Sex differences in young adults’ snack food intake after food commercial exposure

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ABSTRACT

Exposure to food commercials on television is considered to be related to elevated snack food intake in front of the television. However, this assumed relation has as yet not been fully established. The present study, therefore examined the direct effects of watching television food commercials on concurrent non-advertised snack food intake in young adults. In addition, possible sex differences were investigated. Participants (N = 82, 50% male) watched a movie interrupted by two commercial breaks that contained either food commercials or neutral commercials. While watching, they could freely eat crisps and chocolate coated peanuts. Afterwards, participants filled out questionnaires and were weighed and measured. Regression analyses showed that men and women were differently affected by the food commercials. Food intake in women was higher when they watched the food commercials than when they watched the neutral commercials. The results suggest that especially women are vulnerable for eating more snack food when exposed to food commercials.

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Introduction

Television watching has often been linked to obesity because of decreased physical activity (Robinson, 2001; Salmon, Bauman, Crawford, Timperio, & Owen, 2000; Thomson, Spence, Raine, & Laing, 2008) and increased snacking behavior (Thomson et al., 2008; Snoek, Van Strien, Janssens, & Engels, 2006). Though food advertising is generally believed to be an important causal factor in increased intake of energy dense foods (French, Story, & Jeffery, 2001; Hill & Peters, 1998), only a few studies tested the relationship between food advertising exposure and adults’ snack food intake in front of the television. So far, most studies have focused on young children and the general finding was that exposure to food commercials is indeed related to higher snack food intake (e.g., Buijzen, Schuurman, & Bomhof, 2008; Coon & Tucker, 2002; Halford, Gillespie, Brown, Pontin, & Dovey, 2004). Although especially children may be susceptible to the persuasive messages in commercials (Rozendaal, Buijzen, & Valkenburg, 2008), there is no reason to believe that exposure to food commercials would not also affect food intake in adults. One correlational study found a relation between general television advertising exposure and increased fast-food consumption in adults (Scully, Dixon, & Wakefield, 2009), but a further study found no effect of food commercials on actual food intake while watching television (Martin, Coulon, Markward, Greenway, & Anton, 2009).

The aim of the present study was to experimentally assess the direct causal effects of exposure to commercials that promote food (in comparison with neutral commercials) on adults’ snack food intake in front of the television.

Food cues (i.e., sight of food) in food advertising can incite increased craving for food (Cornell, Rodin, & Weingarten, 1988; Mattes, 1997; Nederkoorn, Smulders, & Jansen, 2000) and subsequent snacking. In food commercials, the act of eating is often presented as being highly rewarding, which might lead to motivation to eat (Ariely & Norton, 2008; Kopalle & Lehmann, 2006) through activation of dopamine systems in the brain eliciting wanting and craving of the food (Berridge, 1996; Schur et al., 2009). Previous studies showed that increased cue reactivity indeed predicted increased likelihood of food intake after exposure to food cues (Coelho, Jansen, Roefs, & Nederkoorn, 2009; Jansen & Van den Hout, 1991; Jansen, 1998; Rogers & Hill, 1989).

Advertising specific as well as individual factors may determine the processes through which people are affected by food advertising. In food advertisements, the reinforcing value of food is often strongly emphasized in food advertising and previous studies showed that increased reinforcing value of food was related to higher intake of energy dense foods (Epstein, Leddy, Temple, & Faith, 2007). Furthermore, models appealing to the
target group are used, to increase the possibility that people are influenced because they identify with the models (see also Austin, Chen, & Grube, 2006; Moyer-Guse & Nabi, 2010). In addition, not everyone might be equally affected by exposure to food commercials. For example, a greater attentional bias towards food cues may relate to increased craving for food after exposure to food commercials (see also Franken, Rosso, & Van Honk, 2003). Previous studies showed that individuals with higher BMI scores (Nijss, Muris, Euser, & Franken, 2010) or restrained eating tendencies (e.g., Hollit, Kemps, Tiggemann, Smeets, & Mills, 2010; Overduin, Jansen, & Louwverse, 1995) displayed a greater attentional bias towards food cues. This attentional bias might make these individuals more vulnerable for the effects of food advertising on energy dense food intake. So, food advertisements are designed to influence consumption – in the broad sense – and individual characteristics may further elicit the effects of food advertising on food intake.

In a recent between-subject experiment among adults, support was found for the generally assumed relation between exposure to food advertising and intake of snack food (Harris, Bargh, & Brownell, 2009). Food intake was tested during a taste-test afterwards. Participants – especially men – that had been exposed to energy dense food commercials ate more and their eating persisted longer during the taste test compared with the participants that had been exposed to commercials that contained a health message (by promoting foods with nutritional benefits; e.g., high in dietary fiber) or the participants that had been exposed to neutral commercials. A drawback of using a taste-test design is that it decreases ecological validity as (1) a taste-test does not resemble a daily life situation, (2) participants can not eat while watching television, and (3) participants are obliged to eat at least something in the taste-test and this oral sensory experience might facilitate an increased subsequent food intake (e.g., Drenowski, 1997).

The present study investigated the direct effects of exposure to food commercials, taking into account the above-mentioned limitations. Recently, in a similar experimental study in young children, it was found that boys were more vulnerable for the effects of exposure to food commercials on increased snack food intake than girls (Anschutz, Engels, & Van Strien, 2009). Furthermore, adult men were found to eat more than women after exposure to food commercials (Harris et al., 2009). This could be explained by the fact that boys tend to be more responsive to external cues (e.g., Snoek, Van Strien, Janssens, & Engels, 2007; Van Strien & Bazelier, 2007) and have lower self-control than girls (Turner & Piquero, 2002). This suggests that they show higher cue reactivity and reward sensitivity when exposed to food cues, which may explain their increased intake after exposure to food commercials. Furthermore, males are in general less influenced by sociocultural pressure to be thin than females (e.g., Gardner, Sorter, & Friedman, 1997; Murnen, Smolak, Mills, & Good, 2003; Sands, Tricker, Sherman, Armatas, & Maschette, 1997), which makes them less likely to feel the urge to inhibit their snack food intake. Therefore, it was expected that especially men would eat more after exposure to food commercials than after exposure to neutral commercials.

Methods

Participants

The sample consisted of 82 non-overweight university students (50% male). They participated in exchange for money or course credits. The mean age of the male students was 20.9 (SD = 2.5) and the mean age of the female students was 20.4 (SD = 1.5). Male students had a mean body mass index (BMI = weight/height²) of 22.1 (SD = 1.6) and female students had a mean BMI of 21.7 (SD = 2.1). Statistical outliers on food intake (>800 kcal) were removed from the dataset (n = 7). None of the participants was aware of the true purpose of the study, which was assessed directly after watching television.

Procedure

The present study was approved by the ethical board of the Faculty of Social Sciences of the Radboud University Nijmegen. Data was collected in 2008 and analyzed in 2009. To increase ecological validity, the setting in which participants were tested was designed to resemble a living room with a comfortable couch, side table, a large television screen and decorating plants and paintings (see Anschutz, Engels, Becker, & Van Strien, 2008; Anschutz, Van Strien, & Engels, 2008). When participants entered the lab, they had to fill out a short questionnaire about their travel preferences (e.g., favorite country and favorite way of transportation). This was done to let the participants think the study was about traveling, hereby covering the true purpose of the study. Subsequently, they were invited to sit down on the couch and make themselves comfortable. Participants were told they were going to watch television for 30 min and did not have to pay attention to anything in particular, but just had to act like they were at home. On the side table in front of the participants stood a glass of water, a bowl of crisps and a bowl of M&M’s. They were invited to drink or eat whatever they liked during watching television.

Participants were exposed to a 30-min clip taken from a nature movie that was considered neutral in content (Traveling Birds; see Anschutz, Van Strien et al., 2008). The television clip was interrupted by two commercial breaks (after 5 and 18 min) of 3 min each. Half of the participants (random assignment) were exposed to commercial breaks that consisted of 3 commercials promoting energy dense foods and 5 neutral filler commercials each. The other half of the participants was exposed to commercial breaks that consisted solely of 8 neutral commercials each. The neutral commercials comprised a relatively large percentage of commercials related to traveling in both conditions to strengthen the cover story of the study. Since we were not interested in testing brand effects, the food offered to the participants differed from the food promoted in the commercials (see Anschutz et al., 2009). Food intake during watching the television clip was measured by pre- and post weighing the bowls with crisps and M&M’s every session.

After watching the television clip, attitudes towards the movie, commercial recall and liking of the commercials were investigated to provide information about how participants perceived the movie and the commercials and to check for possible differences between the two commercial conditions (randomization check). Finally, participants’ height and weight was measured (without shoes).

Measures

Satiation

Individual differences in deprivation might influence food intake (e.g., Polivy, Coleman, & Herman, 2005; Urbzsat, Herman, & Polivy, 2002). After they had watched the movie clip, participants filled out a 14-cm Visual Analogue Scale (VAS) to establish the extent to which they had felt hungry or satisfied before they entered the experiment ranging from ‘very hungry’ to ‘totally satisfied’ (cf. Anschutz et al., 2009; Anschutz, Engels et al., 2008; Anschutz, Van Strien et al., 2008). So, higher scores represented more satiation and less hunger.

Attitudes towards the movie

Participants were asked to indicate on a 5-point Likert-scale (ranging from 1 ‘totally not agree’ to 5 ‘totally agree’) to what extent they considered the movie interesting, boring, bad and nice.
The items assessing whether participants found the movie boring or bad were recoded, so the final score of participants represented the extent to which they had a positive attitude towards the movie. Cronbach’s alpha was 0.79.

**Commercial recall**

Participants were asked to write down as many commercials as they remembered. All correctly remembered commercials (brand and product name) were summed to get a total recall score for each participant (cf. Anschutz et al., 2009; Anschutz, Van Strien et al., 2008).

**Commercial liking**

For each remembered commercial participants could indicate how much they liked that specific commercial, which enabled us to assess what explicit attitudes the participants had towards the commercials they remembered. They could rate the commercials on a 5-point Likert scale ranging from 1 ‘did not like the commercial at all’ to 5 ‘did like the commercial very much.’ Liking of the food commercials was distinguished from liking of the neutral commercials.

**Food intake**

A total food intake score (in kcal) was computed for every participant, by measuring the total amount of crisps and M&M’s the participants consumed while watching television. The bowls with crisps and M&M’s were pre- and post weighed, using a professional balance (Kern 200).

**Strategy for analyses**

Using ANOVA’s it was tested whether there were any differences between the commercial conditions on BMI, pre-experimental satiation, attitudes towards the movie, commercial recall, and commercial liking to check whether randomization was successful. Furthermore, sex differences in attitudes towards the movie, commercial recall and commercials liking were tested. Effect sizes (Cohen’s d) were calculated (Cohen, 1988).

A hierarchical regression analysis was conducted to test the effects of commercial condition (food or neutral) and sex on total food intake (kcal), controlling for satiation. The predictors were entered into the equation in the following order: step (1) satiation, step (2) commercial condition, step (3) sex, and step (4) commercial condition × sex (interaction). For each step, it was investigated whether adding the variable(s) to the regression model led to a significant increase in explained variance of food intake.

Additionally, BMI was tested as a moderator in the relation between commercial condition and total food intake (kcal), controlling for satiation and sex. A second hierarchical regression analysis was conducted with the following order of predictors being entered into the equation: step (1) satiation and sex, step (2) commercial condition, step (3) BMI, and step (4) commercial condition × BMI. Standardized BMI scores were used in this analysis.

**Results**

**Descriptives**

Table 1 shows the means and standard deviations of all variables, split by commercial condition (food or neutral) and sex. No significant differences were found between conditions on satiation, attitude towards the movie, commercial recall, liking of the neutral commercials, or BMI. This indicates that randomization was successful. Interestingly, women liked the food commercials better than men, *F*(1, 37) = 4.054, *p* = 0.052, Cohen’s *d* = 0.7. No sex differences were found on attitudes towards the movie, commercial recall or liking of the neutral commercials.

Satiation was negatively associated with food intake (*r* = −0.30, *p* < 0.01), the more satiated participants were before entering the lab the less they ate. Further, higher liking of the neutral commercials was related to higher liking of the food commercials (*r* = 0.33, *p* < 0.05). Sex was negatively related to food intake, indicating that women in general ate less snack food than men (*r* = −0.26, *p* < 0.05). Sex was positively related to liking of the food commercials, indicating that women liked the food commercials more than men (*r* = 0.32, *p* < 0.05). All other correlations were not significant.

**Food intake**

The first regression analysis (Table 2) showed that satiation (step 1) explained a significant proportion of variance in food intake. Inspection of the beta coefficients revealed that satiation had a negative relation with food intake, the more satiated participants were, the less they ate. During watching television. Commercial condition did not result in a significant increase in explained variance when entered into the model. However, sex had a significant main effect on food intake. In general, men ate more than women. Furthermore, the interaction between commercial condition and sex was significant. Women ate more when exposed

<table>
<thead>
<tr>
<th>Table 1</th>
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</thead>
<tbody>
<tr>
<td>Means (standard deviations) of all variables split by commercial condition and sex.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Food commercial condition</th>
<th>Neutral commercial condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male (N=20)</td>
<td>Female (N=21)</td>
</tr>
<tr>
<td>BMI</td>
<td>21.6 (1.6)</td>
<td>22.3 (2.0)</td>
</tr>
<tr>
<td>Satiation</td>
<td>7.1 (4.1)</td>
<td>8.2 (3.4)</td>
</tr>
<tr>
<td>Attitude towards movie</td>
<td>3.8 (0.9)</td>
<td>3.7 (0.9)</td>
</tr>
<tr>
<td>Commercial recall</td>
<td>4.7 (2.0)</td>
<td>4.8 (2.0)</td>
</tr>
<tr>
<td>Liking of neutral commercials</td>
<td>2.7 (0.9)</td>
<td>2.7 (0.9)</td>
</tr>
<tr>
<td>Liking of food commercials</td>
<td>2.4 (0.8)</td>
<td>3.1 (1.1)</td>
</tr>
<tr>
<td>Food intake (in grams)</td>
<td>201.2 (211.3)</td>
<td>175.7 (184.3)</td>
</tr>
</tbody>
</table>

**Table 2 Hierarchical regression analysis predicting total food intake (kcal), including sex as moderator variable (N=82).**

<table>
<thead>
<tr>
<th>Step</th>
<th>B</th>
<th>SE (B)</th>
<th>β</th>
<th>R²</th>
<th>R² change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Satiation</td>
<td>−16.74</td>
<td>5.89</td>
<td>−0.30</td>
<td>0.09</td>
</tr>
<tr>
<td>2.</td>
<td>Commercial condition</td>
<td>−52</td>
<td>43.12</td>
<td>−0.001</td>
<td>0.09</td>
</tr>
<tr>
<td>3.</td>
<td>Sex</td>
<td>−93.78</td>
<td>41.89</td>
<td>−0.24</td>
<td>0.15</td>
</tr>
<tr>
<td>4.</td>
<td>Commercial condition × sex</td>
<td>−170.26</td>
<td>81.87</td>
<td>−0.52</td>
<td>0.19</td>
</tr>
</tbody>
</table>

*p* < 0.05.  
*p* < 0.01.
to the food commercials than when exposed to the neutral commercials. Men, in contrast, ate more when exposed to the food commercials than when exposed to the neutral commercials.

### Additional analysis

Results of the second regression analysis (Table 3) showed that satiation and sex, together in step 1, explained a significant amount of variance of food intake. Beta coefficients revealed that both satiation and sex had a negative relation with food intake. Addition of commercial condition to the model did not lead to a significant increase in explained variance. Further, BMI had no significant main effect on food intake. The interaction between commercial condition and BMI was also not significant.

### Discussion

The main finding of the current study was that the effect of food commercials on direct intake of palatable food is different for men and women; women showed a higher food intake after viewing commercials promoting energy dense foods than after viewing neutral commercials. In contrast, men showed a lower food intake after viewing the food commercials than after viewing the neutral commercials.

The present findings are in contrast with recent findings in young children, showing that food commercials affected the food intake of boys more strongly than that of girls (Anschtutz et al., 2009). An explanation for this difference might be that these commercials tend to focus at boys (Brown, 1998; Chils & Maher, 2003), whereas food commercials aimed at adults might rather target women. Since adult women more often manage the food supply of their family homes than men (Harnack, Story, Martinson, Neumark-Sztainer, & Stang, 1998; Lake et al., 2006) advertisers may primarily focus on women when promoting foods. In the present study, women liked the food commercials more than men did. Ewing, Napoli, and Du Plessis (1999) also found that food commercials were more liked by women than men. This could result from the fact that food commercials focus on women. Advertisers use characters that appeal to the target group, i.e., attractive and popular boys in child advertising or happy mothers in adult advertising. In alcohol and smoking research, it has been shown that a media model is more likely to influence people when they have a positive attitude towards the model and perhaps even identify with the model (e.g., Austin et al., 2006; Dal Cin, Gibson, Zanna, Shumate, & Fong, 2007). Identification increases the motivation to adopt some of the habits or values of the model (e.g., Austin & Kraus, 2000; Moyer-Guse & Nabi, 2010; Scull, Kupersmidt, Parker, Elmore, & Benson, 2010). If a portrayal corresponds closely to a personally relevant reference group, individuals will be more likely to wish to emulate the portrayal because they expect that imitating the models’ behaviors will lead to positive outcomes. Using appealing models to promote food in the commercials might therefore elicit the process of eating as a response to these food cues in the target group. Measures of identification should be included in future studies to examine the hypothesized role of identification with media models in the relation between food commercial exposure and snack food intake. In addition, the positive attitudes towards the commercials might have (further) facilitated snack food intake while watching television in women. Previously, it was found that positive affect can lead to higher food intake (Macht, Haupt, & Salewsky, 2004; Patel & Schlundt, 2001). So, perhaps the positive attitudes women had towards the food commercials increased their positive mood and subsequently made them eat more of the snack food. It would be interesting to include mood in future studies to test this hypothesis.

On an individual rather than an advertising specific level, another explanation for the sex difference found is that women are more susceptible for cues providing a norm about the ‘appropriateness’ of food intake in a certain situation. When promoting products, advertisers may try to influence the ‘normative beliefs’ of consumers (e.g., Wakefield, Flay, Nichter, & Giovino, 2003). They present the use of the product to the consumers’ target group as a (social) norm, which increases the likelihood of adopting behaviors in terms of product use (e.g., Brown & Moodie, 2009; Wallack, Crupe, Maiden, & Breed, 1990). Women might be more susceptible than men for being influenced by these normative cues (Chaiken & Pliner, 1987; Herman & Polivy, 2005; Herman, Larson, Larsen, & Engels, 2010; Pliner & Chaiten, 1990; Roth, Herman, Polivy, & Pliner, 2001). Future studies could test this hypothesis by varying normative messages about food intake across experimental conditions. In line with this, adult women in general are more likely to restrict (snack) food intake compared to men (e.g., Barnes & Tantleff-Dunn, 2010). Restrictive eating tendencies are found to be related to a greater attentional bias towards food cues (e.g., Francis, Stewart, & Hounsell, 1997; Green & Rogers, 1993; Hollit et al., 2010; Overduin et al., 1995). Further, restrictive eating is suggested to be related to higher cue reactivity in terms of craving after food deprivation (e.g., Hill, Weaver, & Blundell, 1991; Nederkoorn et al., 2000). Therefore, adult women, but apparently not young girls, may be in general more vulnerable to the influence of the food cues in commercials compared to men. Further examination is required to test this hypothesis. This could be done by including measures of restrictive eating behavior and investigate attentional bias towards food cues in commercials in future studies.

Our results are not in line with the findings of Harris et al. (2009). They found that men ate more than women in a taste test after exposure to food commercials, whereas they did not find a sex difference after exposure to commercials containing a nutrition message. However, differences in intake patterns between men and women did not differ between the food commercial and neutral commercial condition in their study. This suggests that their results could be mainly explained by the fact that men suppressed their food intake after exposure to the commercial containing a nutrition message. Other differences between their and our design were the use of a comedy video and a taste-test paradigm, which may have produced the difference in results. Further research is required to investigate the effects of context (tv program) which the advertisements appear in and food intake setting on the relation between food advertising and energy intake.

An unexpected and remarkable finding of the present study was that men ate more after viewing the neutral commercials than after viewing the food commercials. When taking a closer look to the content of the neutral commercials one might conclude that these commercials (i.e. promoting a car, camera or bank) might have been more focused on male consumers than the food commercials. Although no differences were found on liking of the

<table>
<thead>
<tr>
<th>Step</th>
<th>B</th>
<th>SE (B)</th>
<th>β</th>
<th>R²</th>
<th>R² change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Satiation</td>
<td>-15.56</td>
<td>74.67</td>
<td>-0.28**</td>
<td>0.15</td>
<td>0.15**</td>
</tr>
<tr>
<td>2. Sex</td>
<td>-93.76</td>
<td>41.62</td>
<td>-0.24**</td>
<td>0.15</td>
<td>0.15**</td>
</tr>
<tr>
<td>3. Commercial</td>
<td>-1.73</td>
<td>42.07</td>
<td>-0.004</td>
<td>0.15</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>condition</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4. BMI</td>
<td>17.51</td>
<td>21.22</td>
<td>0.09</td>
<td>0.15</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>5. Commercial</td>
<td>38.47</td>
<td>44.95</td>
<td>0.31</td>
<td>0.16</td>
<td>0.01</td>
</tr>
<tr>
<td>condition + BMI</td>
<td></td>
<td></td>
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* p < 0.05.  
** p < 0.01.
neutral commercials between men and women, men might therefore have paid more attention to the neutral commercials. Previously, distraction was found to be related to increased food intake (Bellisle & Dalix, 2001; Wansink, 2004). It was found that the more attention people paid to a movie the more they ate during watching the movie in a theatre (Wansink & Park, 2001). A suggestion for further studies would be to measure attention paid to the commercials to test this hypothesis.

Replicating the present study using other commercials would also allow testing some of the possible explanations deriving from our sex-specific findings. For example, varying commercials with respect to the target group of the advertisements (men or women) or normative messages in food commercials would enable testing whether these features underlie the sex differences we found. Furthermore, other neutral commercials could be used, to investigate whether the unexpected higher intake of men in the neutral commercial condition would be replicated. Another suggestion for future research is to further examine which aspects of food commercials affect food intake. Which cues used in the commercials urge people (women) to directly eat more (i.e. sight of food, creation of reward expectancies by the storyline)? Investigating this might provide more insight into the processes underlying the relation between exposure to food commercials and food intake. Snack food intake while watching television might also depend on what kind of food is available at home. Furthermore, young adults often watch television together with other people who might influence their food intake as well. A suggestion for future research is to experimentally test the effects of food commercials on food intake in real life settings (i.e. in the cinema or at people’s homes). A possible underlying mechanism in the relation between food commercial exposure and snack food intake might be the cue-craving paradigm. The food cues in the commercials may have elicited craving for the snack food in women, which resulted in increased food intake (Cornell et al., 1989; Mattes, 1997; Nederkoorn et al., 2000). Future studies might explicitly test craving after viewing food commercials to test the cues craving paradigm as an underlying mechanism. In the present study, a convenience sample was used, which allowed comparison with previous findings. However, this sample might not have been totally representative of the population. To investigate the generalizability of our findings, our study should be replicated using other samples. For instance, future samples could include overweight or lower educated individuals.

The results of the present study suggest that especially women are vulnerable for eating more snack food after exposure to food commercials. If replicated, the results might be important in the light of prevention of development of unhealthy eating behaviors. Food commercials targeted at children are already restricted in several countries (Hawkes, 2007), which eventually might be an option for commercials targeting adults as well.

References


