



Research report

Good mood food. Positive emotion as a neglected trigger for food intake



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ABSTRACT

Research on emotions as a trigger for food intake has mainly been focused on the role of negative emotions. In the present studies the role of positive emotions as a trigger for food intake is investigated in a sample of healthy participants with a normal weight. Two laboratory studies were conducted in which positive emotions or no emotions were induced (Study 1) or in addition negative emotions were induced (Study 2) after which unhealthy food intake was assessed by bogus taste tests. In Study 3, food intake was assessed by registering snack intake in a 7-day diary study together with the emotions accompanying each snacking episode to provide a more ecologically valid test of our hypothesis. Studies 1 and 2 showed that positive emotions, compared to the control conditions, evoked more caloric intake. Dietary restraint did not moderate this effect. Study 2 additionally showed that positive emotions evoked caloric intake to the same extent as negative emotions. Study 3 showed that snack intake in daily life was reported to result from positive emotions more frequently than from negative emotions. *Conclusions:* Positive emotions serve as an important but under-investigated trigger for unhealthy food intake that deserves further scrutiny. Future research should further investigate whether food intake results from emotional arousal in general, or from emotional valence in particular.

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Introduction

In modern societies excessive food intake has become a more serious threat for human health than hunger and shortage of food (Pinel, Assanand, & Lehman, 2000). Consequently, the factors that make people vulnerable to engage in overeating have been extensively investigated and one important factor that has been identified as contributing to overeating is the experience of emotions. Although the relation between emotions and overeating has been thoroughly investigated during the last few decades, the typical emphasis has been on negative emotions rather than positive emotions as important instigators of overeating (e.g., Greeno & Wing, 1994). The present paper focuses on the role of positive emotions as a trigger for food intake, as positive emotions may be considered as a relatively neglected trigger for indulgence in palatable foods, despite several theoretical indications hinting towards positive emotions as an important trigger for food indulgence.

Several factors may explain why positive affect would precede food intake. First, positive affect and food intake are likely to be related via an associative learning mechanism, where positive feelings have been associated with eating more food (Patel & Schlundt, 2001). That is, across cultures food is irrefutably used to highlight the celebration of special occasions like weddings and birthdays that are generally accompanied by positive emotions (Rozin, 1999). As a result, positive emotions and eating may have become

inherently interrelated. A second explanation can be derived from the observation that socializing and eating are tightly connected. In relation to positive emotions particularly, research has illustrated that increased amounts of food are eaten at meals with familiar and friendly people, not only because it results in an extended time duration of the meal, but also because these people assist in making a meal relaxing and more enjoyable (Chaiken & Pliner, 1990; Wansink, 2004). Third, emotions orient people to goal-related features in the environment. Positive emotions impose a signal that the environment is benign and safe (Andrade, 2005; Schwarz & Clore, 2003). Consequently, attention may be biased toward potential rewards, so that the person can build resources (Fredrickson, 1998; Tamir & Robinson, 2007). In the case of eating, the focus may be directed on the short-term goal of enjoying hedonic foods rather than the long-term goal of watching a diet or keeping a slim figure (Dingemans, Martijn, van Furth, & Jansen, 2009). This assumption is corroborated by findings indicating that when people experience high degrees of positive emotion, they may be more likely to engage in risk behaviors such as alcohol consumption, drug intake, and binge eating (Cyders & Smith, 2008; Martin et al., 2002). A fourth reason is related to research revealing that participants enjoy eating hedonic foods particularly when in a positive mood (Macht, Roth, & Ellgring, 2002). For example, motivation to eat has been found to be higher during joy than during sadness (Macht, 1999) and chocolate was rated as more pleasurable during positive emotions (Macht et al., 2002). Consequently, when in a positive mood exposure to tempting food may increase the pleasure of eating and result in more intake. Finally, research on justifications and self-licensing

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has illustrated that people are motivated to find reasons that justify food indulgence (Kivetz & Zheng, 2006), and amongst these justifications positive emotions have been identified as well-known justification cues (De Witt Huberts, Evers, & De Ridder, 2012). Thus, there are several theoretical indications pointing towards positive emotions triggering food intake.

There are, however, alternative theoretical views on the role of positive emotions in relation to eating (see also Fedorikhin & Patrick, 2010). For instance, according to the “broaden-and-build” theory (Fredrickson, 2001) positive emotions increase personal resources, making subsequent challenges (such as resisting palatable foods) easier to achieve. Similarly, according to the “mood maintenance theory” (Andrade, 2005) positive emotions are believed to decide people against indulgence, since they would not want to undermine the positive feeling by giving in. Accordingly, such theories would not predict that positive emotions precede food intake.

This lack of theoretical consensus is reflected in the empirical evidence. To illustrate, amongst student samples positive emotions have been found to increase eating behavior (Evers, de Ridder, & Adriaanse, 2009), to decrease eating behavior (Turner, Luszczynska, Warner, & Schwarzer, 2010), or to have no effect on eating behavior (Lowe & Fisher, 1983; Yeomans & Coughlan, 2009) compared to neutral emotional states. Other studies that focused on the extent to which individual differences in eating styles predict positive emotion induced eating resulted in diverse outcomes as well. Cools, Schotte, and McNally (1992) found that positive emotions, just like negative emotions, can act as a disinhibitor of dietary restraint, thus showing that positive emotions caused food intake in restrained eaters only. Yeomans and Coughlan (2009), however, found that positive emotions only triggered food intake in individuals who scored low on restraint in combination with high scores on disinhibition. Again other findings were reported by Turner et al. (2010), who found that positive emotions resulted in *decreased* eating among individuals with a more controlled eating style, which is in line with a naturalistic eating study revealing that restrained eaters ate less in the presence of positive moods (Tomiyama, Mann, & Corner, 2009). Finally, in relation to other characteristics than dietary restraint, some studies showed that positive moods resulted in larger meals compared to neutral moods in obese women (Patel & Schlundt, 2001) or in increased eating in binge eaters with high expectations that food is pleasurable and useful as a reward (Dingemans et al., 2009). To summarize, compared to negative emotions, positive emotions have been relatively under-investigated as a trigger of food indulgence and the empirical evidence on how positive emotions affect eating behavior seems inconsistent. Additional research on how positive emotions relate to indulgence seems therefore warranted.

By investigating food intake in a controlled lab environment as well as in daily life, and by comparing positive emotions to neutral as well as negative emotions we aimed to provide more unambiguous evidence for the role of positive emotions in predicting food intake. More insight into the extent to which positive emotions are a relevant and important trigger for unhealthy food intake is pivotal not only to reconcile previous findings, but also to guide future interventions aiming to decrease overconsumption. That is, if positive emotions do prove to be an important, but frequently overlooked trigger for overconsumption, future interventions should be designed to target these critical triggers for unhealthy eating.

Based on the theoretical underpinnings pointing towards an important role of positive emotions in promoting eating behavior, we hypothesize that positive emotions have the potential to trigger intake of palatable foods in healthy individuals. We did not formulate any specific hypotheses in relation to how dietary restraint would affect eating in response to positive emotions, as prior research yielded mixed results (Cools et al., 1992; Turner et al., 2010; Yeomans & Coughlan, 2009), but for reasons of com-

paring our results with these studies we assessed whether dietary restraint moderated the effect of positive emotion on food intake.

The present studies

In order to investigate our assumption, in two laboratory studies positive emotions were induced and compared to a neutral control condition (Studies 1 and 2) or to a negative emotion condition (Study 2). The advantage of these laboratory studies is that they allow for assessing a causal association between emotions and eating while standardizing the emotional encounter and the external food environment. Actual food consumption was assessed by bogus taste tests (Evers et al., 2009). As assessing food intake in the laboratory may be ecologically less valid, Study 3 entailed a diary study, with snack intake registered several times a day for 1 week. For each eating episode, participants had to register their emotional state in order to allow for testing to what extent positive (and negative) emotions affect people's unhealthy food intake in real life. Assessing the role of positive emotions in both laboratory and field studies is an important contribution to existing research. Across all three studies, we measured dietary restraint as to explore how restraint may affect the role of positive emotions on eating. Only normal weight or overweight participants were included in the analyses, as being underweight (Body Mass Index: BMI < 18) or obese (BMI > 30) has been associated with pathological responses to food (Stice, Spoor, Ng, & Zald, 2009).

Study 1

In Study 1, film excerpts were used to induce positive emotions in the positive emotion condition vs. no emotions in the control condition. Exposing people to film excerpts has been found to reliably induce the intended emotions (e.g., Turner et al., 2010). We assumed that participants in the positive emotion condition would show higher food intake compared to participants in the control condition.

Method

Participants

In total, 70 university students completed the study. Data from participants with a BMI < 18 ($N = 2$) were excluded from the analyses. No obese people participated. The final sample consisted of 68 participants (16 men; 52 women) with a mean age of 21.9 years ($SD = 3.3$) and a BMI ranging from 18.04–26.83 ($M = 21.50$; $SD = 1.95$); 97% of the sample had a normal weight and 3% was overweight).

Procedure

The study was presented as two unrelated studies, one about the effect of multimedia on emotions and one about the effect of cognitions on taste perception. To create standardized satiety states, participants were informed upon scheduling an appointment that they were not allowed to eat 2 h before the study on taste perception; they were only allowed to drink water. After signing an informed consent form, the experimenter randomly started one of two film excerpts as part of the alleged ‘first’ study. In the positive emotion condition ($N = 36$), the film excerpt consisted of four short fragments (e.g., one about a baby panda sneezing so loud that the mother startles). The excerpt had been successfully pilot tested to induce positive emotions. In the control condition ($N = 32$), the film excerpt consisted of a scene about birds in the desert, and had been pilot tested to induce neither positive nor negative emotions. Film excerpts in both conditions lasted 2.5 min. Before and after the film excerpt participants rated their current emotional experience.

Next, as part of the alleged 'second study' the extent to which participants were hungry was assessed, after which participants were provided with three bowls of unhealthy snack foods (M & Ms, coated peanuts, and wine gums) and a nine-item questionnaire to ostensibly evaluate the food types. Unbeknownst to the participants, bowls were weighed in advance and after the taste test. Participants were told to taste as much as they preferred and that they would have ten minutes for the test, to provide them with ample time to taste (see also Evers, Stok, & de Ridder, 2010). Subsequently, participants completed a scale assessing dietary restraint. After participants had been fully debriefed, reimbursed with course credit, and were dismissed, the bowls with food were weighed.

Materials

Emotion experience

Emotion experience was assessed before and after the film excerpts by asking participants how strongly they experienced 19 different emotions extracted from the Post Film Questionnaire (Rottenberg, Ray, & Gross, 2007), based on seven-point Likert scales ranging from 0 (*not at all*) to 6 (*very much*). The six positive emotions (happiness, pleasure, joy, cheer, contentment, and satisfaction) were combined into a positive emotion composite (before vs. after excerpt: $\alpha = .82$ vs. $\alpha = .83$). The 13 negative emotions (e.g., anger, sadness, fear, worry, and shame) were combined into a negative emotion composite (before vs. after excerpt: $\alpha = .84$ vs. $\alpha = .85$).

Food intake

The weight of food consumed (M & Ms, coated peanuts, and wine gums) was calculated based on the difference in weight of the bowl before and after the taste test. The consumed grams per food type was calculated and transformed into caloric intake. Total caloric intake was measured by summing all calories consumed by each participant. As the data were not normally distributed, data were subjected to log transformations. For the ease of interpretation, means will be described in kilocalories (kcal).

Dietary restraint

To measure individual differences in dietary restraint, the DEBQ (Van Strien, Frijters, Bergers, & Defares, 1986) was administered, including the dietary restraint subscale (DEBQ-RS: 10 items, $\alpha = .94$).¹

Hunger

To control for hunger, participants indicated on seven-point scales how much they currently experienced hunger, appetite, and were feeling like a bite. These items were combined into a hunger scale ($\alpha = .83$).

Results

Randomization check

A chi square analysis revealed that men and women were equally distributed across conditions ($p > .15$) and separate analyses of variance (ANOVAs) demonstrated that there were no significant differences between conditions for BMI and hunger (F 's < 1) or emotions at baseline (p 's $> .25$), indicating successful randomization.

¹ Besides the restraint subscale, the DEBQ also includes subscales measuring emotional and external eating. There was no reason to assume that these eating styles would moderate food intake as triggered by positive emotions, because the emotional eating subscale measures the desire to eat in response to negative emotions only, and because there is no a priori theoretical rationale for including the external eating subscale as moderator. Analyses also did not implicate that these subscales are of importance in the present studies: emotional and external eating indeed did not moderate the relation between positive emotion and food intake.

Emotion induction

Positive and negative emotional experience were subjected to a Mixed-Model ANOVA with condition (positive vs. control) as between-subjects factor and emotion type (positive vs. negative) and time (before vs. after film excerpt) as within-subjects factors. The interaction between condition, emotion type, and time was significant, $F(1, 66) = 13.71$, $p < .001$, $p\eta^2 = .17$. Simple effects revealed that positive emotions increased due to the positive film excerpt ($M_{\text{before}} = 3.55$, $SD = .88$, $M_{\text{after}} = 4.25$, $SD = .75$; $p < .001$), while they were unaffected due to the control excerpt ($M_{\text{before}} = 3.79$, $SD = .80$, $M_{\text{after}} = 3.88$, $SD = .85$; $p > .42$). Negative emotions decreased in both conditions (positive condition: $M_{\text{before}} = .79$, $SD = .69$, $M_{\text{after}} = .33$, $SD = .41$; $p < .001$; control condition: $M_{\text{before}} = .70$, $SD = .68$, $M_{\text{after}} = .49$, $SD = .53$; $p = .006$). Thus, the positive emotion condition was successful in inducing positive emotions, and although the control condition did not induce positive emotions, as expected, it was not entirely neutral as it decreased the experience of negative emotions.

Food intake

An ANOVA with condition as independent variable and total caloric intake as dependent variable revealed a significant condition effect, $F(1, 66) = 18.24$, $p < .001$, $p\eta^2 = .22$: participants in the positive emotion condition ($M = 217$, $SD = 145$) consumed more kcal on unhealthy snacks than participants in the control condition ($M = 116$, $SD = 112$).

Dietary restraint

A hierarchical regression analysis was performed to assess if dietary restraint moderated food intake as triggered by positive emotion. Variables were mean-centered to avoid multicollinearity (Aiken & West, 1991). Food intake was regressed onto the control variables BMI and positive and negative emotion at baseline (step 1); condition (1 = positive; 0 = control) and dietary restraint (step 2); and the interaction between condition and dietary restraint (step 3). The first step was not significant ($F < 1$) with none of the beta weights being significant (p 's $> .37$). Step 2 added 21% to the explained variance, a significant increment, $p = .001$, with only the beta weight associated to the positive emotion condition being significant ($\beta = .458$, $p < .001$). Step 3 did not add significantly to the explained variance (1%; $p > .28$) and the only significant beta weight remained the one associated with the positive emotion condition ($\beta = .636$, $p < .001$). Thus, dietary restraint did not moderate the relation between positive affect and eating.

Discussion

Study 1 revealed that positive emotions evoked by a 2.5 min film excerpt caused an higher snack intake of 100 kcal during a 10 min taste test compared to the control condition. Dietary restraint did not have a moderating impact on this result. In Study 2 we wanted to replicate this effect. Moreover, as it remains unclear to what extent it is emotion in general or the emotional valence (i.e., positive or negative emotion) in particular that is responsible for food intake, an additional negative emotion condition was included. As the control film excerpt in Study 1 turned out to be slightly negative, another emotion induction procedure was used, with the participants themselves as the actor of the emotional encounter.

Study 2

An ecologically valid in vivo provocation procedure was used in order to induce emotions. Participants had to recall, re-experience, and verbalize about a recent and personally relevant pleasant event (positive emotion condition), sad event (negative emotion condition), or a regular, daily event (control condition).

Method

Participants

In total 93 university students completed the study. Data from participants who did not comply with the instruction to refrain from eating 2 h before participation ($N = 1$), who were substantially older than the regular student sample (age > 43 years: $N = 3$), who were obese (BMI > 30: $N = 1$), or who were underweight (BMI < 18: $N = 4$) were excluded from the analyses. The final sample consisted of 84 female university students with a BMI ranging from 18.49 to 28.53 ($M = 22.35$; $SD = 2.48$; 79% of the sample had a normal weight and 21% was overweight).

Procedure

The procedure was similar to Study 1, except from the emotion induction procedure and the food types used in the taste test. For the emotion induction a standardized 'recall' procedure was used (Evers et al., 2009; Neumann & Waldstein, 2001). In the positive emotion condition ($N = 28$) participants were instructed in step 1 to recall and re-experience a recent and personally relevant pleasant event. It was stressed that it had to be an event that still evoked pleasure when it was brought to mind. Participants were motivated to verbalize freely, like they were talking to a good friend, and to close their eyes if they felt more comfortable doing so. Participants were instructed to talk until they re-experienced the event again. In step 2 participants were instructed to think in silence for two more minutes about the event. In the negative emotion condition ($N = 27$) participants had to recall a sad event and in the control condition ($N = 29$) a regular, daily event, like taking a walk. Food intake was assessed similar to Study 1, by unobtrusively measuring the amount (in grams), but this time chocolate, crisps, biscuits, and crackers were offered in the taste test.

Materials

Emotion experience

Emotion experience was assessed before and after the recall task by the same items as in Study 1. The same positive emotion items were combined into a positive emotion composite (before vs. after recall: $\alpha = .85$ vs. $\alpha = .95$). Since the negative emotion induction focused on sadness recall, sadness ratings were the target negative emotions.

Food intake

The consumed grams per food type (chocolate, crisps, biscuits, and crackers) were calculated and transformed into caloric intake. Total caloric intake was measured by summing all calories consumed by each participant.

Dietary restraint

The DEBQ-RS was assessed similarly to Study 1 ($\alpha = .94$).

Hunger

The same items as in Study 1 were used to assess hunger ($\alpha = .87$).

Results

Randomization check

Separate analyses of variance (ANOVAs) demonstrated that there were no significant condition effects for hunger, BMI, and positive and negative emotion at baseline (p 's > .10). Randomization was therefore considered successful.

Emotion induction

Positive emotion and sadness were subjected to a Mixed-Model ANOVA with condition (positive vs. sadness vs. control) as between-subjects factor and emotion type (positive vs. sadness) and time (before vs. after film excerpt) as within-subjects factor. The interaction between emotion type, time, and condition was significant, $F(2,81) = 110.35$, $p < .001$, $p\eta^2 = .73$. Simple effects revealed that in the positive emotion condition, positive emotion increased (before vs. after recall: $M = 3.41$, $SD = .93$ vs. $M = 4.36$, $SD = .89$; $p < .001$) and sadness remained low and unaffected ($M = .68$, $SD = .86$ vs. $M = .71$, $SD = .90$; $p = .85$); in the negative emotion condition, positive emotion decreased (before vs. after recall: $M = 3.33$, $SD = .80$ vs. $M = 2.10$, $SD = .95$; $p < .001$) and sadness increased ($M = .96$, $SD = 1.16$ vs. $M = 3.93$, $SD = 1.49$; $p < .001$); in the control condition, both positive emotion (before vs. after recall: $M = 3.75$, $SD = .80$ vs. $M = 3.66$, $SD = 1.08$; $p = .45$) and sadness did not change from before ($M = .65$, $SD = .84$) to after recall ($M = .45$, $SD = .85$; $p = .21$). The emotion induction was therefore considered successful.

Food intake

An ANOVA with condition as independent variable and total caloric intake as dependent variable revealed a significant condition effect, $F(2,81) = 4.78$, $p = .011$, $p\eta^2 = .106$. Simple effects revealed that participants in the positive emotion condition ($M = 249$, $SD = 128$) consumed more food than participants in the control condition ($M = 159$, $SD = 91$), $p = .008$, but did not differ from participants in the negative emotion condition ($M = 247$, $SD = 152$), $p = .955$. Participants in the negative emotion condition also consumed more than participants in the control condition, $p = .010$.

Dietary restraint

A hierarchical regression analysis was performed to assess if dietary restraint moderated food intake as triggered by positive emotion. Variables were again mean-centered to minimize multicollinearity, and food intake was regressed onto the control variables BMI and positive and negative emotion at baseline (step 1); dummy coded positive condition (1 = positive; 0 = control; 0 = negative), dummy coded negative condition (1 = negative; 0 = control; 0 = positive) and dietary restraint (step 2); and the interaction between positive condition and dietary restraint (step 3). The first step was not significant ($p = .092$) with the beta weight for positive emotion at baseline significant ($\beta = -2.278$, $p = .025$). Step 2 added 14% to the explained variance, a significant increment, $p = .006$, with the following beta weights being significant: positive emotion condition ($\beta = .304$, $p = .012$), negative emotion condition ($\beta = .280$, $p = .023$), and dietary restraint ($\beta = -.266$, $p = .015$). Step 3 did not add significantly to the explained variance (0.6%; $p > .43$) and the interaction term was not significant ($\beta = .102$, $p = .429$). Thus, dietary restraint did not moderate the relation between positive affect and eating.²

² To assess if dietary restraint moderated food intake as triggered by negative emotion, a similar regression analysis was performed including in step 3 the interaction between negative condition and dietary restraint (step 3). Step 3 added 7% to the explained variance, a significant increment ($p = .01$). The interaction term was significant ($\beta = -.335$, $p = .01$), indicating that dietary restraint moderated the relation between negative affect and eating. In a follow-up regression analysis including only the negative condition, food intake was regressed onto the control variables BMI and positive and negative emotion at baseline (step 1) and restraint (step 2). Restraint was negatively associated with food intake ($\beta = -.521$, $p = .005$). Thus, higher restraint scores resulted in decreased food intake in reaction to negative emotions. Although this finding is counter-intuitive as empirical literature usually suggests that restrained eaters show increased eating in reaction to negative emotions (e.g., Greeno & Wing, 1994), it seems important to note that several other studies also failed to find that restraint eaters increase their food intake while feeling negative (e.g., Chua, Touyz, & Hill, 2004). Such findings indicate that restraint status is at least not a necessary requirement for a potential to overeat in negative emotional encounters (Spoor, Bekker, Van Strien, & Van Heck, 2007; Williams et al., 2002).

Discussion

In line with Study 1, Study 2 showed that positive emotions trigger, compared to a neutral control condition, more food intake. Positive emotions did not differ from negative emotions in their effects on food intake. Again the findings revealed that dietary restraint did not have a moderating impact on the positive emotion induced eating.

Although experiments in the laboratory have the advantage of standardizing the environment, a limitation may lie in the fact that participants were exhibited to only one (manipulated) emotional encounter and had to eat under rather artificial circumstances, which may not correlate to a more general desire to eat under emotional conditions in real life. This limitation was addressed in Study 3.

Study 3

Food intake was assessed in a naturalistic setting using a prospective diary design. During 7 days participants recorded on a daily basis each snacking episode together with their emotional state.

Method

Participants

Participants were female students recruited at a University of Applied Sciences. Fifty females aged 17–25 years were initially recruited and 43 students completed the study by returning the food diary. Underweight participants ($BMI < 18$; $N = 4$) were excluded from the analyses and one participant³ who was an extreme outlier on the amount of snacks consumed in relation to positive affect ($>3 SD$). The sample included no obese people. The final sample consisted of 38 women with a BMI ranging from 18.3 to 27.0 ($M = 21.3$, $SD = 2.2$; 92% of the sample had a normal weight and 8% was overweight).

Procedure

Upon recruitment, participants were informed that the objective of the study was to gain insight into female students' snacking behavior and that their responses would remain anonymous. The study consisted of keeping daily a food diary for 1 week administering where, when, and why people regularly eat unhealthy snacks. All participants received detailed instructions on how to use the diary and made an individual appointment to return their diary. When the diary was completed, participants were debriefed and reimbursed with €5.

Food diary

In the daily food diary (Adriaanse, de Ridder, & Evers, 2011) participants were requested to record the unhealthy snacks they consumed during each of seven consecutive days. Unhealthy snack intake was chosen as eating behavior, as similar diary methods assessing discrete aspects of eating behavior such as between-meal snacking have been found to be reliable and valid measure of food intake (Conner, Fitter, & Fletcher, 1999). Moreover, emotional eating has been typically paired to eating hedonic, high fat foods (Macht & Simons, 2011). The instructions stated that participants were supposed to fill out one entry for each occasion (defined as a 30-min period) they were eating something unhealthy between meals. Healthy snacks did not have to be reported and examples of unhealthy and healthy snacks were provided. The diary consisted of six entries per day for each day of the week. Each entry consisted of several columns, with two of particular importance

for this study: one column with 12 types of unhealthy snacks including an option 'other', and another column including 10 positive and 10 negative emotions (PANAS; Watson, Clark, & Tellegen, 1988). The other columns were added as control variables and included options for places, times, and activities during the snack consumption. Thus, for each snacking episode, participants were asked to indicate (a) which snack(s) they consumed and how much of this/these snack(s) they consumed, (b) how they felt when starting to eat the snack, and (c) where/when/with whom they were when starting to consume the snack (control questions).

With regard to their emotions, participants were asked to choose one option that best described their emotional state when they were going to eat the snack. This way, both general caloric intake from unhealthy snacks and the frequency of unhealthy snacking preceded by positive and negative emotions could be determined. The mean amount of kilocalories (kcal) derived from unhealthy snacks was estimated by multiplying each reported snack by the average amount of kilocalories it contains (based on guidelines by the Dutch Nutrition Centre, <http://www.calorie-checker.nl>, and validated by a professional dietician). As dependent variable we used the proportion of unhealthy snacking episodes preceded by positive vs. negative emotions in relation to the total number of unhealthy snacking episodes. Thus, the frequency of unhealthy snacking preceded by positive vs. negative emotions was divided by the frequency of unhealthy snacking in total for each participant.

Results and discussion

Participants consumed unhealthy snacks on average 14.8 times per week ($SD = 6.02$). The mean amount of kilocalories per day derived from unhealthy snacks was 401 ($SD = 280$).

On average, consumption of snacks preceded by positive emotions occurred 10.89 times per week ($SD = 5.28$) and consumption of snacks preceded by negative emotions occurred 3.95 times a week ($SD = 4.40$).

In order to assess if the number of snack episodes preceded by positive vs. negative emotion in relation to the total number of snack episodes differed significantly, an ANOVA was performed with emotion type (positive vs. negative) as within-participants variable. The percentage of unhealthy snacking preceded by positive emotions ($M = 74$, $SD = 27$) was significantly higher than the percentage of unhealthy snacking preceded by negative emotions ($M = 23$, $SD = 22$), $F(1, 37) = 60.40$, $p < .001$, $\eta^2 = .62$.

In order to explore how dietary restraint was related with the snack episodes preceded by positive vs. negative emotions, correlations were computed for these variables with dietary restraint. Dietary restraint was not significantly correlated to the proportion of unhealthy snacking episodes preceded by positive emotions vs. negative emotions ($r = .04$ vs. $.22$).

General discussion

While research on the relation between emotions and overeating has predominantly focused on negative emotions, the present studies focused on positive emotions as instigators of unhealthy eating behavior. In three studies the results pointed towards the essential role of positive emotions in food indulgence. Specifically, the two laboratory studies showed that experimentally induced positive emotions, compared to a neutral control condition, triggered an intake of about 100 kcal more. Study 2 demonstrated that this difference was comparable to the effect of negative emotions, indicating that positive emotions are at least as important in triggering unhealthy food consumption in healthy individuals. The relation between positive emotion and food intake was corroborated

³ Results were identical with inclusion of this outlier.

rated in the diary study. Moreover, this more ecologically valid study demonstrated that snack intake in daily life particularly resulted from positive, as compared to negative emotions, providing further evidence for the imperative role of positive emotions in triggering food consumption in a healthy sample.

An important implication that results from these findings is that in order to gain better understanding of the relation between emotions and eating, positive emotions should receive a more prominent role in the discussion on how emotions affect eating behavior. Currently, emotional eating is typically defined as eating in response to *negative* emotions (e.g., Arnow, Kenardy, & Agras, 1995; Van Strien et al., 1986). This is related to the origin of the emotional eating concept, which is the psychosomatic theory (Bruch, 1964). According to this theory, emotional eating either results from the inability to distinguish hunger sensations from arousal due to other aversive internal states (see also Schachter, Goldman, & Gordon, 1968), or it results from eating as a means to alleviate negative emotional states, and this again is assumed to result from early learning experiences (see also Macht & Simons, 2011).

If positive emotions indeed deserve more attention in the emotional eating concept, this also implies that emotional eater scales, measuring the extent to which individuals perceive themselves as emotional eaters, should be complemented with positive emotion states. The three traditionally used emotional eater scales are restricted to negative emotional states (DEBQ: Van Strien et al., 1986; EES: Arnow et al., 1995; TFEQ: Stunkard & Messick, 1985). More recently however, new emotional eater scales have been developed and fortunately, these have been extended by including positive emotional states, although no clear rationale was provided for why positive emotions were added. To illustrate, the Emotional Overeating Questionnaire (EOQ: Masheb & Grilo, 2006) was specifically developed for overweight patients with binge eating disorders, and besides several negative emotion subscales, it also included a happiness subscale; the Emotional Appetite Questionnaire (EMAQ: Nolan, Halperin, & Geliebter, 2010) was developed including positive emotions and situations in addition to negative ones; and the EES has been modified into a version adding several positive emotions such as happiness and enthusiasm (EES-II: Kenardy, Butler, Carter, & Moor, 2003). Although these newer emotional eater scales have not yet been validated, they nevertheless cover a more complete reflection of the phenomenon of emotional eating in light of the present findings.

The present findings further revealed that dietary restraint did not moderate the relation between positive emotion and food intake. This finding is in contrast to Cools et al. (1992) who found that positive emotions caused *increased* eating in restrained eaters, and in contrast to Turner et al. (2010) who found that positive emotions triggered *decreased* eating among individuals with a more controlled eating style. These different findings regarding the moderating impact of dietary restraint may be related to how dietary restraint was measured, as there are different views regarding the best means to assess dietary restraint (e.g., Stice, Sysko, Roberto, & Allison, 2010). According to Yeomans and Coughlan (2009) the combination of restraint and disinhibition is helpful in identifying on the one hand successful and unsuccessful dieters and additionally those prone to overeating in the absence of restraint. This latter group of individuals (prone to overeating in absence of restraint) was found to be vulnerable for increased eating in reaction to positive emotions (Yeomans and Coughlan). Understanding how positive emotions and dietary restraint precisely interact in relation to overeating thus seems unclear, and future studies might examine this further.

An important question is why the findings from the present studies conform or deviate from previous studies investigating food intake in response to positive emotions. An important consis-

tency across most studies is that the effect of positive emotion on food intake was investigated in controlled laboratory settings where food was offered as bogus taste tests (Dingemans et al., 2009; Evers et al., 2009; Yeomans & Coughlan, 2009) or as so called 'gestures of gratitude' during the emotion induction procedure (Cools et al., 1992; Turner et al., 2010). Moreover, in all studies including the present ones (Cools et al., 1992; Evers et al., 2009; Turner et al., 2010; Yeomans & Coughlan, 2009), positive emotion in general was measured. Despite these consistencies however, findings on how positive emotions affected eating behavior diverged, as described in the introduction. An important variation that may account for these inconsistent findings across studies, is the type of positive emotion that was induced. That is, whereas positive emotion in general was measured, it is not clear to what extent a particular positive emotion may have been more prevailing. For example, in several studies (Cools et al., 1992; Turner et al., 2010; Yeomans & Coughlan, 2009) comedy clips were used to trigger positive emotion, but comedy is a very broad genre that can result in joy, humor, amusement, interest, entertainment, pride, or gratitude. The type of positive emotion that was triggered may be quite crucial, especially since it has been shown that positive affect with low arousal enhances self-control, while positive affect with high arousal diminishes self-control (Fedorikhin & Patrick, 2010). Another illustration that the type of positive emotion should be considered in more detail, can be illustrated by research of Winterich and Haws (2011). Their research showed that the temporal focus of the positive emotion may be crucial for self-control and more specific for snack consumption. That is, they showed that future-focused positive emotions (e.g., hopefulness) resulted in decreased unhealthy food intake compared to past- or present-focused positive emotions (e.g., pride and happiness). Together, such findings show that it may be important for future research to incorporate the arousal level of the induced emotions combined with distinct types of positive emotions.

An important question for future research concerns the underlying theoretical mechanism behind overeating in response to positive emotions. In the introduction above several theoretical explanations have been outlined that may be worthwhile to investigate. Related to this, from the present studies it remains unclear whether healthy individuals engage in food consumption as a result from emotional arousal in general, or from positively valenced emotions in particular. That is, laboratory Study 2 pointed towards emotional arousal in general being responsible for food intake, as both positive and negative emotions induced intake compared to neutral control conditions. The diary study, Study 3, however, specifically hinted towards positively valenced emotions as being responsible for food intake, as snack intake in daily life was reported to result from positive emotions more frequently than from negative emotions. This result may well be an artifact of the study design (see also below), but the question whether emotional arousal, regardless of valence, may trigger eating behavior is an intriguing topic for future research (see also Cools et al., 1992). In this perspective, it seems crucial for future research to contrast positive emotions against negative emotions that have a corresponding arousal level. Thus far, the negative emotion conditions against which the positive emotion conditions were contrasted, varied substantially across studies. For example, in our second study we contrasted general positive emotion against sadness, which is a low arousal negative emotion. However, Yeomans and Coughlan (2009) contrasted general positive emotion against a negative emotion condition that was anxious and arousing. Cools et al. (1992) then again, compared general positive emotion to a negative emotion condition that was horrifying. Finally, Dingemans et al. (2009) used general negative affect as reference group. Accordingly, future research unraveling the question whether food consumption results from emotional arousal in general or from

emotional valence in particular could benefit from a more consistent measurement of the corresponding arousal level of the particular emotion that is being evoked.

A number of limitations of the current research should be mentioned. We acknowledge that in particular the design of Study 3 may not have been ideal, as participants had to indicate for each snacking episode which emotion they felt, which may have evoked the impression that participants had to feel an emotion when snacking. Moreover, participants may have experienced more positive than negative emotional events, which can be responsible for a biased positive-to-negative emotion ratio liable for the higher percentage of snack intake in response to positive emotions. Previous research has indeed revealed that there is in general a large difference between the occurrence of positive and negative affect (e.g., Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004) with negative affect being relatively infrequent and mild compared to positive affect. In addition, our studies provide no information on the report of positive vs. negative affect without eating, which limits the conclusions that can be drawn. It would be fruitful if future research attempted to incorporate a more careful assessment of emotions preceding snack intake in daily life. Despite these limitations, an important strength of this study was its measurement of food intake, an ecologically valid measure assessing each snacking episode during a whole week. Further, it remains to be seen if our results generalize to other populations, as the present findings are based on a mainly young, female, healthy sample without eating disorders and without underweight or having obesity.

To conclude, across three studies, both experimental studies and a real life diary study, findings illustrated that positive emotions in general seem important triggers for food indulgence amongst healthy people with a normal weight. Future research benefits from looking in more detail how feeling good and eating food are precisely related and what are the theoretical underlying mechanisms.

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