

Exposure to television food advertising primes food-related cognitions and triggers motivation to eat

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Objective: This study investigated the effect of exposure to television food advertising on accessibility of food-related cognitions and motivation to eat.

Design and main outcome measures: We initially developed a word stem completion task to measure accessibility of food-related cognitions. In two subsequent experiments, 160 female undergraduate students (Experiment 1) and 124 overweight or obese community-dwelling women (Experiment 2) viewed a series of television commercials advertising either food or non-food products. They then completed the word stem task and also rated their desire to eat.

Results: Exposure to televised food advertisements led to the completion of word stems with more food- and eating-related words in both experiments. It also increased self-reported desire to eat, but only for overweight and obese individuals (Experiment 2). In both samples, there was a positive association between accessibility of food-related cognitions and reported desire to eat, following priming with television food advertisements.

Conclusion: We conclude that an increased activation of food-related cognitions may provide a mechanism for the link between food advertising and consumption. This has implications for tackling pathological (over)eating.

Keywords: television food advertising; priming; food cognitions; motivation to eat; word stem completion task; obesity

There is an abundance of food cues in contemporary Western environments. We are continually exposed to images of food and eating – in shops, restaurants and fast food outlets, as well as through advertising in magazines, on billboards, public transport and most notably television. Approximately a third to half of all television advertisements are for food (Chapman, Nicholas, & Supramaniam, 2006; Powell, Szczypka, Chaloupka, & Braunschweig, 2007). Of these, the majority are for unhealthy food, that is, food high in fat, sugar and/or salt with little nutritional value. This intense advertising of unhealthy food has been linked to the (over)consumption of such food. Indeed, recent studies show that exposure to television advertisements promoting snack foods increases snack food intake in both adults and children (Halford, Gillespie, Brown, Pontin, & Dovey, 2004; Harris, Bargh, & Brownell, 2009). Food advertising stimulates people's desire to eat and motivation to act (i.e. consume) (Cohen, 2008). However, the mechanism by which food advertising increases consumption remains unclear.

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One possibility is that food advertising activates thoughts, or cognitions, about food and eating, which then trigger a corresponding motivation to eat. A number of priming studies have shown that pre-exposing participants to food cues increases the accessibility of food-related cognitions on a subsequent task (Papies, Stroebe, & Aarts, 2007, 2008). More recent investigations have linked this activation of food-related cognitions to an increased motivation to consume. In particular, Hofmann, van Koningsbruggen, Stroebe, Ramanathan, and Aarts (2010) found a positive correlation between accessibility of food-related cognitions following pre-exposure to food cues and self-reported desire to eat. van Koningsbruggen, Stroebe, and Aarts (2013) further showed that participants for whom food priming had activated food-related cognitions worked harder to earn food rewards. Priming effects on cognitive accessibility and motivational processes have also been shown for other behaviours, including academic achievement, weight management and athleticism (Ferguson, 2008; Ferguson & Bargh, 2004; Fishbach, Friedman, & Kruglanski, 2003).

Taken together, these findings suggest that exposure to environmental food cues may contribute to (over)eating because such cues trigger food-related cognitions and a corresponding motivation to eat. The aim of the present study was to investigate the effect of exposure to food advertising on the cognitive and motivational processing of food- and eating-related information. Thus, unlike previous priming studies where food primes consisted of food- or eating-related words or sentences, often presented subliminally, we exposed participants to real-world food primes, in this case, televised food advertisements. Specifically, we investigated whether exposure to television food advertising primes food-related cognitions and triggers a motivation to eat.

According to Hofmann, Friese, and Strack (2009), thoughts about food and eating often occur spontaneously and without awareness, and thus are best captured by indirect measures. Previous priming studies have assessed accessibility of food-related cognitions by indirect measures such as the lexical decision task (Fishbach et al., 2003; Papies et al., 2007; van Koningsbruggen et al., 2013), the dot probe task (Papies et al., 2008), the automatic attitude task (Ferguson, 2008) and the affect misattribution procedure (Hofmann, van Koningsbruggen, et al., 2010). These tasks require computerised equipment, and can only be individually administered. To circumvent these issues, we developed a word stem completion task, parallel to the one created by Tiggemann, Hargreaves, Polivy, and McFarlane (2004) as an indirect measure of appearance and weight schema activation. Completing word stems is a simple, straightforward task that requires no specialised equipment, and can be administered in a group setting. Unlike some of the tasks listed above (lexical decision task, affect misattribution procedure), it has the added benefit that it does not prime the to-be-measured construct. In addition, the word stem task is particularly suitable for experimental studies of television advertising because of its demonstrated responsiveness to manipulations of media exposure (Hargreaves & Tiggemann, 2002, 2003; Tiggemann & Slater, 2004). Using a similar task, van Koningsbruggen, Stroebe, Papies, and Aarts (2011) recently demonstrated activation of the dieting goal in chronic dieters who reminded themselves of this goal upon exposure to food cues.

We first developed a food version of the word stem completion task as an indirect measure of accessibility of food-related cognitions. We then used this task in two experiments to assess the activation of such cognitions following exposure to television food advertising. In addition to measuring cognitive accessibility, we also measured

participants' motivation to eat. Following Hofmann, van Koningsbruggen, et al. (2010), we operationalised this motivational component as desire to eat. A better understanding of the cognitive and motivational processes activated by food advertising is important as such advertising, and particularly its effect on (over)consumption is thought to contribute to the obesity epidemic (Harris et al., 2009). In line with much food priming research, Experiment 1 was conducted with an undergraduate student sample. Experiment 2 specifically recruited participants who display a strong eating-oriented reaction to food, namely overweight and obese individuals. Overweight and obese people show increased activation in the brain's reward system in response to food cues (Stoeckel et al., 2008). Compared to individuals of normal weight, they also bias their attention towards food cues (Long, Hinton, & Gillespie, 1994), hold more positive attitudes about food (Roefs et al., 2006) and are willing to work harder for food rewards (Saelens & Epstein, 1996). This heightened cognitive and motivational orientation to food may make overweight and obese individuals particularly vulnerable to food advertising.

Development of the food- and eating-related word stem completion task

An initial pool of over 200 common food- and eating-related words was generated. This list was then reduced to 45 three-letter word stems, which could be completed to form both an unambiguous food- or eating-related word, and at least one reasonably high frequency alternative word that is not related to food or eating. For example, the word stem BRE__ could be completed as *bread* (food related) or *break* or *breath* (non-food related).

Final selection of word stems was determined by a pilot study on a sample of 31 female undergraduate students aged 18–29 years ($M=20.48$, $SD=2.25$). Participants were given the 45 word stems, printed on a single A4 sheet of paper, and instructed to complete them with whatever word came to mind first. Using Tiggemann et al.'s (2004) criteria, 21 word stems were selected for inclusion in the final task. Specifically, for each stem: (1) at least one food-related word was generated; (2) the food-related word was generated by fewer than 50% of participants; (3) any single non-food word was generated by fewer than 50% of participants; (4) the number of non-completions of the word stem was less than 4 and (5) there was complete inter-rater agreement between two raters regarding whether the generated word was food related. Mean number of food- and eating-related words generated for these word stems in the pilot study was 3.77 ($SD=1.93$). Table 1 shows examples of possible (food and non-food) words generated for the selected 21 stems. An additional 15 control stems that cannot be completed as a food- or eating-related word (e.g. EXC__, ACC__) were included to minimise the likelihood of participants becoming consciously aware of the food theme in the word stems, and consequently trying to actively search for, or conversely, inhibit food words. The control stems were randomly interspersed among the target word stems. The entire 36-item word stem completion task is presented in Appendix 1.

Effect of exposure to television food advertising on cognitive and motivational processing

We included the word stem completion task in two experiments to measure accessibility of food-related cognitions following priming with television food advertisements. In

Table 1. Examples of possible word completions for the 21 word stems (word frequencies per 10,000 in parentheses).

Word stem	Food- or eating-related word	Non-food word
BRE	Bread (41)	Break (88)
BAC	Bacon (10)	Back (967)
SNA	Snack (6)	Snake (44)
ROA	Roast (10)	Road (197)
SUP	Supper (37)	Support (180)
CHE	Cheese (9)	Check (88)
WAL	Walnut (11)	Walk (100)
CRE	Cream (20)	Creative (49)
APP	Apple (9)	Appear (118)
MIL	Milk (49)	Military (212)
BAN	Banana (4)	Bank (83)
MAY	Mayonnaise (1)	Maybe (134)
COO	Cook (47)	Cool (62)
FEA	Feast (3)	Fear (127)
HUN	Hungry (23)	Hundred (171)
BUR	Burger (1)	Burden (44)
HON	Honey (25)	Honour (66)
CAL	Calorie (1)	Call (188)
POT	Potato (15)	Potential (67)
CER	Cereal (17)	Certain (313)
RES	Restaurant (41)	Result (244)

each experiment, exposure to televised food advertisements was manipulated by showing participants a series of television commercials advertising either food or non-food products. As mentioned previously, the design also included a rating of participants' desire to eat. This enabled us to capture the effect of exposure to television food advertising on participants' motivation to eat.

Experiment 1

Method

Participants

Participants were 160 female undergraduate students at Flinders University who took part for course requirements and credit. They were aged between 18 and 44 years ($M = 22.29$, $SD = 5.05$). Participants were mostly of normal weight, with a mean BMI of 23.05 ($SD = 4.51$). Participants had on average 2.29 ($SD = 1.36$) television sets in their homes. They watched on average 1.88 h ($SD = 1.89$) of television per day, of which most ($M = 1.71$ h, $SD = 1.80$) was of commercial channels. Thus, the current sample would have been exposed to television advertisements for food products virtually on a daily basis.

Design

The experiment used a between-subjects design, with participants randomly allocated to the two advertisement conditions (food, control), subject to equal numbers per

condition. The two outcome measures were the number of food words generated on the word stem completion task and ratings of desire to eat.

Materials

Advertisements

Two sets of television advertisements were created, one containing 16 food and 8 non-food advertisements presented in randomly intermixed order (food condition), and the other containing 24 non-food advertisements (control condition). The 8 non-food advertisements in the food condition were a subset of the 24 used in the control condition, and were included to minimise the likelihood of demand effects. The food commercials advertised a range of food products including chocolate, chips, yoghurt and fish, whereas the control commercials advertised various non-food products such as cars, paint, nappies and telecommunication. None of the advertisements for any products contained words or images that could complete any of the word stems of the word stem completion task.

The advertisements were selected on the basis of pilot data. Twenty-three female students aged 19–46 years ($M=24.04$, $SD=5.29$) viewed a set of 93 advertisements. These were recorded from free-to-air commercial television channels over a one-week period. Participants rated each advertisement on food-relatedness ('how much does the advertisement relate to food?') and positive appeal ('how much do you like the advertisement?') on 10-point Likert scales ranging from 'not at all' to 'very much'. Sixteen advertisements rated high on food-relatedness ($M=9.19$, $SD=.47$) were individually matched for overall positive appeal to 16 advertisements rated low on food-relatedness ($M=1.12$, $SD=.28$) to construct clearly separate sets of food and control (i.e. non-food) advertisements that were nevertheless of equal interest. Mean likeability ratings for the food and control advertisements were 6.23 ($SD=1.02$) and 6.28 ($SD=.99$), respectively, $t(15) = 1.20$, $p > .05$. To disguise the food theme in the set of food advertisements, and create a realistic ratio of food to non-food advertisements, an additional 8 advertisements with low food-relatedness ratings ($M=1.04$, $SD=.06$), but comparable likeability scores ($M=6.43$, $SD=.73$), were included in both sets of advertisements. Total viewing duration was 10 min and 45 s for the food advertisements, and a comparable 11 min for the control advertisements.

Accessibility of food-related cognitions

Accessibility of food-related cognitions was assessed by the word stem completion task. As shown in Appendix 1, participants were instructed to complete the word stems with whatever word came to mind first. They were given two examples followed by the 36 stems to be completed. Performance on the task was scored by categorising each completion as either a food related or a non-food word, and then summing the number of food-related words generated.

Desire to eat

Desire to eat was assessed using a 100-mm visual analogue scale. Participants indicated their current desire or urge to eat by placing a vertical mark on the scale, ranging from 'no desire or urge to eat' to 'extremely strong desire or urge to eat'.

Procedure

Participants were recruited for a study on the effectiveness of television advertising. They were tested in small groups in a quiet room in the Applied Cognitive Psychology Laboratory in a single session of 30 min duration. Participants were seated approximately 50 cm in front of an IBM compatible computer with a 22-inch monitor. After giving informed consent, participants viewed the set of food or control advertisements. These were presented in PowerPoint. To aid the cover story, participants were asked to rate the advertisements on overall appeal and effectiveness under the guise of marketing research. Following each advertisement, participants indicated on 5-point Likert scales how much they liked it (1 = 'do not like the advertisement at all', 5 = 'like the advertisement very much') and how effective they thought it was (1 = 'the advertisement is not at all effective', 5 = 'the advertisement is very effective'). After viewing and rating the final advertisement, participants completed the word stem completion task. Next they rated their current desire to eat. Finally, participants completed a brief demographics questionnaire, which included questions about television viewing. In addition to indicating the number of television sets in the home, to get an accurate account of participants' television viewing they were given the previous week's television guide and asked to circle the programmes they had watched.

Results

Accessibility of food-related cognitions

To investigate the effect of exposure to television food advertising on accessibility of food-related cognitions, an independent samples t-test was conducted comparing the number of food-related words generated on the word stem completion task between the food and control advertisement groups. As predicted, participants who viewed the food advertisements produced more food- and eating-related words on the word stem completion task ($M=4.48$, $SD=2.37$) than those who had viewed the control advertisements ($M=3.75$, $SD=1.96$), $t(158)=2.11$, $p<.05$, $d=.34$. BMI was not correlated with the number of food-related words generated, $r=-.08$, $p>.05$. As only a minority were food- and eating-related words (on average 20%, with a maximum score of 10), it seems unlikely that participants consciously chose food-related words.

Desire to eat

We similarly examined the effect of television food advertising on participants' ratings of desire to eat. There was no significant difference between the food ($M=47.03$, $SD=32.62$) and control ($M=42.65$, $SD=31.75$) advertisement conditions, $t(158)=.86$, $p>.05$, with both groups giving ratings just under the mid-point of the scale. BMI was significantly negatively correlated with ratings of desire to eat, $r=-.19$, $p<.05$.

Relationship between accessibility of food-related cognitions and desire to eat

Following Hofmann, van Koningsbruggen, et al. (2010), we examined the association between accessibility of food-related cognitions and desire to eat. Specifically, we conducted a hierarchical multiple regression to assess the effect of cognitive accessibility, and

its interaction with advertisement condition, on reported desire to eat. Advertisement condition (food, control) and centred word stem completion scores were entered in Step 1, and the product term representing the interaction between these two variables in Step 2. The main effects of condition and word stem scores explained a significant proportion of the variance in ratings of desire to eat, $R^2 = .05$, $F(2, 157) = 4.22$, $p < .05$, such that reported ratings were positively associated with the number of food-related words generated on the word stem task, $\beta = .22$, $t(156) = 2.77$, $p < .01$. The product term did not explain any additional variance in ratings, $R^2 \text{ Change} = .01$, $F \text{ Change} (1, 156) = 1.59$, $p > .05$.

Discussion

As predicted, Experiment 1 showed that exposure to television food advertising increased the accessibility of food-related cognitions. Specifically, viewing television advertisements for food products led to the completion of word stems with more food- and eating-related words. This is consistent with previous priming studies in the eating domain (Papies et al., 2007, 2008), and with priming research more broadly (Ferguson, 2008; Ferguson & Bargh, 2004; Fishbach et al., 2003).

By contrast, exposure to television food advertising did not affect ratings of desire to eat. Thus, contrary to van Koningsbruggen et al. (2013), we found that food priming did not affect participants' motivation to eat. Furthermore, although we obtained a significant positive association between accessibility of food-related cognitions and self-reported desire to eat, unlike Hofmann, van Koningsbruggen, et al. (2010), we obtained this relationship across the board, not specifically for participants who had been primed with food cues. Nevertheless, Hofmann et al. found that the relationship between accessibility of food-related cognitions and self-reported desire to eat was more pronounced for chronic dieters, who display a strong eating-oriented reaction to food (Papies et al., 2007). Thus, Experiment 2 specifically recruited a sample known to exhibit such a reaction to food (Stroebe, van Koningsbruggen, Papies, & Aarts, 2013), namely individuals who are overweight or obese.

Experiment 2

Method

Participants

Participants were 124 overweight or obese community-dwelling women. They were recruited from the Adelaide metropolitan area via an advertisement in the local newspaper seeking volunteers with a BMI > 25, and received a \$20 honorarium. Participants were between 18 and 64 years old ($M = 44.38$, $SD = 11.92$). Mean BMI for the sample was 31.28 ($SD = 6.70$). Participants had on average 2.35 ($SD = 1.28$) television sets in their homes, and watched on average 2.81 h ($SD = 2.16$) of television per day. Of that, most ($M = 2.30$ h, $SD = 2.03$) was of commercial channels. Thus, there was again a high rate of exposure to television commercials for food products in this sample.

Design, materials and procedure

Design, materials and procedure were the same as in Experiment 1.

Results

Accessibility of food-related cognitions

Participants in the food advertisement condition ($M=5.53$, $SD=2.87$) again generated more food- and eating-related words on the word stem task than those in the control condition ($M=4.52$, $SD=2.65$), $t(122)=2.05$, $p<.05$, $d=.37$. Although the size of the effect was similar to that of Experiment 1, the overall number of food- and eating-related words generated was somewhat higher. A one-sample t-test conducted against the mean of the student sample in Experiment 1 ($M=4.11$) showed that the overweight and obese participants produced significantly more food-related words ($M=5.02$), $t(123)=3.64$, $p<.001$, $d=.36$. Separate analyses for the food and control advertisement conditions showed the same pattern (food: $t(61)=2.89$, $p<.01$, $d=.40$; control: $t(61)=2.27$, $p<.05$, $d=.33$)

Desire to eat

In contrast to Experiment 1, participants who viewed the food advertisements also reported a stronger desire to eat ($M=31.22$, $SD=29.48$) than those who had viewed the control advertisements ($M=20.70$, $SD=21.52$), $t(122)=2.27$, $p<.05$, $d=.41$. Participants' ratings of desire to eat were, however, relatively low, with both groups giving ratings below the mid-point of the scale.

Relationship between accessibility of food-related cognitions and desire to eat

We again performed a hierarchical multiple regression to examine the effect of cognitive accessibility, and its interaction with advertisement condition, on reported desire to eat. Advertisement condition (food, control) and centred word stem completion scores were entered in Step 1, followed by their product in Step 2. The main effects of condition and word stem scores explained a significant 6.8% of the variance in ratings of desire to eat, $R^2=.07$, $F(2, 121)=4.44$, $p<.05$. In contrast to Experiment 1, the product term accounted for a significant additional 5.9% of the variance in ratings, $R^2=.06$, $F(1, 120)=8.09$, $p<.01$. As can be seen in Figure 1, simple slopes analysis showed a significant positive relationship between accessibility of food-related cognitions and reported desire to eat in the food advertisement condition, $B=3.73$, $\beta=.40$, $t(120)=3.37$, $p<.01$, but not in the control condition, $B=-.91$, $\beta=-.10$, $t(120)=.76$, $p>.05$.

Discussion

Experiment 2 replicated the effect of exposure to television food advertising on accessibility of food-related cognitions in a sample of overweight and obese individuals. As in Experiment 1, participants who viewed a series of food advertisements produced more food- and eating-related words on the word stem task than those who had viewed a series of comparable advertisements for non-food products. It is noteworthy that this sample of overweight and obese women produced more food- and eating-related words across the board than did the undergraduate students in Experiment 1. In both the food and control advertisement conditions, the current sample generated on average one

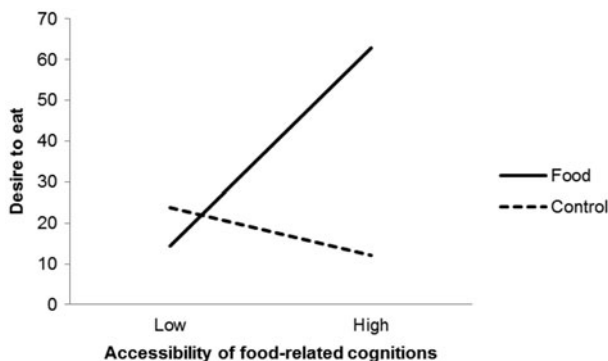


Figure 1. Interaction between advertisement condition (food, control) and accessibility of food-related cognitions on ratings of desire to eat in Experiment 2.

additional food-related word. This suggests that food- and eating-related information is generally more accessible to overweight and obese individuals.

In contrast to Experiment 1, exposure to television food advertising also affected ratings of desire to eat. The overweight and obese sample here reported a stronger desire to eat, following priming with a series of television advertisements for food products than when primed with advertisements for non-food products. This suggests that in overweight and obese individuals, exposure to food commercials not only activates food-related cognitions, but also triggers a motivation to eat. This increased motivational orientation to food in response to food advertising echoes a recent finding by van Koningsbruggen et al. (2013) that unsuccessful dieters in particular worked harder to obtain food rewards when pre-exposed to food cues.

This greater motivation to eat in response to food priming may make overweight and obese individuals particularly vulnerable to television food advertising, particularly as they spend more time watching television (Boulos, Vikre, Oppenheimer, Chang, & Kanarek, 2012) and thus are exposed to more such advertising. Indeed, the current sample of overweight and obese women watched more television, especially commercial television, than the undergraduate student sample of Experiment 1. Specifically, they watched on average an additional hour of television per day, and thus would have been exposed to a greater number of food advertisements, most of which would be for unhealthy food (Chapman et al., 2006; Powell et al., 2007).

We again found a significant positive association between accessibility of food-related cognitions and reported desire to eat, but unlike in Experiment 1, this was particularly the case for the food advertising group. Following pre-exposure to television food advertisements, participants who generated more food- and eating-related words on the word stem completion task also reported a stronger desire to eat. Thus, in line with Hofmann, van Koningsbruggen, et al. (2010), increased accessibility of food-related cognitions following food priming was linked here to an increased motivation to eat.

General discussion

The present study investigated the effect of exposure to television food advertising on cognitive and motivational processing of food- and eating-related information. In

particular, in two experiments we examined whether exposure to television food advertising primes food-related cognitions and triggers a motivation to eat. As predicted, exposure to televised food commercials increased the accessibility of food-related cognitions. Specifically, viewing television advertisements for food products led to the completion of word stems with more food- and eating-related words, both in an undergraduate student sample of mostly normal weight (Experiment 1), and in a community sample of overweight and obese individuals (Experiment 2). This supports previous priming research on eating behaviour (Papies et al., 2007, 2008), as well as other behaviour, such as academic achievement, weight management and athleticism (Ferguson, 2008; Ferguson & Bargh, 2004; Fishbach et al., 2003). It also extends the previous use of food word primes to real world primes, notably television food advertisements.

The finding that exposure to television food advertising increased the number of food words produced on our word stem completion task mirrors observations that exposure to media images portraying the thin ideal led to the generation of more appearance-related words on Tiggemann et al.'s (2004) original word stem task (Hargreaves & Tiggemann, 2002, 2003; Tiggemann & Slater, 2004). In line with these latter studies, the size of the priming effects on cognitive accessibility observed here was small to medium. Similar effect sizes have been reported in other priming studies of eating behaviour (Papies et al., 2007; van Koningsbruggen et al., 2011). This suggests that priming effects in the eating domain are generally modest.

It should be noted that the absolute number of food- and eating-related words generated was quite low (on average, 4 or 5 out of 21) in both experiments. This suggests that participants were not deliberately presenting food-related words. The inclusion of control stems that cannot be completed as a food- or eating-related word was a methodological improvement that may have guarded against participants' awareness of the food theme. Thus, our food-related version of the word stem task seems to have empirical utility. We would welcome other researchers trialling it as a measure of cognitive accessibility in a range of other contexts.

Exposure to television food advertising also increased participants' motivation to eat, but only for overweight and obese individuals (Experiment 2). As predicted, these individuals reported a stronger desire to eat after watching a series of television commercials for food products. This fits with a recent finding by van Koningsbruggen et al. (2013) who showed that unsuccessful dieters worked harder to obtain food rewards following pre-exposure to food words. Moreover, in line with Hofmann, van Koningsbruggen, et al. (2010), accessibility of food-related cognitions was positively associated with self-reported desire to eat for participants who had viewed the commercials advertising food products. Although priming with televised food advertisements also activated food-related cognitions in students of mostly normal weight (Experiment 1), this did not trigger an intention to eat. Additionally, although there was an overall link between cognitive and motivational processing of food-related information in the student sample, this was not particularly in response to food priming. It would appear that only for people who have a strong eating-oriented reaction to food, such as overweight and obese individuals (or chronic dieters), does food priming trigger a motivation to eat, and does this motivation link to the activation of food-related cognitions.

Compared to individuals of normal weight, overweight and obese individuals have a greater tendency to restrict or attempt to suppress their desire to eat (van Strien, Frijters, Bergers, & Defares, 1986). In support, the overweight and obese participants

(Experiment 2) reported much lower ratings of desire to eat than the sample of undergraduate students (Experiment 1). Further, in the latter sample (Experiment 1), BMI was negatively correlated with desire to eat. Thus, exposure to food cues, such as food advertisements, may act to disinhibit this desire in overweight and obese individuals. This is consistent with our finding that overweight and obese participants, but not undergraduate students, reported a stronger desire to eat following exposure to food advertisements. This in turn could offer an explanation as to why food-related cognitions primed by food advertisements triggered a motivation to eat in overweight and obese individuals, whereas for normal weight individuals the link between cognitive and motivational processing of food-related information existed regardless of pre-exposure to food cues. Future research will be needed to replicate these findings and test this explanation.

Thus, one theoretical mechanism by which food advertising may increase eating behaviour is by activating food-related cognitions and, in individuals with a strong eating-oriented reaction to food, triggering a corresponding motivation to eat. This may make overweight and obese people particularly vulnerable to television food advertising, and to environmental food cues in general. Their increased cognitive, and motivational response to such food primes could contribute to their consumption behaviour and place them at risk of overeating. This is particularly problematic given the large proportion of advertisements for food, particularly unhealthy food, on television (Chapman et al., 2006; Powell et al., 2007), as well as the well-established link between time spent watching television and obesity (Boulos et al., 2012). Future research will need to also include a measure of actual food intake to determine whether increased cognitive and motivational responsiveness to food primes do indeed contribute to (over) eating in overweight and obese individuals. Emerging evidence points to a link between food cognitions (albeit without priming) and actual consumption behaviour (Hofmann, Friese, & Roefs, 2009).

The current findings have practical implications for tackling dysfunctional eating behaviour. In our contemporary food-rich environment it is virtually impossible for anyone, including overweight and obese individuals, to avoid exposure to food cues. Thus, interventions might be better placed to target the activated food-related cognitions in response to food cue exposure. One potential strategy for reducing such cognitions would be to decrease the reward value of the food prime. In support, Hofmann, Deutch, Lancaster, and Banaj (2010) showed that participants who had been instructed to imagine a chocolate product in a non-consummatory manner exhibited a less positive affective reaction to the product compared to participants who had been instructed to focus on its consummatory aspects. Another strategy could involve forming implementation intentions to refrain from consumption. In a subsequent study, Hofmann et al. found that participants who had formed the intention not to eat chocolate also displayed a less positive affective reaction to this food product. Similar implementation intentions designed to remind unsuccessful dieters of their dieting goal when primed with food cues have been shown to boost activation of that goal (Kroese, Adriaanse, Evers, & De Ridder, 2011), and also to reduce consumption (van Koningsbruggen et al., 2011). Thus, future research could usefully explore strategies such as decreasing the reward value of food primes and forming implementation intentions to refrain from eating as possible interventions for reducing the accessibility of food-related cognitions in response to food cue exposure in overweight and obese individuals.

A number of limitations of the present study need to be acknowledged. First, the television advertisements included commercials for some relatively healthy (e.g. yoghurt), as well as other more unhealthy food products (e.g. chips). Some previous food priming studies have similarly used a mixture of healthy and unhealthy food cues (Papies et al., 2007, 2008). Additionally, although the word stems were designed to elicit words from the broad category of food and eating (e.g. milk, snack), some could be completed to generate a relatively healthy food word (e.g. apple), whereas others could be made to produce rather an unhealthy food word (e.g. burger). While priming food cognitions with unhealthy food cues can lead to unhealthy eating or overeating, priming such cognitions with healthy food cues may actually be beneficial. As such, exposing people to advertisements for healthy foods could lead them to eat these foods, and thus could have positive health effects. Future research would benefit from separating out advertisements for healthy vs. unhealthy food products, and word stems that can be completed as healthy vs. unhealthy food words. Second, following Hofmann, van Koningsbruggen, et al. (2010), we used a self-report rating of desire to eat to measure motivation to consume. Self-report ratings are susceptible to social desirability biases, which could explain the relatively low ratings, especially in the overweight and obese sample. Future research could consider a behavioural index of motivation to eat in line with van Koningsbruggen et al.'s (2013) measure of effort to obtain food rewards. Finally, hunger or food deprivation could have contributed to the observed effects of exposure to television food advertising, especially on desire to eat. We chose not to measure these variables because we did not want to prime notions of food or eating before participants watched the advertisements. Future studies could perhaps include a retrospective measure of hunger or deprivation.

Despite these limitations, the present study contributes to our understanding of the potential mechanisms underlying the link between food cue exposure and (over)eating. In particular, we have demonstrated that exposure to television food advertising primes food-related cognitions, and in overweight and obese individuals also triggers a motivation to eat.

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Appendix 1. Word stem completion task

Please complete the following word stems in order with whatever word comes to your mind first. The completed words must be real English words, and must not be proper nouns (i.e. names).

For example;

EXA _____ → EXA mple__ or EXA mination or EXA
 FRE _____ → FRE eze__ or FRE e_____ or FRE

1	BRE _____	13	FAC _____	25	REA _____
2	BAC _____	14	APP _____	26	HUN _____
3	EXC _____	15	SYM _____	27	INS _____
4	SNA _____	16	MIL _____	28	BUR _____
5	ROA _____	17	FLI _____	29	HON _____
6	ACC _____	18	BAN _____	30	THR _____
7	SUP _____	19	MAY _____	31	CAL _____
8	TRA _____	20	PLE _____	32	COM _____
9	CHE _____	21	COO _____	33	POT _____
10	SOC _____	22	DIF _____	34	ELE _____
11	WAL _____	23	FEA _____	35	CER _____
12	CRE _____	24	LAN _____	36	RES _____

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