children (> age 12) did not actively use their cognitive advertising literacy as a defense mechanism to counter the automatic affect transfer process. Moreover, separate analyses per advertising format showed that children did not use their cognitive advertising literacy for neither format and regardless of their age. These findings contradict the expectations of the PCMC-model and cognitive-developmental models that young people can spontaneously apply advertising literacy as a defense mechanism from age twelve (Buijzen et al., 2010; Brucks et al., 1988; Friestad & Wright, 1994; John, 1999).

The findings of Chapter 1 further showed that children's levels of brand recognition and cognitive advertising literacy were lower for the advergame than the TV advertisement, which supports the prediction of the PCMC-model that children are more likely to process nontraditional types of advertising at a lower, more automatic level of cognitive elaboration compared to traditional types of advertising (Ambler, 2009; Buijzen et al., 2010; Nairn & Fine, 2008). In line with the PCMC-model (Buijzen et al., 2010), children's level of cognitive advertising literacy was significantly higher among those who could recall the advertised brand, and thus who had paid more attention to the commercial message.

Additionally, the findings of Chapter 1 did not support the assumption of the PCMC-model (Buijzen et al., 2010) that an advergame persuades through a different pathway compared to a TV ad. The evidence showed that if watching a TV advertisement or playing an advergame is persuasive this both occurs through an affect transfer mechanism, regardless of children's age. Separate regression analyses per advertising format showed that children's cognitive advertising literacy was not significantly related to their brand responses for neither format, whereas ad liking

was the main predictor of brand responses regardless of children's age and advertising literacy. These results thus extend previous studies that found that cognitive advertising literacy can only mitigate advertising effects for TV advertising but not for advergames (Panic et al., 2013). Finally, the results of Chapter 1 do not support the assumption that older children are less vulnerable to advertising than younger children. Although children's age was negatively related to ad liking and brand responses, format specific analyses showed that, taking advertising literacy and ad liking into account, age only appeared to diminish advertising effects for the TV advertisement and not the advergame. Further explorative analyses suggest that age differences in advertising susceptibility are partially due to underlying age-related differences in attitudes towards the advertising format, which indicates that younger children are more vulnerable because they have more positive attitudes towards advertising, and thus not because they are less advertising literate as was previously assumed.

The findings of the study described in Chapter 1 lead to several important conclusions. A first key finding of the research discussed in Chapter 1 is that children's attitudes towards the specific advertising format (or ad liking) appears to be the primary persuasive mechanism that explains how food marketing exposure affects children's brand responses for the entire age-range of children between 6 and 14 years old. Hence, food marketing exposure influences children's brand responses via an *affect transfer process:* advertising stimuli or contexts that are perceived as positive automatically evoke affective responses, such as positive attitudes or affective states, that carry over to the brand without children being consciously aware of this effect (e.g., Ambler, 2008; Chartrand, 2005; Gawronski & Bodenhausen, 2006; Harris et al., 2009; MacKenzie, Lutz, & Belch, 1986).

These results are in line with the PCMC-model (Buijzen et al., 2010), which states that contemporary forms of food advertising influence young people's brand responses through low-elaboration, affect-based mechanisms: children's attitudes towards the specific advertising format mediate the influence of food marketing exposure on their brand responses. The findings thus confirm the *affect transfer process* as described by Mackenzie and colleagues (1986) which suggests that consumers will associate an overall positive evaluation of the advertisement (i.e. ad liking) with the advertised brand, thereby strongly influencing brand attitudes. Prior studies have indeed already established a strong connection between ad liking and attitudes towards the brand (Mackenzie et al., 1986, Phelps & Hoy, 1996; van Reijmersdal, Rozendaal, van Noort, & Buijzen, 2016).

The idea that children's brand responses are predominantly mediated by their affective responses towards peripheral advertising cues and their attitudes towards the advertisement is not

new. The mediating role of attitudes toward the advertisement (AAD) also represents the peripheral route of the Elaboration Likelihood Model (ELM, Petty & Cacioppo, 1986), and corresponds to the heuristic and automatic route of the PCMC-model (Buijzen et al, 2010), and the heuristic route in the Heuristic-Systematic Model (HSM, Chaiken, 1980, 1987; Chen & Chaiken, 1999).
These models predict that when cognitive capacities or involvement are low, persuasion is based on a general evaluation of the peripheral elements of the advertisement (such as colors and cartoon characters). This evaluation of peripheral advertising characteristics can either take the form of a conscious and explicit association between peripheral cues and the brand, or as subconscious and automatic affective responses towards peripheral cues.

A second major contribution of Chapter 1 is that it showed that the underlying affect transfer process was not moderated by children's age. By conducting this study among a broad age category of children between 6 and 14 years old, we were able to show that *ad liking* was the underpinning mechanism regardless of age and contrary to expectations based on the PCMC-model (Buijzen et al., 2010). An important finding was that even older children (> age 12) were not able (or not motivated) to override this automatic affect transfer process by using their cognitive advertising literacy as a defense mechanism. The affect transfer mechanism was observed for the entire age range of children between 6 and 14 years old who found the advergame far more enjoyable than the TV ad, which resulted in an affect transfer from the game to the brand. Conform the PCMC model (Buijzen et al., 2010), playing an advergame evoked more positive affect than watching a TV ad which then automatically transferred to the brand, thereby overruling cognitive defenses even among teenagers. Overall, since the effects were mediated by ad liking and not by cognitive advertising literacy regardless of children's age, this finding supports the expectation of the PCMC-model (Buijzen et al., 2010) that, contrary to adults, children up to 14 years old process food advertising using low elaboration, affect-based mechanisms.

A third major contribution of Chapter 1 is that it showed that although children seemed to process the advergame on a lower level of cognitive elaboration than the TV ad (i.e., lower brand recognition and cognitive advertising literacy), ad liking was the primary mechanism explaining the influence of food marketing exposure on children's brand outcomes for both the TV ad and the advergame. However, it should be noted that the lack of a mediation effect for cognitive advertising literacy needs to be interpreted with caution since this study only measured two indicators of the cognitive dimension of advertising literacy (i.e., understanding advertising's selling intent and commercial source recognition). It is possible that other more affective dimensions of advertising literacy do mediate advertising format effects. Measuring children's skepticism towards a specific commercial message might better capture children's capacity to be critical. Future studies should

therefore measure several dimensions of advertising literacy, including affective advertising literacy and advertising skepticism (Rozendaal et al., 2016), and examine whether these findings also hold with affective advertising literacy, advertising skepticism, and children's actual critical processing of advertising as mediators (Hudders et al., 2015).

Similar research could also conduct separate studies per age group (or cognitive-developmental stage) while using more age-relevant advertising. Finally, future research should be undertaken to explore additional mediational factors that could explain (age-related) differences in young people's advertising responsiveness. Such variation might, for instance, also be explained by differences in perceived relevance of advertising, cognitive attention to advertising and processing motivation, different types of attitudinal responses towards advertising (explicit and implicit), physiological responses such as galvanic skin responses, and self-regulation abilities such as impulse-control.

Conclusion Chapter 1: b) Age Moderates the Impact of the Advertising Format on Children's Brand Responses (RQ1)

An additional aim of the study described in Chapter 1 was to explore whether the influence of the advertising format is moderated by children's age. The findings based on the additional analyses in appendix 1 (p. 72) showed that advertising format effects on children's brand responses differed significantly according to children's age. To further explore these effects, children were divided into three age groups based on their level of cognitive development and advertising literacy as described in the PCMC-model (Buijzen et al., 2010): age 6-8 (middle childhood); age 9-11 (late childhood); age 12-14 (early adolescence).

These explorative analyses showed that playing the advergame was only more effective than watching the TV ad or no advertising exposure for younger (middle childhood), but not for older children (late childhood and early adolescence). This partially confirms the prediction of the PCMC-model that nontraditional types of advertising such as advergames are more persuasive than traditional types of advertising such as TV advertising in children under age 12 because playing an advergame demands more mental effort than watching a TV ad, and young children are more sensitive to the positive affect evoked by playing the game.

Remarkably, however, the main effect of the advertising format on children's brand responses was not significant among children in late childhood. This contradicts both the expectations of the PCMC-model (Buijzen et al., 2010) and the results of previous studies that found that playing an advergame has a greater influence on children's brand attitudes and purchase

request intentions than watching a TV advertisement among children between age 7 and 10 (cf. Panic et al. 2013; Waiguny et al., 2013). However, the lack of a main effect of the advertising format on these children's brand responses might be due to a ceiling effect, since the majority of the children reported high scores on brand attitudes and pester intentions in all three conditions.

Interestingly, the oldest children (early adolescence) reported significantly more positive brand attitudes and higher pester intentions when they were not exposed to any advertising. In fact, watching TV advertising even decreased advertising effectiveness among teenagers between 12 and 14 years old compared to the no advertising exposure control condition. In contrast, advergames did not show such a negative effect while they more strongly persuade the younger children than TV advertising does.

These findings seem to indicate that a shift takes places from late childhood (9-11 years). From that stage on, the advergame was no longer more persuasive than the TV ad (and the no-exposure control group) in terms of brand attitudes and pester intentions. However, only adolescents reported significantly less positive brand attitudes and pester intentions after exposure to advertising, yet only for the TV ad and not so for the advergame. This might indicate that although teens can defend themselves better against advertising compared to younger children, the defense mechanism is still stronger for TV advertising compared to advergames.

This finding aligns with the assumption that younger children are more strongly influenced by peripheral advertising cues, such as entertaining advertising contexts, than older children (Buijzen et al., 2010; Livingstone & Helsper, 2006). This study supports the hypothesis that ad liking explains advertising effects to a great extent independently of age. Young people's liking of the advertising format will influence their attitudes towards the advertisement, which implies that the observed age-effect can even be reversed using another selection of stimuli. Future studies should therefore continue to examine age differences in advertising susceptibility comparing the effects of age appropriate and inappropriate advertising stimuli on different age groups. In conclusion, these findings show that young people's attitudes towards advertising types are more important than a maturing advertising literacy. Future interventions to limit advertising effects among children should therefore explore the effect of cues affecting these attitudes. Researchers could, for instance, experiment with cues that automatically trigger children's disbelieving and disliking of advertising and advertising skepticism (Rozendaal et al., 2016). This should be more effective than cueing cognitive advertising literacy since the affective component of advertising literacy does not require any conscious mental effort to activate (Ambler, 2008; Nairn & Fine, 2008).

Conclusion Chapter 2: Affect-based Food Marketing Cues Are Pervasive on Child-Targeted Branded Websites (RQ1)

Chapter 2 extends the findings of Chapter 1 by showing that unhealthy food marketing stimuli on child-targeted branded food websites are pervasive and diverse, and that these websites predominantly use affect-based marketing tactics. The large majority (88.5%) of the foods and beverages that were marketed online were labelled as unhealthy according to the criteria of the Nutrient Profiling Model (UK Food Standards Agency; Lobstein & Davies 2007). In addition, Chapter 2 suggested that food industry self-regulation is inadequate to protect young people against the harmful effects of (online) food marketing since only a minority of food and beverage companies actually sign the pledge, and most members do not pursue these guidelines. Chapter 2 revealed that only 30% of the 49 sampled websites were EU Pledge members who promised not to promote unhealthy foods and beverages to children under age twelve. This is in sharp contrast with the food industry claiming their pledge members to represent about 80% of the food companies (EU Pledge, 2018). Marketing tactics promoting unhealthy foods and beverages were still present at the child-targeted websites pertaining to companies that had signed this pledge. Another interesting finding was that the use of marketing tactics (frequency and type) and the nutrient profile of the online-promoted foods and beverages did not differ significantly between pledge and non-pledge members.

The findings of the study discussed in chapter 2 further suggest that child-targeted branded websites predominantly use affect-based peripheral cues and tactics to persuade children such as promotional characters (79.2%, i.e., licensed and branded characters, celebrities), fun branded items (57%, i.e., screensavers, recipes etc.) advergames (40%), tie-ins with child-targeted media entertainment such as TV series, movies and sports events (40.8%), and promotional incentives (37%, i.e., contest, premiums). These affect-based marketing tactics aim to create positive associations around these online branded messages so that children will develop positive attitudes towards the brand, making them more likely to request their parents to buy these food brands and products. The findings of Chapter 2 suggest that child-targeted branded websites predominantly use affect-based marketing tactics to increase the likelihood that children will process these messages using low-elaboration mechanisms and thus develop food brand attitudes and purchase request intentions based on their attitudes towards these online messages rather than by objective information or arguments. Affect-based marketing tactics aim to circumvent the activation of advertising literacy and skepticism. Brand benefit claims (present at 98% of the sites)-were the only tactic that has the potential to trigger advertising literacy.

The first part of this dissertation shows that children and young people are surrounded by food marketing stimuli both offline through TV advertising, and online through branded websites. The mere presence of a marketing stimulus can have an influence through affect-based mechanisms. When marketing stimuli are perceived as positive they influence young people's attitudes and behavior. In addition, children are exposed to many other food marketing incentives, such as persuasive on-pack marketing tactics (e.g. cartoon characters and brand mascots, bright colors & games), and subtle portion-size suggestions and sales promotions such as shelf positioning and product facing strategies (Aerts & Smits, 2017; Neyens, Aerts, & Smits, 2015).

Conclusion Chapter 3: Food Cues in Advertising Can Affect Children's Eating Behavior through Food Cue Reactivity (RQ2)

The second research objective of this dissertation was to examine how food cues in advertising can have a direct influence on children's eating behavior. While Chapter 1 showed that food marketing influences children's brand attitudes and purchase intentions through affective mechanisms, Chapter 3 showed that food cues can directly affect children's eating behavior, even outside of a marketing context. More specifically, Chapter 3 shows that observing foods being prepared in a popular TV cooking show influences the amount of food and garniture that children select and consume.

First, the findings of Chapter 3 showed that watching a TV cooking episode has an influence on children's food consumption regardless of their hunger level. Overall, children ate significantly more after exposure to a TV cooking show compared to a non-food TV show. More specifically, the findings of Chapter 3 showed that children who watched one of the two versions of a cooking program ate significantly more of the pancakes compared to children who watched a non-food, nature show, even after controlling for children's level of hunger and sugar eating habits.
This finding is in line with prior research among adults that found that adults who were exposed to a cooking program ate more chocolate compared to those who were exposed to an adventure program (Bodenlos & Wormuth, 2013). These findings also support the assumption of the food cue reactivity theory that food cues can activate the urge to snack (Boyland et al., 2016; Jansen, 1998).

Moreover, children ate significantly more of the pancakes when the cooking show featured a sugar portion-size norm compared to when this descriptive norm was not shown. Hence, children ate the largest amount of pancakes in the condition in which two matching food cues, pancakes and sugar, were featured. This seems to indicate that observing matching food cues may have a greater impact on children's eating behavior than observing only one food cue. The results of this study

thus provide support for the idea that merely seeing visual food cues can trigger a hedonic desire for food or cravings, as predicted by the Reactivity to Embedded Food Cues in Advertising Model (REFCAM) (Folkvord et al., 2016). An implication of this is the possibility that observing two matching palatable food cues has a greater impact on eating behavior than observing only one food cue.

Second, the findings of Chapter 3 suggest that exposure to portion-size norms in a TV cooking episode influences the amount of food ingredients that children select, even beyond the effects of hunger and (sugar) eating habits. This study has shown that children used significantly more sugar on their pancakes after watching a cooking show compared to a non-food TV show. However, against expectations, children's sugar selection did not differ significantly between a cooking episode that did and did not feature a portion-size norm. What this seems to indicate is that children's sugar selection was influenced by observing food cues (pancakes, sugar) in a TV cooking show rather than by observing the actual sugar portion-size norm that was used (i.e., How much sugar the chef used in this episode). This finding supports the premise of the REFCAM (Folkvord et al., 2016) that merely seeing palatable foods can indirectly affect how much food children select and eat by activating food cravings (Jansen, 1998). Another possible explanation for the lack of an overall portion-size cue effect could be that children might not have paid conscious attention to the portion-size cues that were displayed, thereby diminishing the difference between the two experimental versions of the cooking show episode. It is reasonable to expect that portion-size cues only affect behavior when they are consciously noticed. Unfortunately, in this experiment, children's attention to visual food cues and portion-size cues or their gaze direction and duration have not been measured.

Furthermore, the difference in sugar selection between the three experimental conditions (cooking show with or without portion-size norm, or nature show) was not significant anymore after controlling for children's level of hunger and habitual sugar usage. However, deeper inspection of the data suggest that, compared to children who watched a non-food TV program, children who observed a portion-size norm in a cooking program used significantly more sugar on their pancakes, even beyond the effects of hunger and sugar eating habits. However, the difference in sugar selection between the no-sugar-display condition and the non-food condition was not significant. This finding indicates that watching a cooking show only affects children's use of ingredients (i.e., sugar usage) when a (sugar) portion-size norm is displayed. It further indicates that observing descriptive portion-size norms in media may affect the amount of ingredients children select regardless of their level of hunger and eating habits.

Another remarkable finding was that the portion-size-cue effect was only significant among the older children in this sample (5th grade). The difference in sugar usage between the sugar-display condition and the no-sugar-display condition was only significant among the older children (aged 10 to11) in the sample but not among younger children (aged 6 to 7).
Among children from the 1st grade (aged 6 to 7), sugar selection (amount of sugar used on their pancakes) was mainly determined by their own feelings of hunger and eating habits whereas the presence of a portion-size cue had no significant impact on their food selection. Among older children of the 5th grade (aged 10 to11), however, food selection was largely influenced by the presence of a portion-size norm in the expected direction with children using significantly more sugar on their pancakes when a sugar-portion-size cue was shown compared to when this was not shown. This finding confirms the hypothesis of socialization theory that social norm susceptibility increases with age (Coleman, 2011). Adolescents find it very important to conform to peer norms (Brown, Bakken, Ameringer, & Mahon, 2008; Coleman, 2011), and these peer norms have already been shown to affect (pre)adolescents' (aged 10-17) food intake (Stok, De Ridder, De Vet, & De Wit, 2014).

Finally, Chapter 3 showed that children's BMI did not moderate the effects of watching a cooking show on children's sugar usage and pancake consumption. These results challenge the findings of prior research that found that overweight children are more likely to overeat in response to food cues (e.g., Francis, Lee, & Birch, 2003; Halford et al., 2008; Jansen et al., 2003).
The influence of watching a TV cooking show on children's sugar selection and pancake consumption was not moderated by children's BMI percentile. However, it should be noted that the variation in BMI was rather small in this study which may explain the absence of a significant moderation effect.

Overall, based on the findings of Chapter 3 we can conclude that merely seeing food being prepared in a TV program can influence the eating behavior of children. Moreover, this study indicates that observing two matching food cues has a stronger impact on food consumption compared to observing only one food cue. The findings of this experiment are in line with prior research that has shown that exposure to TV food advertising affects eating behavior in children (Boyland et al., 2016; Folkvord et al., 2016). Overall, the results of the study described in Chapter 3 provide empirical support for the *Reactivity to Embedded Food Cues in Advertising Model (REFCAM,* Folkvord et al., 2016) stating that exposure to visual, palatable food cues can trigger food cravings, and thereby influence subsequent snacking behavior and overeating (Jansen, 1998). The findings of this research thus support the idea that visual food cues in advertising can immediately induce food cravings and directly influence eating behavior.

The main contribution of this study has been to confirm that that merely seeing food cues – even outside of a marketing context- can automatically affect children's eating behavior, even outside of their conscious awareness. Although this study focuses on the impact of visual food cues and portion-size cues in the context of a TV cooking show, the findings contribute to our understanding of how visual food cues in advertising affect children's food intake. In general, the findings suggest that merely seeing visual food cues can have strong, automatic effects on children's eating behavior beyond the effects of hunger and eating habits (Boyland et al., 2016; Harris et al., 2009; Norman et al., 2016), and beyond the influence of other more explicit advertising cues.

Since children were unaware of the influence of visual food cues on their eating behavior, this study strengthens the idea that the impact of food marketing on children's eating behavior is largely explained by the automatic, subconscious effects of visual food cues on children's food cravings and food intake (Buijzen et al., 2010; Folkvord et al., 2016). If merely seeing palatable food cues already influences children's and teenagers' dietary preferences and how much they eat, without them necessarily being aware of these cues or their effect, than it is highly unlikely that advertising literacy based interventions will be sufficient to reduce the impact of food marketing on children's food preferences and eating behavior. Therefore, new types of interventions are necessary that intervene directly in children's impulsive responses to food cues in advertising by strengthening their inhibitory control. Although such inhibitory-control interventions have proven to be effective to reduce snacking behavior in adults (Allom et al., 2016; Jones et al., 2016), these interventions have only recently been introduced into the field of child-targeted food marketing. The study described in Chapter 4 has therefore investigated whether these inhibitory-control interventions can also reduce the influence of food marketing on children's eating behavior.

Conclusion Chapter 4: Inhibitory-Control Interventions only Reduce the Impact of TV Food advertising on Children's Candy Intake among a Subset of High Candy Consuming Children (RQ3)

Since Chapters 1 to 3 have shown that food marketing exposure can have a direct influence on children's brand attitudes and purchase request intentions (i.e. pester intentions) and eating behaviors, a final research objective of this dissertation was to examine how children can be protected against these effects.

Chapter 4 therefore examined whether inhibitory-control interventions may diminish the impact of food marketing exposure on children's eating behavior and whether these interventions

are also effective among older children. Prior research has mainly focused on advertising literacy based interventions which have yielded inconsistent results. Only recently researchers are paying attention to inhibitory-control strategies that intervene in children's impulsive responses to food cues in advertising. Since only one published study (Folkvord, Veling, & Hoeken, 2016) has shown that a Go/No-Go inhibitory-control training reduces the impact of playing a food advergame on children's (aged 7-10) snack intake it remained unclear whether this type of intervention would also be successful among older children and adolescents and across another advertising medium, more particularly TV advertising. Therefore, a final aim of this dissertation was to examine whether such interventions are also effective among older children aged nine to fourteen, and within the context of TV food advertising. The study described in Chapter 4 examined whether performing a Go/No-Go task, in which children learn to inhibit automatic approach reactions towards palatable foods, would decrease the impact of TV food advertising exposure on children's (aged 9-14) candy intake during TV viewing.

Overall, the results of Chapter 4 showed that performing a Go/No-Go task had no significant effect on children's caloric intake. Children who performed the Go/No-Go food task did not eat significantly less candy than children who performed the Go/No-Go control task. Furthermore, contrary to prior studies (e.g., Boyland et al., 2016; Harris et al., 2009; Norman et al., 2016), the main effect of watching TV food advertising on children's candy intake was not significant. It should be noted that the lack of a main effect of TV food advertising exposure on candy intake might be due to a ceiling effect: the amount of candy that the children could snack on in this study was restricted to one bowl of 42 grams of Haribo sweets per child, and a large percentage of the children (38%) ate the entire bowl of candy. This resulted in an extremely large variance in candy intake in our data, which implies that the findings of this study should be interpreted with caution. Future studies should therefore, in accordance with Folkvord et al. (2016), be careful not to place any restrictions on children's snacking opportunities and thus present them with a larger amount of candy whilst giving them the opportunity to ask for additional candy.

The absence of a main effect of food advertising exposure is consistent with the study of Folkvord et al. (2016) who did not find a main effect of playing a food advergame on children's snack intake. However, in their study children were required to perform a Go/No-Go food or control task *after* playing the advergame and *before* a snacking opportunity which might have interrupted the craving inducing influence of a food promoting advergame.

In addition, no significant interaction effect was found between the type of TV advertising (food vs non-food) and the Go/No-Go training task (Go/No-Go food vs Go/No-Go control).

This finding implies that performing a Go/No-Go task did not significantly reduce children's candy intake, regardless of whether children were exposed to food or non-food TV advertising.

Overall, the findings of Chapter 4 indicate that performing a Go/No-Go task does not diminish the impact of TV food advertising exposure on children's candy intake. Furthermore, and contrary to our expectations, the results of Chapter 4 showed that the impact of food advertising exposure on children's candy intake did not differ significantly according to children's level of impulsiveness as measured by their scores on reward sensitivity (BAS Reward), and the motivation to follow one's goals (BAS Drive) (Franken, Muris, & Rassin, 2005). It should be noted, however, that the measurement of inhibitory control (BIS) was omitted from the analyses due to the low reliability of this scale. These findings contradict the results of a previous study that found that more impulsive children are more susceptible to the influence of food advertising exposure on snacking behavior (Folkvord et al., 2014). Similarly, the findings of Chapter 4 showed that the impact of a Go/No-Go task on candy intake did not differ significantly according to children's reward sensitivity (BAS Reward), and the motivation to follow one's goals (BAS Drive).

Another remarkable finding was that the influence of food advertising exposure on candy intake did not differ significantly depending on children's level of understanding of advertising's selling intent and persuasive intent. This finding confirms the results of previous studies that found that cognitive knowledge of advertising (i.e. the ability to recognize advertising and understand its selling and persuasive intentions) does not adequately protect children against (attitudinal) advertising effects (e.g. An & Stern, 2011; Mallinckrodt & Mizerski, 2007; Rozendaal et al., 2011). This result also supports the notion of the *Food Marketing Defense Model* (Harris et al., 2009) that children's level of cognitive advertising literacy does not suffice to mitigate the impact of food advertising on actual eating behavior.

However, the key finding of Chapter 4 was that performing a Go/No-Go task was only successful in reducing children's candy intake among those children who reported high scores on habitual candy consumption, (Haribo) taste appreciation, and brand attitudes. These effects were found regardless of the type of advertising (food vs non-food TV advertising). More specifically, children who reported an above average level of habitual candy consumption consumed significantly less candy after conducting a Go/No-Go food task compared to a Go/No-Go control task in both the food and non-food advertising conditions. Similar results were found for those children who reported above average scores on taste appreciation and brand attitudes. These findings imply that performing a candy-specific Go/No-Go task was only successful in reducing candy intake among a subset of children who reported that they frequently eat sweets at home, like

the taste of sweet candy such as Haribo, and had above average positive attitudes towards the stimulus brand.

The findings of Chapter 4 result in several important conclusions. First, we can conclude that performing a Go/No-Go task was only effective in reducing children's candy intake among high candy consumers who reported above average scores on habitual candy consumption, Haribo tastiness evaluation, and Haribo brand attitudes. Moreover, these effects did not differ significantly depending on children's level of impulsiveness as measured via the BAS Reward and BAS Drive scales.

Second, against expectations, more impulsive children were not more susceptible to the influence of TV food advertising on eating behavior. However, the lack of an interaction effect could also be due to the specific measurement of children's level of impulsivity in this study (i.e., BAS Reward & BAS Drive). Future studies should use age-modified versions of these scales (cf. Muris, Meesters, de Kanter, Timmerman, & Eek, 2005), and explore other measures of children's inhibitory control and reward sensitivity, such as the computerized door opening task (Matthys, Van Goozen, Snoek, & Van Engeland, 2004), food-specific reward sensitivity and inhibitory control, such as the Power of Food Scale (Cappelleri et al., 2009), or include behavioral manipulations of children's level of impulsivity (cf. Folkvord et al., 2014). Third, children's level of cognitive advertising literacy does not moderate the influence of TV food advertising exposure on children's (aged 9 to 14) snacking behavior.

The study described in Chapter 4 thus extends the previous findings of Folkvord and colleagues (2016) by showing that a Go/No-Go task is only an effective tool to mitigate the impact of TV food advertising exposure on children's food intake among those children who are already vulnerable. More specifically, children who regularly consume candy at home, who enjoy the taste of candy, and who are already very positive towards the advertised candy brand. In general, therefore, it seems that a Go/No-Go task is only effective among children who already are avid candy consumers.

What's Next?
Academic Implications: Suggestions and Challenges for Future Research

The findings of the four chapters of this dissertation addressed several gaps in the literature and provided answers to the research questions posed in this dissertation. However, as in any research, these findings also raise several new and important research questions. Moreover, the studies described in this dissertation also have certain limitations that give rise to suggestions for future research. This final section will therefore outline the most important challenges that still remain at an academic and societal level and provide directions for future research.

First, further research is recommended to investigate *how* food marketing affects young peoples' brand responses and eating behavior. Future research should further identify and test the underlying persuasive processes that explain attitudinal food marketing effects on children and examine how these processes differ depending on several individual and situational variables. Furthermore, this type of research would greatly benefit from a collaboration with neurocognitive scientists. Second, researchers should continue to examine how food marketing exposure affects children's eating behavior by focusing on the mediating role of food cue reactivity, and the moderating roles of individual sensitivity factors such as attentional bias, impulsiveness, inhibitory-control and reward sensitivity. Third, the role of self-regulating abilities in food advertising susceptibility needs further scrutiny. More research is needed on intervention tactics that directly respond to children's impulse-control abilities.

Research Propositions Related to Children's Advertising Processing: Continue to Investigate Underlying Persuasive Processes

The results of Chapter 1 indicate that food marketing exposure affects children's brand responses through an affect transfer process based on ad liking regardless of children's age and the specific advertising format. This suggests that children up to age 14 process advertising at a low level of cognitive elaboration. However, more research is needed on how children process advertising and how the level of advertising processing (systematic, heuristic, automatic) is influenced by distinct individual and message factors.

First, researchers are recommended to continue to investigate how children's advertising processing level influences the underpinning persuasive processes and advertising effects by a) directly manipulating young peoples' advertising processing level (instead of advertising exposure or advertising format), and b) by including mediating variables that represent each of these persuasive processes. Future research could for example manipulate individual factors (i.e. children's attention to, awareness of, and involvement with the advertisement) and message factors (i.e. level of integration of embedded messages, interactivity) that are related to children's abilities and motivation to process advertising. More specifically, children's level of involvement with advertising may be manipulated by varying the personal relevance of the advertisement, similarly, children's attention to advertising can be manipulated using different instructions (e.g., pay close attention to win a prize; McAlister & Bargh, 2016). Furthermore, rather than comparing traditional with nontraditional advertising formats, future studies could directly manipulate message factors, such as the level of integration of branded messages and the level of interactivity, within the same advertising format (e.g., playing versus viewing an advergame, Rifon et al., 2014).

In addition, researchers are encouraged to elaborate on the operationalization and measurement of children's advertising processing level since a clear consensus on a definition and standardized measuring scales are lacking in the current literature. Following van Reijmersdal, Rozendaal, Smink, van Noort and Buijzen (2016) it might be interesting for future researchers to include cognitive, affective, and behavioral mediating variables that represent each of the three levels of cognitive elaboration upon advertising as described in the PCMC-model (systematic, heuristic, automatic; Buijzen et al., 2010). For example, researchers could measure children's implicit and explicit attitudes towards advertising (ad liking), perceived personal relevance of the message, and advertising literacy as indicators of low, moderate, and high levels of advertising processing respectively (cf. van Reijmersdal et al., 2016).

The operationalization and measurement of advertising literacy also plays an important role in research into the persuasive mechanisms behind food marketing effects. Researchers are advised to always include multiple dimensions of advertising literacy (i.e. cognitive & affective advertising literacy, skepticism, performance etc.), and to use standardized scales (cf. The Advertising Literacy Scale for Children; Rozendaal, Opree, & Buijzen, 2016). In addition, new scales should be developed that are specific to children's developmental phase for research within a specific age group.

Furthermore, researchers are also encouraged to include implicit (e.g. IAT, Greenwald, McGhee, & Schwartz, 1998; Baron & Banaji, 2006; Cvencek, Greenwald, & Meltzoff, 2011; spontaneous reactions) and (neuro)physiological measures (e.g. heart rate, fMRI) of children's automatic, affective responses towards advertising, as these measures are more reliable compared to self-reporting data. Moreover, such measures would allow future researchers to make a more clear distinction between the automatic and heuristic route of persuasion.

Second, more research is required to determine the role of young peoples' age and cognitive-developmental stage on advertising processing and effects. Further research might explore age-related differences in young people's attention to advertising (i.e., eye-tracking procedures), their processing motivation (i.e; involvement), their explicit and implicit attitudes towards advertising, and their physiological responses to advertising (i.e. Galvanic skin responses etc.). Future researchers are, for example, advised to include a measure of children's attentional bias towards specific advertising features using eye-tracking procedures to explore whether children's age influences how much attention they pay to certain (central or peripheral) advertising characteristics such as brand logos, claims, and endorsing characters (cf. Folkvord et al., 2015). Rather than looking at age effects, it might also be interesting to have a closer look at the potential moderating role of children's actual cognitive abilities based on cognitive tests such as executive functioning.

Furthermore, future studies that aim to explore age differences in children's advertising processing and susceptibility should take into account the importance of the personal relevance of the advertisement. The results of the study described in Chapter 1 might be biased because the advertising stimuli used were more appealing to the younger children of our sample. Therefore, it remained unclear whether affective processes are indeed the dominant persuasive process in teenagers as well, or whether this finding was due to teenagers low levels of involvement with the TV ad and the advergame. Hence, similar studies should be repeated for each developmental stage separately using age appropriate and relevant advertising and including a measure of involvement with the advertisement. In addition, future research efforts should particularly focus on teenagers

between the ages of 14 and 18 years old because this age group has been largely understudied in the current literature on child-targeted food marketing effects. Since teenagers spend a lot of time on social media such as Instagram, Youtube and Facebook, future research should focus on new, online forms of food marketing such as targeted advertising, and sponsored messages and vlogs on instagram and youtube. Future research should investigate whether and how social media influencers, such as food vloggers on Youtube and Instagram, influence young people's food preferences and food intake. Such research could, for instance, develop mock Instagram profiles of popular social media influencers endorsing either healthy, unhealthy or nonfood products. Participants can then be randomly assigned to view a healthy food, unhealthy food or nonfood endorsing Instagram profile, after which food intake can be measured (Coates et al., 2019). Additionally, this type of research can also manipulate and examine the impact of sponsorship disclosures such as sponsorship hashtags.

Third, further research into the persuasive processes that underlie food marketing effects on young people would greatly benefit from a collaboration between communication scholars and neuroscientists. Neuroscientific methods can give a more precise account of the exact processes that underlie food marketing effects compared to traditional attitudinal and behavioral measures (Weber, Fisher, Hopp, & Lonergan, 2018). Including brain imaging techniques, such as functional magnetic resonance imaging methods (fMRI), within communication research will allow us to examine brain activity during advertising exposure and unravel the neural mechanisms behind food marketing effects.

Neuroscientific evidence among adults for instance suggests that celebrity endorsement increases brain activity in brain regions that are associated with positive affective responses (Stallen et al., 2010). Similarly, among children neuroimaging experiments have shown that exposure to food images activates brain networks linked to reward, motivation and cognitive control (Bruce et al., 2010; Davids et al., 2010; Holsen et al., 2005; Killgore & Yurgelun-Todd, 2005). These neuropsychological measurements can provide a deeper insight into the roles of information processing, affective responses, reward sensitivity and cognitive control within child-targeted food marketing effects.

It might be interesting for future researchers to combine cognitive, attitudinal and conative measures of persuasion processing with neuroimaging measurements, such as fMRI, to examine how children's neural responses to food advertising might differ depending on their level of cognitive development, impulsivity, weight status, and specific message characteristics such as the level of integration of branded messages. Masterson et al. (2018), for instance, have recently discovered that food advertising exposure reduces children's brain engagement in cognitive control

regions relative to toy advertising exposure. Adding neural measurements to attitudinal and behavioral measures has the additional advantage that it produces new theoretical insights, increases the predictive value of communication-scientific models, and reduces the number of participants that are required to achieve well-powered studies (Weber et al., 2018). However, non-clinical fMRI research in children can be challenging for researchers because of difficulties in collecting and interpreting the data (e.g., children moving in the scanner) and because of ethical considerations. Although some of these challenges can be partially solved by following a protocol in which children complete training sessions in a mock scanner to become acquainted with the experience (cf. English, Lasschuijt, & Keller, 2015; Masterson et al., 2018), it may be better to only conduct non-clinical fMRI studies in adults given the potential adverse effects of fMRI testing (such as anxiety, claustrophobic reactions, etc.), whereas in children to limit the use of neuroscience techniques to electroencephalography (EEG), and eye tracking (Harris, CiorCiari, & Gountas, 2018).

Research Propositions Related to the Impact of Food Marketing on Children's Eating Behavior: Continue to Examine the Mediating Role of Food Cue Reactivity and the Moderating Role of Individual Dispositional Factors

Future research should focus on the mechanisms underpinning the influence of food advertising exposure on young people's food intake, such as the psychological and physiological responses that are elicited by observing palatable food cues in advertising. Further research is required to establish whether food cue reactivity mediates the influence of exposure to embedded food cues in advertising on young people's food intake. As already suggested by Folkvord et al. (2016) in their *Reactivity to Embedded Food Cues in Advertsing Model* (REFCAM), researchers should measure young peoples' psychological and physiological responses towards embedded food cues in advertising (i.e., food cue reactivity). Psychological measurements might for example include food-related cognitions, a hedonic desire to eat, and attentional bias towards food, whereas physiological measurements might include salivation, heart rate, pupil dilation, galvanic skin responses, gastro-intestinal activity and hormonal responses (increased ghrelin and insulin) (cf. Boyland et al., 2017).

In addition, future studies need to be carried out to examine whether food cue reactivity and its effects on food intake are moderated by individual susceptibility factors and message factors. It is especially important to further explore individual differences in young people's responses to embedded food cues since these differences may contribute to overconsumption and obesity. Furthermore, the identification of vulnerable groups allows us to develop more targeted intervention

techniques that focus specifically on these risk factors. More insight is needed into the moderating roles of individual susceptibility factors such as weight, attentional bias towards food cues, impulsiveness, inhibitory control and reward sensitivity (cf. Folkvord et al., 2015; Spielvogel, Matthes, Naderer, & Karsay, 2018).

Individual dispositional factors such as inhibitory control and reward sensitivity are especially important to explain variability in advertising induced food cue reactivity and food intake effects since prior research has related these variables to overconsumption, binge-eating disorders, and being overweight (e.g. Jansen, Houben, & Roefs, 2015; Kidd & Loxton, 2018). Given that the Behavioral Inhibition System scale (BIS, Carver & White, 1994) in the study described in Chapter 4 did not appear to be reliable among our sample of children aged 9 to 14, future researchers are recommended to explore other measurements and manipulations of young peoples' impulsivity, inhibitory-control and reward sensitivity. These measurements might include, but are not limited to, the door opening task (Matthys, Van Goozen, Snoek, & Van Engeland, 2004), or behavioral manipulations of children's level of impulsivity such as promising children a reward if they delay gratification (cf. Folkvord et al., 2014). Further studies might also benefit from using age-modified and food specific measurements of reward sensitivity and inhibitory-control abilities such as the Power of Food Scale (Cappelleri et al., 2009). In addition, exploring the potential moderating role of related variables from the eating disorders literature, such as *trait external eating* (i.e. the impulse to eat in response to external food-related cues), on food cue reactivity and intake might be an interesting future research angle.

Further research could also be conducted to determine the moderating role of message factors such as the level of integration of food cues in advertising. Future researchers could for instance examine whether new, embedded types of food advertising with higher levels of message integration and interactivity evoke stronger levels of food cue reactivity in children, and have a greater influence on children's food intake than traditional types of food advertising.

Research Propositions Related to Inhibitory-Control Training: Continue to Examine Impulse-Control Enhancing Interventions Tactics

The study described in Chapter 4 does not support the view that inhibitory control training reduces the impact of TV food advertising exposure on children's snacking behavior. Performing a Go/No-Go task only reduced children's candy intake during TV viewing among a subset of vulnerable children who are high habitual candy consumers (in both the food and non-food advertising condition). However, the lack of a significant interaction effect between TV food

advertising exposure and the Go/No-Go intervention task to predict candy intake may partially be the result of a number of limitations of this study.

First, the main effect of TV food advertising exposure on candy intake was not significant due to a ceiling effect in our measurement of candy intake. Future research should therefore offer children a larger and more diverse amount of both healthy and unhealthy snacks. Second, the inability of the Go/No-Go food task to reduce the influence of TV food advertising on candy intake might also be due to the experimental procedure. Contrary to the earlier study conducted by Folkvord et al. (2016), the intervention (Go/No-Go food vs control task) took place *before* the advertising exposure instead of after. Future research should therefore make a clear distinction between inhibitory-control training that focuses on increasing *state* versus *trait* inhibitory control. Folkvord et al. (2016) manipulated children's *state inhibitory control* by letting them perform a Go/No-Go food task *after* food advertising exposure and prior to snacking. The study described in Chapter 4 aimed to manipulate children's *trait inhibitory control* by using a Go/No-Go task to strengthen children's inhibitory control *prior* to food cue exposure. Although performing a Go/No-Go task after food advertising exposure and before a snacking opportunity might produce better results in a lab setting because it interrupts food cue reactivity, it remains unclear whether the effect is actually due to the training task or due to the interruption of automatic approach tendencies towards palatable foods. Furthermore, in the long term it would be better to focus on improving children's trait inhibitory control.

Prior studies have shown that the ability to automatically inhibit the urge to snack in response to unhealthy food cues requires a very strong association between unhealthy food and a no-go response which can only be achieved after repeated training sessions (Allom et al., 2015; Jones et al., 2016). Hence, performing a Go/No-Go task prior to food marketing exposure might only become effective to teach children to inhibit automatic approach tendencies towards snack foods evoked by advertising exposure after multiple training sessions. Future research would therefore benefit from the development of longitudinal studies in which children perform a Go/No-Go task multiple times over several weeks. Furthermore, future studies could check how many training sessions are needed, and whether multiple training sessions provide long-term effects.

The findings of Chapter 4 further indicate that performing a Go/No-Go task was only effective in reducing food intake in children who reported high scores on habitual candy consumption, Haribo taste appreciation, and brand attitudes. It is therefore possible that these types of interventions are only successful among certain vulnerable groups of children. However, further research is required to determine whether a Go/No-Go task is indeed more effective among a

subgroup of vulnerable children, such as children who often eat candy, who regularly snack while watching TV, or who are overweight. Future researchers are also recommended to control for the impact of children's general eating habits.

Future researchers should also consider the possible priming effects of conducting a Go/No-Go task: exposure to appetitive food cues in a Go/No-Go task might actually trigger cravings in some children thereby enhancing the effectiveness of subsequent food advertising exposure. Future studies could also look into which groups might be more sensitive to this priming effect.

In addition, future researchers are recommended to include a measurement of food specific inhibitory-control or the ability to suppress automatic approach reactions towards palatable foods (Jones et al., 2016) to conduct manipulation checks. Further research might also explore the mechanisms by which inhibitory-control training can reduce the impact of food advertising exposure on snacking behavior. Does it work by strengthening inhibitory-control or by devaluating implicit attitudes towards snack foods (Jones et al., 2016)? This way, new interventions can be developed that target these mechanisms more directly and effectively. Future studies might explore whether a Go/No-Go training also has the capacity to reduce children's reward sensitivity for and desire to eat the advertised foods using both self-report measures of food specific reward sensitivity, such as the Power of Food Scale (Cappelleri et al., 2009), and salivation measurements.

Future research should also include a greater variety of snacking foods and investigate the consumption of both unhealthy and healthy foods following training, to check whether a stimulus-specific inhibitory-control training only reduces children's intake of the stimulus food or whether it actually reduces their overall snacking behavior. Furthermore, more research is needed into the influence of individual factors in the effectiveness of the Go/No-Go task. Further research should focus on determining whether inhibitory-control training is more effective among young children, whose inhibitory control system has not matured yet, or among teenagers who are highly impulsive despite having a mature inhibitory control system (Casey et al., 2008; Romer et al., 2009; Sowell et al., 1999; Steinberg, 2007; Vara et al., 2014). Future studies could also explore further whether inhibitory-control training is more effective among highly impulsive children by including other behavioral measures of impulsiveness such as the computerized door opening task (Matthys et al., 2004).

Practical Recommendations for Policy, Parents and Caregivers

In terms of regulation, the findings of this dissertation indicate a definite need to impose binding restrictions on all forms of child-targeted food marketing. Current industry self-regulations regarding child-targeted food marketing have proven to be unsuccessful since the food industry defines its own non-binding guidelines without any form of external control. Given the importance of children's self-regulating abilities to resist tempting food cues in marketing, and the exhaustibility of these self-regulating abilities, it becomes clear that the individual responsibility approach will never succeed in reducing childhood obesity. Policy interventions that change the food environment are the most effective to accomplish changes in eating habits and behavior. Unless governments adopt binding legislation regarding the supply and promotion of food and beverages to children, the childhood obesity crisis will continue to grow out of proportion. A key policy priority should therefore be to regulate the quality of the advertised foods as well as the marketing tactics that automatically activate cravings and stimulate overeating such as food-related cues, portion-sizes and portion-size suggestions.

Based on the existing scientific knowledge, a first recommendation is to prohibit the marketing of unhealthy food products and beverages that exceed certain maximum limits of sugar, fat, and salt. These limits should be determined based on scientific criteria on healthy nutrition in cooperation with scientists, physicians, nutritionists and the food industry.

A second recommendation for policy makers is to develop binding legislation with rules on specific child-targeted marketing techniques rather than a medium-specific regulation. Existing forms of self-regulation such as the EU Pledge (2007) have failed to protect children against unhealthy food marketing because these regulations suffer from some giant loopholes and ultimately are non-binding. These loopholes are the result of definition problems regarding child-targeted marketing and healthy nutrition. Hence, it would be more effective to regulate child-targeted marketing at the level of the persuasive techniques regardless of the medium. Persuasive marketing tactics that urgently require legislation are those tactics that immediately affect eating behavior, such as food-related cues and portion-size suggestions, and affect-based tactics which influence food and brand preferences, such as celebrity or character endorsement.

More particularly, since mere exposure to visual food cues can have strong, automatic behavioral effects, policy-makers should restrict the use of palatable food cues in all child-targeted food marketing communications. There is an urgent need for a binding legal framework that prohibits the use of food-related cues in all marketing communications that children

are effectively exposed to, rather than relying on an industry definition of child-targeted marketing that excludes many forms of actual child-targeted advertising.

Furthermore, the government should oblige child-targeted food marketers to only use persuasive techniques such as celebrity endorsement, whose effectiveness has been demonstrated by scientific studies, to promote healthy nutrition to children. Governmental institutions could, for example, develop legislation whereby popular persuasive techniques, such as endorsement advertising, are only allowed to promote relatively healthy food (below a certain maximum limit for sugar, fat, and salt). Such a measure was recently imposed in the Netherlands. The dutch renewed advertising code for children prohibits the use of child idols on packaging of unhealthy food products targeted at children (Stichting Reclame Code, 2019). One could also impose that there should no longer be any difference between the portion suggestions (images) on packaging and the portion suggested in the nutritional value table on the back of the packaging.

In addition, members of parliament could submit legislative proposals requiring that the use of food-related cues in marketing are accompanied by disclosures warning children about the influence (cognitive advertising literacy) and unfairness (affective advertising literacy) of such cues. However, advertising disclosures might not suffice to diminish the influence of embedded food cues on children's actual food choices and eating behavior since they are improbable to interrupt the automatic activation of cravings, and because children are unlikely to pay conscious attention to these cues in daily life (Harris et al., 2009).

A final policy recommendation is the use of *nudging tactics* to encourage parents and children to make healthier choices. The food industry has been using nudges (i.e. large containers & portion-size suggestions) that are detrimental to consumers' health for years to maximize profits. The government should therefore oblige the food industry to use the same techniques to nudge healthy food choices and food portions, for example by displaying smaller standardized portion-size suggestions on food packaging (Aerts & Smits, 2018). The government would also benefit from applying nudging techniques themselves to facilitate desirable behavior through small interventions in communication and choice architecture (Thaler & Sunstein, 2008). Nudging is a psychological technique to subtly steer the behavior of people in the desired direction by pushing forward the desirable choices without taking away freedom of choice (Thaler, Sunstein, & Balz, 2010). By consciously intervening in the choice architecture, the consumer unconsciously gets the impetus to make better and more rational choices. Nudging responds to the mindless nature of eating behavior by encouraging people to automatically make healthier choices without having to rely on explicit mental processes and self-control (Wilson, Buckley, Buckley, & Bogomolova, 2016).

Systematic literature reviews on nudging interventions have concluded that nudging can indeed stimulate healthier food and beverage choices among adults and adolescents, although the current evidence base remains inconclusive (Arno & Thomas, 2016; Wilson et al., 2016; Nørnberg, Houlby, Skov, & Peréz-Cueto, 2015). Prior research has for instance shown that food positioning nudges can stimulate healthy choices (Bucher et al., 2016; Levy, Riis, Sonnenberg, Barraclough, & Thorndike, 2012). Recently, a systematic review has assessed whether nudges in the family home environment can effectively improve children's diet (Lycett et al., 2017). This review shows that 83% of the 40 reviewed studies provided weak to moderate empirical evidence that nudges in the family home environment improve children's short-term dietary behaviors. Based on this review, one practical recommendation could be to expand the range of healthy snack options that are offered by default in outlets and vending machines, and to make the range of healthy options more varied and more attractive (Bucher et al., 2014; Hakim & Meissen, 2013; Roe et al., 2013). Healthy options such as fruit, vegetables, soup, etc. should become a standard option in school vending machines. Another practical recommendation is to encourage supermarkets and school cafeterias to highlight the healthier options while keeping the less healthy options in the background. For instance, children can be encouraged to opt for healthy options more often when the healthy options are set at eye level and made attractive whereas the unhealthy options are placed out of sight (Jansen, Mulkens, & Jansen, 2010; van Kleef et al., 2014). Another tactic would be to make the healthy option the norm by communicating social norms (e.g. 'more and more people choose healthy options')(Stok et al., 2014).

However, previous reviews, such as the review conducted by Lycett et al. (2017), on the effectiveness of nudging techniques to improve children's dietary behaviors might be biased due to the inclusion of several controversial studies published by Dr. Brian Wansink and his team (Food and Brand Lab). The nudging literature has lost considerable credibility as a result of the recent controversy around the Wansink experiments. Dr. Brian Wansink resigned as a marketing professor at Cornell University on suspicion of scientific misconduct after fifteen of his publications were retracted. Wansink investigated how environmental and marketing factors (i.e., portion-sizes, branding) influence people's eating behavior and stimulate overconsumption and how those same factors can be used to encourage people to make healthier choices. The recent retraction of several influential publications raises questions about the validity of previous research into nudging as a technique to encourage healthy dietary behaviors in parents and children. In spite of this commotion, there are many other studies that suggest that nudging might improve children's dietary behavior (e.g., Jansen et al., 2010; Roe et al., 2013; Stok et al., 2014; van Kleef et al., 2014), hence it remains useful and important to further investigate the potential of nudging techniques.

Future studies should further develop various types of nudging interventions aimed at facilitating healthier dietary choices in young people and investigate and evaluate the effectiveness and sustainability of such interventions using randomized controlled trials.

Furthermore, governmental behavioral insights teams could further develop, implement and evaluate such measures in an evidence-based fashion. At the Flemish level, a team of behavior insights was set up in 2016 to ensure evidence-based policy making based on insights from the behavioral sciences (cf.https://overheid.vlaanderen.be/gedragsinzichten). However, the Flemish team has to date not been very active in the field of nudging interventions that encourage a healthy diet, and such a behavioral insights team is currently lacking within the Belgian federal government.

Recently, the Belgian minister of public health introduced the Nutri-score: a front-of-pack nutrition label that indicates the nutritional value of a product. This label consists of a letter and color combination that varies from A (green, highest score) to E (red, lowest score) and is calculated on the basis of positive (fibers, proteins, fruit, nuts) and negative elements (kilocalories, saturated fatty acids, sugars and salt) (Food Standards Agency nutrient profiling system, Lobstein & Davies, 2009).

The Nutri-score can be considered as a type of *nudge* since it intervenes in front-of-pack communication to subtly encourage consumers to make more healthy food choices. Although a few studies have shown that the Nutri-score facilitates the identification of healthier foods and stimulates consumers to purchase more food products with a higher nutritional value (Ducrot et al., 2015; Ducrot et al., 2016; Julia et al., 2016; Julia & Hercberg, 2017), empirical evidence for the effectiveness of such nutrition labels on actual purchases and diet is still scarce (Hersey, Wohlgenant, Arsenault, Kosa, & Muth, 2013; van Kleef & Dagevos, 2015). Moreover, under current European legislation the use of the Nutri-score label remains voluntary for the food industry.

On the one hand, the Nutri-score might be an effective tool to effortlessly guide consumers' low-involvement food choice decisions in the right direction. On the other hand, the plethora of different governmental and industry-based labeling systems can create confusion, and the information conveyed by the Nutri-score might also create *health halo effects* (van Kleef & Dagevos, 2015). For instance, products with an A-score that are communicated as 'good for us' can stimulate overconsumption of these products which can still result in health problems. Finally, these labeling systems continue to compete with numerous other marketing communication nudges that encourage consumers to indulge in unhealthy rewarding foods (Cohen & Farley, 2008; van Kleef & Dagevos, 2015). Therefore, the Nutri-score can only be an effective tool to improve parents' and children's food choices and diet in combination with other environmental changes such as actually

improving the quality of our food supply, limiting the marketing of unhealthy foods and beverages, and developing binding legislation to restrict the use of palatable food cues, portion-size suggestions and popular, affect-based marketing tactics to promote unhealthy foods and beverages to children.

With regard to practical recommendations for parents and caregivers, this dissertation suggests that, in an obesogenic environment where children are constantly exposed to palatable food cues, their abilities to control their impulses and regulate their eating behavior are their most powerful tools to cope with advertising-induced cravings. Parents and caregivers can use several *food parenting practices* to arm their children against the temptations of food-related cues and teach them how to control their food related impulses from an early age. However, Larsen et al. (2017) have noted that parents' good intentions to teach their children healthy eating habits and their actual parenting behavior do not always match due to their own automatic, food-related habits and reactions. Since habits are hard to change, the solution might be to make healthy food parenting practices habitual themselves. Larsen et al., (2017) propose that in order to model healthy food parenting behavior and promote healthy eating habits among children, parents can use both impulse-focused and reflective techniques.

First, impulse-focused techniques directly modify unhealthy eating habits through nudging and inhibitory-control training. By making small changes in the positioning and presentation of food in the home environment, parents can nudge healthy food choices by making them easily accessible and more attractive. For example, parents could make an effort to keep less healthy snacks out of their children's sight while increasing the visibility and attractiveness of healthy snacks, for instance by placing healthy snacks at eye-level in the fridge, presenting a large fruit bowl on the table, or by presenting healthy dishes in an attractive manner (e.g., funny shapes and names) (Jansen et al., 2010; Larsen et al., 2017; Lycett et al., 2017; van Kleef et al., 2014).

Furthermore, since they often make impulsive food decisions themselves, parents could benefit from food specific inhibitory control training to help them model healthy eating behaviors better (Baranowski et al., 2013; Larsen et al., 2017; Larsen et al., 2015; Vaughn et al., 2016). For instance, when such training results in a devaluation of snack food, parents might become less likely to frequently buy energy-dense snacks and model unhealthy snacking behavior in front of their children (Larsen et al., 2017).

Second, reflective techniques can change unhealthy eating habits indirectly through volitional regulation behaviors such as implementation intentions (Larsen et al., 2017). Implementation intentions are if-then structures that specify a desired behavior in certain situations

(Hagger & Luszczynska, 2014). For instance, parents might make it a habit to offer their children some water or fruit first every time they ask for a snack.

Finally, experts have recently been advising parents to include a mindfulness approach into their parenting tactics (e.g., Dalen, Brody, Staples, & Sedillo, 2015; Forman, Butryn, Manasse, & Bradley, 2015; Larsen et al., 2017; Mason et al., 2016; Townshend, Jordan, Stephenson, & Tsey, 2016). Parents could for instance teach their children to be more mindfully aware of their food choices and portions, and internal feelings of hunger and satiety (Warren, Smith, & Ashwell, 2017).

Final Comments

The global obesity epidemic poses a significant threat to our public health. The dramatic rise in obesity during the last three decades is largely due to remarkable changes in the availability and composition of our food as well as the increase in sophisticated marketing techniques (Morris, Beilharz, Maniam, Reichelt, & Westbrook, 2014). Food choices and intake are often driven by impulsive decisions based on automatic psychological and neurophysiological processes that are very impressable by marketing tactics such as food-related cues (Cohen, 2008; Kahneman, 2011). Hence, the omnipresence of tasty, visual food cues in marketing communications combined with the accessibility of inexpensive, rewarding foods are a clever way to exploit the impulsive processes that often drive human eating behavior.

This dissertation shows that food marketing is indeed a major external factor that influences human eating behavior both indirectly, by creating brand preferences and purchase intentions, and directly by evoking feelings of hedonic hunger. The studies described in this dissertation support the argument that palatable food cues embedded in advertising and other media operate as conditioned cues that trigger psychological and physiological motivations to seek and indulge in rewarding foods (i.e., food cue reactivity) thereby significantly increasing children's food intake, even in the absence of hunger (Boyland et al., 2017; Harris, Bargh, & Brownell, 2009). The ability to override such automatic processes to make conscious and informed decisions requires substantial cognitive resources. However, the cognitive resources that are required to exercise self-control over our eating behavior and resist temptations are limited; self-control capacities *fatigue like a muscle* (Baumeister, Muraven, & Tice, 2000). As argued by Cohen (2008), it is time to abandon the idea that our eating habits and weight are purely a matter of individual, rational choices, since people only have limited abilities to control their automatic responses to food-related cues. Although good food parenting techniques can certainly contribute to resolving the childhood obesity crisis, we cannot expect that parents are individually and solely responsible for, and capable of countering the

subconscious effects of pervasive food marketing on young people. Moreover, if marketers are able to exploit our conditioned (neuro)physiological and psychological responses towards food images and limited cognitive resources to make us buy and eat more (Cohen, 2008), then national and international governments should make it a priority to create binding legislation in order to change our current obesogenic food environment by strictly regulating the supply and marketing of foods and beverages. In order to truly change children's eating habits and combat childhood obesity, far-reaching, long-term policy measures are needed that focus on the environmental context in which we make our food choices, rather than on individual behaviors and responsibilities.

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Samenvatting

Overgewicht en obesitas bij kinderen komen steeds vaker voor in de Westerse wereld en vormen een uitdaging voor de publieke gezondheid. In Europa zijn 20 tot 30% van de kinderen te zwaar. In België hebben ongeveer 23,6% van de jongens en 24,3% van de meisjes tussen 5 en 19 jaar overgewicht (NCD Risk Factor Collaboration, Abarca-Gómez et al., 2017). Kinderen met overgewicht en obesitas lopen een groter risico om als volwassene aan obesitas te lijden, en hebben een grotere kans om gezondheidsproblemen te ontwikkelen die vroeger nooit bij kinderen voorkwamen, zoals diabetes type 2, hypertensie, hart -en vaatziekten en niet-alcoholische leververvetting (Kumar & Kelly, 2017; Skinner, Perrin, Moss & Skelton, 2015). Internationale gezondheidsorganisaties waarschuwen dat voedingsmarketing een van de factoren is die indirect bijdraagt aan overgewicht bij kinderen via het promoten van ongezonde voedingskeuzes en overconsumptie (Institute of Medicine, 2006; Federal Trade Commission, 2012; WHO, 2016).

Volgens een rapport van de Wereldgezondheidsorganisatie (2013) spendeert de Europese voedingsindustrie bijna 7 miljard euro per jaar aan kindgerichte voedingsmarketing. Internationaal onderzoek toont aan dat meer dan 90% van de kindgerichte marketing *high fat, sugar or salt* (HFSS) voeding en drank promoot (Aerts & Smits, 2017; Castonguay, Kunkel, Wright, & Duff, 2012; Powell, Schermbeck, & Chaloepka, 2013). De voedingscategorieën die het vaakst gepromoot worden naar kinderen toe zijn gesuikerde ontbijtgranen, frisdranken, snacks, snoep en fastfood (WHO, 2016). Kinderen worden dagelijks geconfronteerd met ongezonde voedingspromoties via verschillende offline (tv reclame, verpakkingen etc.) en online mediakanalen (websites, sociale media en apps). Bovendien gebruiken marketeers steeds vaker subtiele technieken die moeilijker te herkennen zijn als reclame zoals *food brand placement* in kinderen hun favoriete films, games en tv-series, online *food advergames* en gesponsorde sociale media-inhoud (FTC, 2012; Powell et al., 2013; WHO, 2016). Recente metastudies kwamen tot de conclusie dat kinderen die werden blootgesteld aan ongezonde voedingsmarketing significant meer aten en vaker voor calorierijke opties kozen in vergelijking met kinderen die werden blootgesteld aan voeding neutrale marketing of geen marketing *(*Boyland et al., 2016; Folkvord et al., 2016; Norman et al., 2016; Sadeghirad et al., 2016).

Hoewel er ondertussen heel wat geweten is over de directe effecten van voedselmarketing op kinderen, is er weinig bekend over de onderliggende overtuigingsmechanismen die deze effecten verklaren, of impulsieve kinderen gevoeliger zijn voor voedingsmarketingeffecten dan anderen, en of interventiestrategieën die er op gericht zijn om kinderen hun impulscontrole te verhogen de invloed van voedingsmarketing op snackgedrag kunnen reduceren. Deze hiaten in de literatuur vormden het uitgangspunt van dit doctoraat. Vier studies (3 experimenten en een inhoudsanalyse) werden uitgevoerd die focusten op : a) de persuasieve mechanismen die de invloed van voedingsmarketing verklaren op kinderen hun merkuitkomsten (deel 1) en eetgedrag (deel 2), b) of een Go/No-Go impulscontrole verhogende interventiestrategie kinderen kan beschermen tegen de invloed van voedingsmarketing op snackgedrag (deel 3) en c) of de invloed van voedingsreclame op snackgedrag verschilt naarmate kinderen hun mate van impulsiviteit, gemeten via *behavioral approach system* (BAS) en *behavioral inhibition system* (BIS).

Vier conclusies kunnen worden getrokken uit de studies die in dit proefschrift worden beschreven. Een eerste conclusie was dat voedingsmarketing kinderen hun merkresponsen

(merkattitudes en zeurintenties) beïnvloedt via een *affect-transfer process* via hun attitudes t.o.v. het specifieke format. Meer specifiek vonden we dat de impact van het advertentieformat (tv-reclame vs advergame) op de reacties van kinderen op het merk (merkattitudes en zeurintenties) volledig gemedieerd werd door hun attitudes ten opzichte van het specifieke advertentieformat, maar niet door hun niveau van cognitieve reclamewijsheid. Met andere woorden, het spelen van een advergame resulteerde dus in significant hogere zeurintenties en positievere merkattitudes dan het kijken naar een televisiereclame omdat kinderen de advergame leuker vonden dan de televisiereclame. Dit proces werd geobserveerd voor kinderen tussen 6 en 14 jaar oud. Verder toonden aparte analyses per format ook aan dat enkel kinderen hun attitudes t.o.v. de reclame significant gerelateerd waren aan hun zeurintenties, en cognitieve reclamewijsheid niet. En dit voor zowel de televisiereclame als de advergame en ongeacht leeftijd. Dit wijst erop dat zelfs de oudere kinderen in deze steekproef hun reclamewijsheid niet toepasten als een verdedigingsmechanisme tegen voedingsreclame.

Een tweede conclusie was dat voedingsmarketing kinderen hun eetgedrag rechtstreeks kan beïnvloeden via het observeren van smakelijke, visuele voedingscues in reclame of *food cue reactivity*. Meer specifiek toonde een experiment aan dat kinderen (1ste en 5de leerjaar) significant meer aten na blootstelling aan voedingscues in een televisiekookprogramma in vergelijking met een non-food televisieprogramma. Hoewel deze studie zich richt op de impact van visuele voedingscues in de context van een tv-kookprogramma, dragen de bevindingen bij aan ons inzicht in de manier waarop visuele voedingscues in reclame het eetgedrag van kinderen beïnvloeden. Over het algemeen suggereren de bevindingen dat het observeren van smakelijke, visuele voedingscues in reclame sterke, automatische effecten op het eetgedrag van kinderen kan hebben die verder gaan dan de effecten van honger en eetgewoonten.

Een derde conclusie was dat het uitvoeren van een Go/No-Go interventietaak, waarbij kinderen leren om impulsieve reacties op smakelijke voedingscues te controleren, de impact van tv-reclame voor voeding op kinderen hun snoepinname niet effectief kon verminderen. De Go/No-Go interventietaak bleek enkel effectief om kinderen hun snoepgedrag te verminderen bij een subset van kinderen die frequent snoepen. Verder toonden de resultaten van hoofdstuk 4 aan dat de impact van voedingsreclame op tv op de snoepinname van kinderen niet significant gemodereerd werd door de mate van impulsiviteit van de kinderen.

Op basis van deze bevindingen werden enkele aanbevelingen geformuleerd. De overheid zou bindende wetgeving moeten uitwerken om de kindgerichte marketing voor bepaalde voedingsproducten die een maximumgrens aan suiker, zout en vet overschrijden te verbieden. Er is dringend behoefte aan een bindend wettelijk kader dat het gebruik van smakelijke voedingscues reguleert in alle kindgerichte marketingcommunicatie. De overheid moet wetgeving uitwerken waarbij populaire overtuigingstechnieken, zoals het gebruik van voedingsafbeeldingen en *endorsement advertising*, enkel toegelaten worden om relatief gezonde voeding (maximumhoeveelheid suiker) te promoten naar kinderen toe. Men zou ook voedingsbedrijven moeten aansporen om een groter deel van het marketingbudget te spenderen aan de promotie van gezonde voeding. Tenslotte kunnen ouders aangemoedigd worden om hun kinderen te wapenen tegen de verleidingen van voedingsmarketing door hen gezonde voedingsgewoonten bij te brengen en hen te leren hoe ze hun voeding gerelateerde impulsen (vb. zin om te snacken) vanaf jonge leeftijd kunnen beheersen. Ouders moeten een thuisomgeving creëren waarbij gezonde voedingskeuzes gemakkelijk en aantrekkelijk zijn. Maar, om overgewicht en obesitas bij kinderen

echt te bestrijden, zijn verreikende, lange-termijn beleidsmaatregelen nodig die zich richten op de context waarin we onze voedselkeuzes maken (aanbod en marketing), in plaats van op individueel gedrag en verantwoordelijkheden.

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