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Seeing Is Doing. The Implicit Effect of TV Cooking Shows on Children's Use of Ingredients.

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1 ABSTRACT

2
3 Prior research has established that TV viewing and food marketing influence children's eating
4 behavior. However, the potential impact of popular TV cooking shows has received far less
5 attention. TV cooking shows may equally affect children's food selection and consumption by
6 distributing both food cues and portion-size cues. In an experimental study, elementary school
7 children were randomly exposed to a cooking show, that either did or did not display a
8 portion-size cue, or a non-food TV show. Results showed that children used significantly
9 more sugar on their pancakes, and consumed significantly more of the pancakes after
10 watching a TV cooking show compared to a non-food TV show. However, observing a
11 portion-size cue in a TV cooking show only influenced sugar selection in older children (5th
12 grade), but not in younger children (1st grade). The findings suggest that food cues in TV
13 cooking shows stimulate consumption by inducing food cravings in children. Actual portion-
14 size cues only appeared to affect older children's food selection.

15
16
17 Keywords: TV Cooking Shows, Children, Descriptive Norms, Food Consumption, Sugar
18 Usage

1. 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 between watching 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, 2016). 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, Anschutz, 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, 2014; 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, 2013; Wansink, Hanks & Kaipainen, 2015). The visual salience of food has been shown to increase food consumption (McCrickerd & Forde, 2016; Wadhera et al., 2013). 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, Anschütz, Boyland, Kelly, Buijzen, 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; 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., 2014a; Stok, de Ridder, de Vet, & de Wit, 2014; Stok, de Vet, de Wit, Luszczynska, Safron, & de Ridder., 2015; Stok, Verkooijen, de Ridder, de Wit, & de Vet, 2014). Prinsen and colleagues (2012), 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 et al., 2003; Fisher, Liu, Birch, & Rolls, 2007; Marchiori, Waroquier, Klein, 2012), and when larger serving-sizes are suggested on food packaging (Neyens, Aerts, & Smits, 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 (Boyland et al., 2015). Prior studies have indeed established that children eat more after seeing images of palatable foods in food advertising (Harris, Bargh, & Brownell, 2009; Harris, Brownell, & Bargh, 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, 2003; Halford et al., 2008; Kaur, Choi, Mayo & Harris, 2003). Finally, we wondered whether the impact of observing descriptive portion-size 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, De Ridder, de Vet, & de Wit, 2014). Therefore, older children and teenagers might be more vulnerable to descriptive portion-size norms communicated through TV cooking shows than younger children.

2. Methods

2.1 Participants

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, $M_{\text{age}} = 8.8$, $SD = 2.1$). Ethical approval for the study was obtained from the authors' university ethical committee, and the parents provided their informed consent.

2.2 Stimuli and Procedure

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 minutes 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^[1]. This episode lasts 3 minutes and 36 seconds. 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 it's 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 it's 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 grams on average), and an individual, pre-weighed cup containing 50 grams 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 minutes.

3. Measures

The amount of sugar that the children used on their pancakes was measured by weighing the individual cups of brown sugar (containing 50 grams 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 grams 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, 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).

3.1 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.

4. Results

Table 1 (see Appendix 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, 2007). Children's level of hunger did not differ significantly between the conditions ($F(2, 105) = .3, p = .741$). Habitual sugar use (how much sugar children usually eat with their pancakes at home, see Appendix 1) was significantly and positively related to total sugar use ($r = .42, p < .0001$) and pancake consumption ($r = .24, p = .019$). 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 ($F(2, 92) = 6.42, p = .002$), which might affect the interpretation of the results.

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

To examine the first two hypotheses, two separate one-way ANOVA's were conducted. The main effect of the experimental condition on sugar usage was significant (Welch $F(2, 66.710) = 8.09, p = .001$). Planned contrasts revealed that children who watched the cooking show that displayed the sugar portion-size sprinkled significantly more sugar on their pancakes compared to children who watched the non-food TV show ($t(54.416) = -3.96, SE = 3.87, p = <.0001, CI [-23.08 - -7.57], d = 1.04$, see Figure 1). Children who watched the cooking show without the sugar portion-size norm also used significantly more sugar compared to the non-food TV show ($t(74.761) = -2.36, SE = 3.8, p = .021, CI [-16.54 - 1.39], d = .51$). However, the difference between the cooking show episode that did and did not display the sugar portion-size was nonsignificant ($t(75.293) = 1.53, SE = 4.17, p = .131, CI [-1.94 - 14.65], d = .33$). 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 ($F(2, 86) = 2.29, p = .108, \eta^2 = .051$). Children's habitual sugar usage ($F(1, 86) = 8.00, p = .006, B = 5.18, \eta^2 = .085$), and their level of hunger ($F(1, 86) = 17.33, p < .0001, B = 10.44, \eta^2 = .17$) 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 ($F(1, 37) = 6.29, p = .017, \eta^2 = .15$). Children used significantly more sugar on their pancakes in the sugar display condition compared to the non-food condition ($M_{diff} = 10.29, SD = 4.1, p = .017, CI [1.97-18.61], d = 1.29$). The main effect of habitual sugar usage was also significant ($F(1, 37) = 11.32, p = .002, B = 8.00, \eta^2 = .23$). 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 ($F(1, 64) = 1.25, p = .267, \eta^2 = .02$). Children's level of hunger ($F(1, 64) = 19.50, p < .0001, B = 12.8, \eta^2 = .23$), and habitual sugar usage were ($F(1, 64) = 4.05, p = .048, B = 4.05, \eta^2 = .06$) significantly and positively related to children's sugar selection.

The main effect of the experimental condition on pancake consumption was also significant (Welch $F(2, 61.381) = 7.25, p = .001$). 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 ($t(57.348) = 3.33, SE = 14.51, p = .002, CI [-35.67 - -6.88], d = .61$). Hence, the second hypothesis was confirmed. Children who watched the cooking episode in which the sugar portion-size was shown ate significantly more pancakes than children who watched the same episode without the scene displaying the sugar portion-size ($t(58.627) = 2.54, SE = 9.08, p = .014, CI [4.91 - 41.24], d = .58$). 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 ($F(2, 84) = 4.36, p = .016, \eta p^2 = .09$). Children's level of hunger was significantly positively related to pancake consumption ($F(2, 84) = 5.57, p = .021; \eta p^2 = .06, B = 12.73$), whereas these children's attitudes towards the TV programme ($F(2, 84) = 6.25, p = .014, \eta p^2 = .07, B = -11.50$) were significantly negatively related to pancake consumption. The main effect of habitual sugar use was nonsignificant ($F(2, 84) = .29, p = .593, \eta p^2 = .003$).

4.2 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. No interaction-effect was found between the experimental condition and BMI percentile to predict sugar usage ($F(2, 57) = .005, p = .995, \eta p^2 = .000$). The main effect of BMI percentile was also nonsignificant ($F(1, 57) = .790, p = .378, \eta p^2 = .014$). However, the main effect of level of hunger was significant ($F(1, 57) = 11.18, p = .001, \eta p^2 = .164$). No interaction-effect was found between the experimental condition and BMI percentile to predict pancake consumption ($F(2, 56) = 1.05, p = .357, \eta p^2 = .036$).

4.3 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. The analysis yielded significant main effects for the experimental condition ($F(2, 104) = 5.19, p = .007, \eta p^2 = .091$) and age-group ($F(1, 104) = 24.44, p < .0001, \eta p^2 = .19$). However, the interaction effect was nonsignificant ($F(2, 104) = 1.63, p = .201, \eta p^2 = .03$). Simple effects analysis showed that the experimental condition only had a significant effect among children from the oldest age-group ($F(2, 104) = 5.84, p = .004$), but not among younger children (see Figure 3) ($F(2, 104) = 1.68, p = .191$). 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 ($t(38.819) = 2.54, SE = 4.13, p = .015, CI [2.14 - 18.86], d = .72$, see Figure 4) and the non-food condition ($t(21.503) = 5.58, SE = 3.40, p < .0001, CI [11.93 - 26.07], d = 1.87$). Further, children in the no sugar-display condition used significantly more sugar on their pancakes than children in the non-food condition ($t(44.983) = 2.96, SE = 2.88, p = .005, CI [2.71 - 14.29], d = .74$).

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 nonsignificant 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 (Jansen, 1998; Boyland et al., 2016). 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, 2014). 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 (Jansen, 1998; Boyland et al., 2016), 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.

A third aim of this study was to examine the potential moderating role of children's BMI. Surprisingly, children's BMI percentile (Barlow, 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 (Kaur et al., 2003; Francis et al., 2003; Halford et al., 2008). 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 (5th 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 (5th 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 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 two food cues evoke stronger behavioral effects than 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; Skinner et al., 2002; Lake et al., 2004), 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).

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Appendix 1

Table 1. Descriptive Statistics: Main Variables per Experimental Condition

Variables	Sugar-display cooking show <i>M(SD)</i> (range)	No sugar-display cooking show <i>M(SD)</i>	Non-food TV show <i>M(SD)</i>
Age	8.5 (2.1)	9.0 (2.0)	8.9 (2.3)
Recognizing show	90.3%	79.6%	50%
Liking the TV show	2.3 (.07) (1-5)	2.2 (.08)	2.7 (.09)
Sugar usage at home	2.9 (.7) (1-5)	2.1 (1.1)	2.0 (.9)
Hunger	1 (.7) (0-2)	1.1 (.8)	1.1 (.7)
BMI	16.4 (1.9)	16.5 (1.7)	17.9 (2.3)
Grams of sugar used	34.1 (16.7)	27.7 (21.3)	18.8 (12.2)
Pancakes eaten in grams	124.4 (41.3)	101.3 (37.7)	88.7 (28.9)

Visual Analogue Scale: Habitual Sugar Usage (Smits & Vandebosch, 2012).

483

No Sugar

Very few sugar

Few sugar

Much sugar

Very much sugar

I don't know

Figure 1 Amount of Sugar Use by Experimental Condition

Figure 2 Amount of Pancake Consumption by Experimental Condition

Figure 3 Amount of Sugar Usage by Experimental Condition (1st grade)

Figure 4 Amount of Sugar Usage by Experimental Condition (5th grade)

References

- Alonso-Alonso, M., Woods, S. C., Pelchat, M., Grigson, P. S., Stice, E., Farooqi, S., ... & Beauchamp, G. K. (2015). Food reward system: current perspectives and future research needs. *Nutrition Reviews*, 73(5), 296-307.
- Arnett, J. J. (1995). Adolescents' uses of media for self-socialization. *Journal of Youth and Adolescence*, 24(5), 519-533.
- Bandura, A. (1986). Social foundations of thought and action. A social cognitive perspective. Englewood Cliffs, NJ: Prentice-Hall.
- Bandura, A. Social cognitive theory of mass communication. In: Zillman, JBD., editor. Media Effects: Advances in Theory and Research. Erlbaum Associates; Mahwah, NJ: 2002. p. 121-154.
- Barlow, S. E., & Committee, E. (2007). Expert committee recommendations regarding prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*, 120(4), 164-192.
- Birch, L., & Fisher, J. (1998). Development of eating behaviors among children and adolescents. *Pediatrics*, 101, 539-549.
- Birch, L. L. (1999). Development of food preferences. *Annual review of nutrition*, 19(1), 41-62.
- Birch, L. L., & Fisher, J. O. (2000). Mothers' child-feeding practices influence daughters' eating and weight. *The American journal of clinical nutrition*, 71(5), 1054-1061.
- Bodenlos, J. S., & Wormuth, B. M. (2013). Watching a food-related television show and caloric intake. A laboratory study. *Appetite*, 61, 8-12.
- Boseley, S. (2015, August 27). Jamie Oliver's Sugar Rush: a crusade to save Britain's health. The Guardian. Retrieved from:

<https://www.theguardian.com/lifeandstyle/2015/aug/27/jamie-oliver-sugar-rush-channel-4-crusade-save-britain-health>. Accessed September 15, 2016.

- Boulos, R., Vikre, E. K., Oppenheimer, S., Chang, H., & Kanarek, R. B. (2012). ObesiTV: how television is influencing the obesity epidemic. *Physiology & behavior*, 107(1), 146-153.
- Boyland, E. J., & Halford, J. C. (2013). Television advertising and branding. Effects on eating behaviour and food preferences in children. *Appetite*, 62, 236-241.
- Boyland, E. J., Nolan, S., Kelly, B., Tudur-Smith, C., Jones, A., Halford, J. C., & Robinson, E. (2016). Advertising as a cue to consume: a systematic review and meta-analysis of the effects of acute exposure to unhealthy food and nonalcoholic beverage advertising on intake in children and adults. *American Journal of Clinical Nutrition*, 104(4), 1-15. doi: 10.3945/ajcn.115.120022
- Brown, B., Bakken, J.P., Ameringer, S.W. et al. (2008) A comprehensive conceptualization of the peer influence process in adolescence. In *Understanding Peer Influence in Children and Adolescents*, pp. 17–45 [MJ Prinstein and KA Dodge, editors]. New York: Guilford Press.
- Buijzen, M., Van Reijmersdal, E. A., & Owen, L. H. (2010). Introducing the PCMC model: An investigative framework for young people's processing of commercialized media content. *Communication Theory*, 20(4), 427-450.
- Burger K.S., Fisher, J.O., Johnson, S.L. (2011). Mechanisms behind the portion size effect: visibility and bite size. *Obesity*, 19, 546–551.
- Castellanos, E. H., Charboneau, E., Dietrich, M. S., Park, S., Bradley, B. P., Mogg, K., & Cowan, R. L. (2009). Obese adults have visual attention bias for food cue images: evidence for altered reward system function. *International journal of obesity*, 33(9), 1063-1073.

- Chan, K., Prendergast, G., Grønhøj, A., & Bech-Larsen, T. (2010). The role of socializing agents in communicating healthy eating to adolescents. A cross cultural study. *Journal of International Consumer Marketing*, 23(1), 59–74. doi:10.1080/08961530.2011.524578.
- Chartrand, T. (2005). The role of conscious awareness in consumer behavior. *Journal of Consumer Psychology*, 15(3), 203–210.
- Chartrand, T.L., Huber, J., Shiv, B., Tanner, R. (2008). Nonconscious goals and consumer choice. *Journal of Consumer Research*, 35, 189–201.
- Cialdini, R. B. (2009). *Influence: Science and practice* (5th ed.). Englewood Cliffs, NJ: Prentice Hall.
- Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct. Recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology*, 58, 1015–1026. doi:10.1037//0022-3514.58.6.1015.
- Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. *Advances in Experimental Social Psychology*, 24, 201-234. doi:10.1016/S0065-2601(08)60330-5.
- Cialdini, R. B., & Trost, M. R. (1998). Social influence. Social norms, conformity, and compliance. In D. T. Gilbert, S. T. Fiske, & G. Lindzey (Eds.), *The handbook of social psychology* (4th ed., Vol. 2, pp. 151–192). New York: McGraw-Hill.
- CIM (2015). Centre for Information on Media in Belgium, www.cim.be.
- Coleman, J. (2011) *The Nature of Adolescence*, 4th ed. Hove, UK: Routledge.
- Collins, K. (2009). *Watching what we eat: The evolution of television cooking shows*. Bloomsbury Academic.

- Danner, F. W. (2008). A national longitudinal study of the association between hours of TV viewing and the trajectory of BMI growth among US children. *Journal of Pediatric Psychology*, 33(10), 1100-1107.
- De Backer, C. J., & Hudders, L. (2016). Look who's cooking. Investigating the relationship between watching educational and edutainment TV cooking shows, eating habits and everyday cooking practices among men and women in Belgium. *Appetite*, 96, 494-501.
- De Graaf, C., & Kok, F. J. (2010). Slow food, fast food and the control of food intake. *Nature Reviews Endocrinology*, 6(5), 290-293.
- De Ridder, D., De Vet, E., Stok, M., Adriaanse, M., & De Wit, J. (2013). Obesity, overconsumption and self-regulation failure: The unsung role of eating appropriateness standards. *Health Psychology Review*, 7(2), 146-165.
- Folkvord, F., Anschutz, D. J., Nederkoorn, C., Westerik, H., & Buijzen, M. (2014). Impulsivity, "advergaming," and food intake. *Pediatrics*, 133(6), 1007-1012.
- Folkvord, F., Anschutz, D. J., Wiers, R. W., & Buijzen, M. (2015). The role of attentional bias in the effect of food advertising on actual food intake among children. *Appetite*, 84, 251-258.
- Folkvord, F., Anschutz, D. J., Boyland, E., Kelly, B., & Buijzen, M. (2016). Food advertising and eating behavior in children. *Current Opinion in Behavioral Sciences*, 9, 26-31.
- Francis, L. A., Lee, Y., & Birch, L. L. (2003). Parental weight status and girls' television viewing, snacking, and body mass indexes. *Obesity Research*, 11(1), 143-151.
- Fisher, J. O., Liu, Y., Birch, L. L., & Rolls, B. J. (2007). Effects of portion size and energy density on young children's intake at a meal. *The American Journal of Clinical Nutrition*, 86(1), 174-179.

- 651 Fisher, J. O., Rolls, B. J., & Birch, L. L. (2003). Children's bite size and intake of an entree
 652 are greater with large portions than with age-appropriate or self-selected portions.
 653 *The American Journal of Clinical Nutrition*, 77(5), 1164-1170.
- 654 Halford, J. C., Gillespie, J., Brown, V., Pontin, E. E., & Dovey, T. M. (2004). Effect of
 655 television advertisements for foods on food consumption in children. *Appetite*, 42(2),
 656 221-225.
- 657 Halford, J. C., Boyland, E. J., Hughes, G., Oliveira, L. P., & Dovey, T. M. (2007). Beyond-
 658 brand effect of television (TV) food advertisements/commercials on caloric intake
 659 and food choice of 5–7-year-old children. *Appetite*, 49(1), 263-267.
- 660 Halford, J.C., Boyland, E.J., Hughes, G.M, Stacey, L., McKean, S., Dovey, TM.(2008).
 661 Beyond-brand effect of television food advertisements on food choice in children:
 662 the effects of weight status. *Public Health Nutrition*, 11, 897–904.
- 663 Hare-Bruun, H., Nielsen, B. M., Kristensen, P. L., Møller, N. C., Togo, P., & Heitmann, B. L.
 664 (2011). Television viewing, food preferences, and food habits among children: a
 665 prospective epidemiological study. *Public Health*, 11(1), 1.
- 666 Harris, J. L., Bargh, J. A., & Brownell, K. D. (2009). Priming effects of television food
 667 advertising on eating behavior. *Health Psychology*, 28(4), 404.
- 668 Harris, J. L., Brownell, K. D., & Bargh, J. A. (2009). The food marketing defense model:
 669 integrating psychological research to protect youth and inform public policy. *Social*
 670 *Issues and Policy Review*, 3(1), 211-271.
- 671 Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food
 672 intake: a normative interpretation. *Psychological bulletin*, 129(6), 873.
- 673 Jansen, A. (1998). A learning model of binge eating: cue reactivity and cue
 674 exposure. *Behaviour research and therapy*, 36(3), 257-272.

- 675 Jones, M., Freeth, E. C., Hennessy-Priest, K., & Costa, R. J. (1926). A Systematic Cross-
 676 Sectional Analysis of British Based Celebrity Chefs' Recipes: Is There Cause for
 677 Public Health Concern? *Food and Public Health*, 3(2), 100-110.
- 678 Kaur, H., Choi, W. S., Mayo, M. S., & Harris, K. J. (2003). Duration of television watching is
 679 associated with increased body mass index. *The Journal of Pediatrics*, 143(4), 506-
 680 511.
- 681 Kostyrka-Allchorne, K., Cooper, N. R., & Simpson, A. (2016). Touchscreen Generation:
 682 Children's current media use, parental supervision methods and attitudes towards
 683 contemporary media. *Acta Paediatrica*.
- 684 Kraak, V. I., & Story, M. (2015). Influence of food companies' brand mascots and
 685 entertainment companies' cartoon media characters on children's diet and health: a
 686 systematic review and research needs. *Obesity Reviews*, 16(2), 107-126.
- 687 Lake, A. A., Rugg-Gunn, A. J., Hyland, R. M., Wood, C. E., Mathers, J. C., & Adamson, A.
 688 J. (2004). Longitudinal dietary change from adolescence to adulthood: perceptions,
 689 attributions and evidence. *Appetite*, 42(3), 255-263.
- 690 Lally, P., Bartle, N., & Wardle, J. (2011). Social norms and diet in adolescents. *Appetite*,
 691 57(3), 623-627.
- 692 Marchiori, D., Waroquier, L., & Klein, O. (2012). "Split them!" smaller item sizes of cookies
 693 lead to a decrease in energy intake in children. *Journal of Nutrition Education and*
 694 *Behavior*, 44(3), 251-255.
- 695 McCrickerd, K., & Forde, C. G. (2016). Sensory influences on food intake control: Moving
 696 beyond palatability. *Obesity Reviews*, 17(1), 18-29.
- 697 Nederkoorn, C., Smulders, F. T. Y., & Jansen, A. (2000). Cephalic phase responses, craving
 698 and food intake in normal subjects. *Appetite*, 35(1), 45-55.

- Neyens, E., Aerts, G., & Smits, T. (2015). The impact of image-size manipulation and sugar content on children's cereal consumption. *Appetite*, 95, 152-157.
- Nijs, I. M., Muris, P., Euser, A. S., & Franken, I. H. (2010). Differences in attention to food and food intake between overweight/obese and normal-weight females under conditions of hunger and satiety. *Appetite*, 54(2), 243-254.
- Norman, J., Kelly, B., Boyland, E., & McMahon, A. T. (2016). The impact of marketing and advertising on food behaviours: Evaluating the evidence for a causal relationship. *Current Nutrition Reports*, 5(3), 139-149.
- Ogden, C.L., Carroll, M.D., Kit, B.K., Flegal, K.M. (2014). Prevalence of childhood and adult obesity in the United States, 2011-2012. *Journal of the American Medical Association*, 311(8), 806-814.
- Pedersen, S., Grønhøj, A., & Thøgersen, J. (2015). Following family or friends. Social norms in adolescent healthy eating. *Appetite*, 86, 54-60.
- Pollan, M. (2009). Out of the kitchen, onto the couch. *New York Times Magazine*. MM26.
- Prinsen, S., de Ridder, D. T., & de Vet, E. (2013). Eating by example. Effects of environmental cues on dietary decisions. *Appetite*, 70, 1-5.
- Quetelet, A. (1835). *Sur l'homme et le développement de ses facultés ou essai de physique sociale* (Vol. 1). Bachelier.
- Robinson, E., Nolan, S., Tudur-Smith, C., Boyland, E. J., Harrold, J. A., Hardman, C. A., & Halford, J. C. (2014). Will smaller plates lead to smaller waists? A systematic review and meta-analysis of the effect that experimental manipulation of dishware size has on energy consumption. *Obesity Reviews*, 15(10), 812-821.

- Rolls, B. J., Roe, L. S., Kral, T. V., Meengs, J. S., & Wall, D. E. (2004). Increasing the portion size of a packaged snack increases energy intake in men and women. *Appetite*, 42(1), 63-69.
- Silva, N., Di Bonaventura, E., Byrnes, C., & Herbold, N. (2010). Are 30-Minute Cooking Shows on the Food Network an Option for Dietitians to Recommend During Counseling? *Topics in Clinical Nutrition*, 25(1), 70-74.
- Skinner, J. D., Carruth, B. R., Bounds, W., & Ziegler, P. J. (2002). Children's food preferences: a longitudinal analysis. *Journal of the American Dietetic Association*, 102(11), 1638-1647.
- Smits, T., & Vandebosch, H. (2012). Endorsing children's appetite for healthy foods: Celebrity versus non-celebrity spokes-characters. *Communications*, 34(7), 371-391.
- Stok, F. M., de Ridder, D. T., de Vet, E., & de Wit, J. B. (2014). Don't tell me what I should do, but what others do: The influence of descriptive and injunctive peer norms on fruit consumption in adolescents. *British Journal of Health Psychology*, 19(1), 52-64.
- Stok, F. M., de Vet, E., de Wit, J. B., Luszczynska, A., Safron, M., & de Ridder, D. T. (2015). The proof is in the eating: subjective peer norms are associated with adolescents' eating behaviour. *Public Health Nutrition*, 18(06), 1044-1051.
- Stok, F. M., Verkooijen, K. T., Ridder, D. T., Wit, J. B., & Vet, E. (2014). How Norms Work: Self-Identification, Attitude, and Self-Efficacy Mediate the Relation between Descriptive Social Norms and Vegetable Intake. *Applied Psychology: Health and Well-Being*, 6(2), 230-250.
- Spence, C., Okajima, K., Cheok, A. D., Petit, O., & Michel, C. (2015). Eating with our eyes: from visual hunger to digital satiation. *Brain and Cognition*, 109
- <http://dx.doi.org/10.1016/j.bandc.2015.08.006>

- Sitwell, W. (2016, July 2). Lights, camera, cookery: how 70 years of foodie TV has changed the way we eat. The Telegraph. Retrieved from <http://www.telegraph.co.uk/food-and-drink/features/lights-camera-cookery-how-70-years-of-foodie-tv-has-changed-the/>
- van der Horst, K., Ferrage, A., & Rytz, A. (2014). Involving children in meal preparation. Effects on food intake. *Appetite*, 79, 18-24.
- Wadhera, D., & Capaldi-Phillips, E. D. (2014). A review of visual cues associated with food on food acceptance and consumption. *Eating Behaviors*, 15(1), 132-143.
- Wansink, B., Hanks, A. S., & Kaipainen, K. (2015). Slim by Design Kitchen Counter Correlates of Obesity. *Health Education & Behavior*, 43(5), 552-558.
- Wansink, B., & Kim, J. (2005). Bad popcorn in big buckets: portion size can influence intake as much as taste. *Journal of Nutrition Education and Behavior*, 37(5), 242-245.
- Wansink, B., Painter, J. E., & North, J. (2005). Bottomless bowls: why visual cues of portion size may influence intake. *Obesity Research*, 13(1), 93-100.
- Reported prevalence of child and adolescent overweight and obesity. (2004). Retrieved October 11, 2016, from http://www.worldobesity.org/site_media/uploads/Appendix_1.pdf
- Zeinstra, G. G., Kooijman, V., & Kremer, S. (2016). My idol eats carrots, so do I? The delayed effect of a classroom-based intervention on 4–6-year-old children's intake of a familiar vegetable. *Food Quality and Preference*.
<http://dx.doi.org/10.1016/j.foodqual.2016.11.007>

[1] In Flanders, brown sugar is a popular and common pancake topping.

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