Research report

Moderation of distress-induced eating by emotional eating scores

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Abstract

Earlier studies assessing the possible moderator effect of self-reported emotional eating on the relation between stress and actual food intake have obtained mixed results. The null findings in some of these studies might be attributed to misclassification of participants due to the use of the median splits and/or insufficient participants with extreme scores. The objective of the two current studies was to test whether it is possible to predict distress-induced eating with a self-report emotional eating scale by using extreme scores. In study 1 (n = 45) we used a between-subjects design and emotional eating was assessed after food intake during a neutral mood or after a control task, whereas high emotional eaters ate more. No such moderator effect was found for emotional eating in the entire sample (n = 124) of study 1 using the median-split procedure or the full range of emotional eating scores. We conclude that it is possible to predict distress-induced eating with a self-report emotional eating scale by using extreme scores.

Introduction

Negative mood or distress is associated with both increased and decreased food intake (Greeno & Wing, 1994) with eating less being the typical and predominant response (Gold & Chrousos, 2002; Heatherton, Herman, & Polivy, 1991; Stone & Brownell, 1994). Negative mood or distress is normally associated with a hyperactive hypothalamic–pituitary–adrenal (HPA) axis, with physiological adaptations that are biologically designed to prepare the individual for a fight-or-flight response. These adaptations include inhibition of gastric motility and the release of sugar into the bloodstream, thereby suppressing feelings of hunger (Gold & Chrousos, 2002). However, so-called emotional eaters show an atypical response and eat the same amount or even more during distress (Oliver, Wardle, & Gibson, 2000; Van Strien & Ouwens, 2003).

Emotional eating is thought to be a learned response (Bruch, 1973). It was found to emerge in adolescence in association with depressive feelings and inadequate parenting (e.g., Ouwens, Van Strien, & Van Leeuwe, 2009; Snoek, Engels, Janssens, & Van Strien, 2007) in interaction with a genetic vulnerability (Van Strien, Snoek, van der Zwaluw, & Engels, 2010; Van Strien, van der Zwaluw, & Engels, 2010). Emotional eating was found to occur in people with poor coping skills, poor interoceptive awareness, and high alexithymia (Larsen, Van Strien, Eisenga, & Engels, 2006; Ouwens et al., 2009; Spoor, Bekker, Van Strien, & Van Heck, 2007; Van Strien & Ouwens, 2007). Emotional eaters have been observed to be poor at recognizing whether they are hungry or satiated or suffer from some other discomfort, and to overeat in response to emotional agitation rather than in response to internal hunger cues. If emotional eating occurs frequently, it may ultimately lead to weight gain and obesity.

Studies assessing the possible moderator effect of self-reported emotional eating on the relation between stress and actual food intake have obtained mixed results. In a laboratory study on the effects of a distress manipulation (the anticipation of a public speaking task), Oliver et al. (2000) found a significant moderator effect of self-reported emotional eating on food choice and food...
intake. Stressed emotional eaters ate more sweet, high-fat foods and a more energy-dense meal than did unstressed eaters and non-emotional eaters in the distress condition. Also Wallis and Hetherington (2004) found that emotional eating was associated with greater chocolate intake after an ego-threatening stressor relative to a control task. No such moderator effect for emotional eating on actual food intake, however, was found by Evers, de Ridder, and Adriaanse (2009) and Rapsopow, Abizaid, Matheson, and Anisman (2010) (n = 48), or Wallis and Hetherington (2009) (n = 26).

Evers et al. (2009) used four different emotion-induction procedures in four different experiments (vignettes, n = 30; film excerpts, n = 60; recall, n = 37; false feedback, n = 57). Failing to find effects for emotional eating, Evers et al. (2009) argued that assessing oneself as an emotional eater is a “mission impossible” because it may be too difficult for individuals to assess their own emotion-related eating behavior.

Another possible explanation for the null results in some studies is misclassification of ‘low’ vs. ‘high’ emotional eaters due to (a) the use of a median split on the emotional-eating scale or (b) insufficient participants with extreme emotional eating scores or (c) both. Median splits are notoriously vulnerable to misclassification of research participants and spurious effects (Maxwell & Delaney, 1993).

Oliver et al. (2000) and Wallis and Hetherington (2004), who did find a significant moderator effect for emotional eating, also used a median-split procedure for their classification of participants into low and high emotional eaters, although, so a median split approach to participant classification is not necessarily fatal. Further, some studies with no significant moderator effect for emotional eating (additionally) used multiple regression analyses on the full range of scores. Another possible explanation for the null results in some studies may be that there had been insufficient participants with extreme scores on the moderating variable. According to McClelland and Judd (1993), pp. 382–383 “jointly extreme observations are crucial for detecting interactions.” In comparison with the ‘four-corners design,’ in which 25% of cases are allocated to each extreme, “a normal like distribution of the two variables has a relative efficiency of only .06 for detecting an interaction and requires nearly 17 times as many observations to have comparable efficiency” (Whisman & McClelland, 2005, p. 117).

Interestingly, most studies with no moderator effect for emotional eating that (additionally) used multiple regression analyses only had a small number of subjects in their study.1

In the following two studies we experimentally tested whether emotional eating moderates the effect of distress on eating by using only subjects with scores from the extreme ends of the DEBQ emotional eating subscale (Van Strien, 2011). In the first study, “an examination of general TV viewing behavior in daily life”, we analyzed food intake following a laboratory control task or stress task (Trier Social Stress Test; TSST). In this study we used a within-subjects design in which all subjects performed the control task and the acute stress task on two consecutive days. A further difference was that emotional eating was assessed well before the experiment, by recruiting participants from a pool of female students taking introductory psychology or pedagogy courses who had completed the emotional eating scale and then inviting only those with scores at the extreme ends to participate in a study on ‘health and physiology’.

Both studies included only females, because there is a greater prevalence of stress-induced food intake in females (O’Connor et al., 2008). We hypothesized that low emotional eaters (i.e., people who score low on the DEBQ emotional eating subscale) would eat less in the negative mood or acute stress condition than in the neutral or control condition, whereas high emotional eaters (i.e., those who score high on the DEBQ emotional eating subscale) would eat more.

**Study 1**

**Methods**

**Participants**

The sample consisted of 124 female students at the Radboud University Nijmegen. They participated in exchange for money or course credits. We also performed analyses on those participants with scores at the extreme ends of the emotional eating subscale of the DEBQ (Van Strien, 2011), using scores below the 20th and above the 80th percentile in the Dutch norm group of females.2 Corresponding cut-points are <1.82 and >3.25.3 A total of 45 female students fulfilled these criteria, 23 low and 22 high emotional eaters. The mean and standard deviations (SD) of age, body mass index (BMI = weight (kg)/height (m²)) and scores on emotional, external and restrained eating of the total sample and the subsamples may be found in Table 1.

**Procedure**

The study was presented as an examination of general TV viewing behavior in daily life. To increase ecological validity, we tested the subjects in a specially equipped, relaxing room at our lab, with a comfortable couch and a big TV screen. On the side table in front of the couch stood a glass of water, two pre-weighed bowls with crisps and M&Ms, and a glass of water. Participants were informed that they would watch TV for about 45 min and were invited to drink or eat whatever they liked while watching. To make sure that everyone would eat something, the experimenter asked them to eat at least one piece of one type of snack food.

Half of the participants viewed a sad movie, “Breaking the Waves,” and the other half viewed a neutral movie, “Travelling Birds.” After 14 and 33 min, the movies were interrupted by a 3.5-min commercial break, containing either neutral ads (e.g., promoting a car or a video camera) or ads with slim models or diet products (e.g., promoting shaving gel or low-fat cheese). For the present study, these ads were not of relevance but in the statistical

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1 This observation also provides a possible explanation for O’Connor, Jones, Conner, McMillian, and Ferguson’s (2008) finding a significant moderator effect for emotional eating in a regression analysis even though they used the entire continuum of emotional eating. O’Connor et al.’s diary study of the effects of daily hassles and eating style on food intake had 422 participants! This line of reasoning would also apply to the results of Conner, Fitter, and Fletcher (1999), who found no moderator effect for emotional eating in a highly similar study with only 60 participants. O’Connor and O’Connor (2004), used 15 participants in their diary study and a median split classification for low vs. high emotional eating but their results were in the predicted direction (for the present article we restrict ourselves to studies that assessed the moderation of distress-induced eating by emotional eating scores).

2 Preliminary results with other cut-off points of the first (of three) analyses of Study 1 have been reported in a Letter to the Editor of Health Psychology (Van Strien, 2010).

3 In their fMRI study, Bohon, Stice, and Spoor (2009) used 1.6 and 3.6 as qualifying scores for low vs. high DEBQ emotional eaters. Some other researchers prefer the median split ±1SD. However with a median of 2.68 ± .78 for emotional eating in Study 1, the cut-off score for low emotional eaters would have been exactly the same as our present cut-off point, and the score for high emotional eaters would have been even higher than the score that we used. So we preferred to use cut-off scores derived from the DCOTAN (Dutch Committee of Test and Testing) representative Dutch norm sample.

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an analyses the possible influence of ad-type was controlled for. After the end of the movie clip, participants completed several questionnaires concerning: the manipulation checks; their attitudes towards the movie and the ads; recall; and an assessment of their eating behavior. Weight and height were measured, (Larsen, Ouwens, Engels, Eisinga, & Van Strien, 2008) and a checklist concerning the purpose of the experiment was presented. Finally, participants were thanked and paid. They were fully debriefed after data collection was finished.

Measures

Mood: Mood was measured at the end of the study. To check whether the emotion manipulation had the desired outcome, we used a visual analog scale (VAS) to measure sadness. We also measured sadness with the item ‘sad’ (a 5-point rating scale). We further asked the participants directly whether they felt better or worse after the movie by asking them to state how well the following statements applied to them: I felt worse after seeing the movie and I felt better after the movie (5-point rating scales).

Eating behavior: Eating behavior was assessed with the DEBQ (Van Strien, 2011). The DEBQ has 33 items, 13 on emotional eating (e.g., “Do you have a desire to eat when you are irritated?”), 10 on external eating (e.g., “If food smells and looks good, do you eat more than usual?”) and 10 on restrained eating (e.g., “Do you try to eat less at mealtimes than you would like to eat?”). All items have to be rated on a 5-point scale with response categories that range from 1 ‘never’ to 5 ‘very often.’ The scales have good internal reliability and good construct and predictive validity (Van Strien, Herman, & Anschütz, in press; Van Strien & van de Laar, 2008).

Hunger: Because food intake may be affected by deprivation, we measured individual differences in hunger by having participants complete a visual analog scale (VAS) measuring the extent to which they felt hungry or satiated before the experiment. Additionally, we asked the respondents at what time they last ate during the experiment.

Food intake: While watching the movie, participants were allowed to eat freely from two pre-weighed bowls of crisps or M&Ms. The amount of food eaten during the experiment was measured with a professional balance (Mettler PM3000) to the nearest 0.1 g. We used total caloric intake as the dependent variable instead of total grams of food consumed, because chips and M&Ms differ in weight and caloric value.

Analytic strategy

All analyses were carried out using SPSS version 15.0 (SPSS Inc., Chicago). Success of randomization and the manipulation was assessed by using one-way ANOVAs and calculating effect sizes (Cohen’s d). Second, with ANCOVAs and hierarchical regression analyses we tested the moderating effect of emotional eating on the relation between movie condition and total intake of food. A significant moderator effect for emotional eating would be demonstrated by a significant interaction between emotional eating and the movie condition, whether or not there is a main effect for the moderator variable (emotional eating). Because of the high interrelations between emotional eating, external eating and dietary restraint (\( .45 < \rho < .54, p < .001 \)), we corrected for external eating and dietary restraint in all analyses. Further, the possible confounding effect of ad type, BMI, time since eating and hunger before the experiment were controlled for. To avoid multicollinearity in the regression analyses, all variables were centered before computing interaction terms (Aiken & West, 1991).

Results

Randomisation check, check of mood induction and outliers

In both the extreme-score subsample and the total sample there were no significant main effects of the movie condition for time since last having eaten before the experiment or for BMI, indicating that random assignment to the movie conditions had been successful (extreme score subsample: mean [sd]:time since last having eaten before the experiment was 1.64 [1.02] vs. 1.49 [1.24], \( p = .66; \) Cohen’s \( d = 0.13 \); BMI: 23.88 [5.72] vs. 22.84 [2.89], \( p = .44; \) Cohen’s \( d = 0.24 \); total sample: mean [sd]:time since last having eaten before the experiment was 1.89 [1.40] vs. 1.62 [1.26], \( p = .26; \) Cohen’s \( d = 0.19 \); BMI: 23.67 [4.32] vs. 22.98 [2.85], \( p = .299; \) Cohen’s \( d = 0.19 \). There were, however, significant main effects of the movie condition on measures of negative moods, indicating that the mood manipulation was successful: extreme score subsample: mean [sd]: feeling worse after the movie: 0.27 [0.55] vs. 1.44 [1.44], \( p < .001; \) Cohen’s \( d = 1.21; \) feeling better after the movie: 1.41 [1.14] vs. 0.30 [0.56], \( p < .001; \) Cohen’s \( d = 1.32; \) VAS sadness: 2.64 [2.88] vs. 5.59 [2.89], \( p < .001; \) Cohen’s \( d = 1.05 \) (total sample: mean [sd]: feeling worse after the movie: 0.26 [0.65] vs. 1.77 [1.45], \( p < .001; \) Cohen’s \( d = 1.43; \) feeling better after the movie: 1.50 [1.18] vs. 0.35 [0.66], \( p < .001; \) Cohen’s \( d = 1.25; \) VAS sadness: 2.56 [2.52] vs. 6.29 [2.73], \( p < .001; \) Cohen’s \( d = 1.41 \).

Next, food intake data were scrutinized for outliers, defined as \( > \text{mean} + 3SD \), and for skewness. There was one outlier with a kcal intake value of 1510.57. This value was winsorised by replacing the outlying value with the value of 3SD above the mean (kcal = 1361.90). After this, no problems with skewness were observed.

Moderator effects

In an ANCOVA on the extreme score subsample (controlling for BMI, hunger, time since last eaten, ad type, dietary restraint and external eating), we tested the moderating effect of emotional eating on the relation between movie condition and food intake. The control variables BMI and hunger had no significant main effects on food intake (kcal), so a reduced ANCOVA was run (controlling for time since last having eaten, ad type, dietary restraint and external eating). There was a significant moderator effect of emotional eating on the relation between movie condition and food intake (kcal), \( F_{1,377} = 9.34, p = .004 \), partial eta squared = .02. As expected, low emotional eaters ate less during the sad movie than during the neutral movie (adjusted means [SE]: 440.32 [68.46] vs. 667.16 [87.68]) whereas high emotional eaters ate more (441.13

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<th>Characteristics of total sample and the subsamples of low and high emotional eaters.</th>
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<td>Total sample (n = 124)</td>
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\( ^a \) Effect size of the difference between low and high emotional eaters by Cohen’s \( d \) (0.20 = small, 0.50 = medium and 0.80 = large).
A limitation of Study 1 is that the DEBQ was administered to participants after the movie; the amount eaten during the movie may have influenced responses to the DEBQ items. Administration of the questionnaire immediately before the movie, however, might have sensitized participants to the purpose of our study. A further limitation is that the negative mood induction (a sad film) may not have been the most effective distress manipulation at eliciting enhanced food intake in high emotional eaters.

Study 2

For the second study we used a distress manipulation that involved a social-evaluative threat, one that has been shown to induce extreme negative affect (Appelhans, Pagoto, Peters, & Spring, 2010; Newman, O'Connor, & Commer, 2007; Raspopow et al., 2010). The Trier Social Stress Test (TSST) involves public speaking before a jury coupled with an arithmetic challenge. In an earlier study on dieters and non-dieters, anticipation of having to give a speech in front of an evaluative audience, a so-called ego-threat, was found to be effective at suppressing eating in non-dieters and increasing eating in dieters (Heatherton et al., 1991). For the present study we were interested in finding out whether a similar effect would also be obtained for low and high emotional eaters challenged with the TSST. Also, in the present study only participants with emotional eating scores at the extreme ends of the scale were used, but this time emotional eating was assessed at least 1 month before the experiment was conducted. We used a within-subjects design in which all participants were subjected to a control task and a stress task (TSST) on two consecutive days.

In addition to a possible emotional eating by stress interaction effect on food intake, we were also interested in a possible emotional eating by stress interaction effect on post-task hunger. We expected that low emotional eaters would show the typical reaction to stress and report less hunger after the stress task than after the control task, but we were unsure whether high emotional eaters would report similar or higher amounts of hunger after the stress task than after the control task.
the threat was still anticipated. This decision is justified by Appelhans et al.’s finding measured eating after the threatening experience had concluded, rather than while words as the previous day.5 After 20 min the experimenter returned invited to help themselves to the water and the food in the same experimental room for 15 min, after which the experimenter took them to a separate room to fill out several questionnaires at a table which also held a glass of water and four bowls filled with, respectively, white grapes, pieces of carrot, M&Ms and pieces of butter cake. The experimenter left the room, saying ‘Please help yourself to the water and the food. You have earned it.’ After 20 min the experimenter returned to take the participants to another room to perform a 15-min computer task (not relevant to the present study).

On the second test day, the subjects were subjected to a modified version of the Trier Social Stress Task (Kirschbaum, Pirke, & Hellhammer, 1993). Briefly, the task consisted of preparing (5 min) and delivering (5 min) a videotaped speech, followed by a serial subtraction task (5 min). The speech and subtraction task were presented in front of a two-person jury who sat behind a table and wore white doctors’ coats. The participant had to stand in front of the jury's judgment of the participant's performance—indeed, many felt the stressfulness of the public speaking task was extended by a prolonged period of waiting for the results—and to fill out a set of questionnaires. After 15 min the experimenter returned to communicate a positive judgment by saying ‘Please help yourself to the water and the food. You have earned it.’ After 20 min the experimenter returned to take the participants to another room to perform a 15-min computer task (not relevant to the present study).

Procedure
Two laboratory sessions were completed on consecutive weekdays. Participants were instructed to wake up at least two and a half hours before the experiment and to refrain from intake of alcohol or drugs. For 1 h prior to the experiment they were not allowed to smoke, to engage in physical exercise (including cycling), to eat or to drink (an exception was made for water) or to brush their teeth. Experimental sessions were scheduled between 11 and 15 h to minimize the effects of diurnal rhythms on HPA-axis reactivity. Upon arrival on the first day participants were asked to fill out an informed consent form. On the first test day, participants were subjected to the control condition, in which they had to rate six different fabrics (wool, fur, felt, silk, linen and cotton) on various attributes (e.g., softness, pleasantness, warmth). The participants were left alone in the experimental room for 15 min, after which the experimenter took them to a separate room to fill out several questionnaires at a table which also held a glass of water and four bowls filled with, respectively, white grapes, pieces of carrot, M&Ms and pieces of butter cake. The experimenter left the room, saying ‘Please help yourself to the water and the food. You have earned it.’ After 20 min the experimenter returned to take the participants to another room to perform a 15-min computer task (not relevant to the present study).

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Participants
Participants were recruited from a pool of female students taking introductory psychology or pedagogy courses who had completed the emotional eating scale. Females with scores below 1.82 or above 3.25 (corresponding to the 20th and 80th percentiles of the Dutch norm group of females) were invited to participate in a study on ‘health and physiology.’ A total of 47 female students agreed to participate, 23 low and 24 high emotional eaters. Their mean age was 19 years (range 18–27 years) and they had a mean body mass index of 21.27 (SD = 2.66). The study protocol was approved by the ethical board of the Faculty of Social Sciences of the Radboud University Nijmegen.

Measures
Food intake: Before and after participants ate, the bowls with grapes, carrots, M&Ms and butter cakes were weighed with a professional balance (Kern 200). We used total caloric intake as the dependent variable because the various types of food differed in weight and caloric value.

Affect and hunger: On both days, ratings of affect and hunger upon arrival and post-task (but before food intake) were measured. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure, on a 5-point (‘not at all’ to ‘extremely’) scale, the degree to which participants experienced 10 positive and 10 negative affects. The descriptor ‘hungry’ was inserted among the PANAS items so that hunger could be evaluated without alerting the participants to the true nature of the study.

Analyses
Intake of food (kcal) in the control and stress condition showed skewness and kurtosis. Only by computing the difference between intake in the stress condition and the control condition could we achieve normality, a positive value meaning a higher intake in the stress condition. A General Linear Model (GLM) was used with emotional eating as the between-subjects factor and a difference score for each type of food as the dependent variable while controlling for pre-task hunger (the mean of pre-task hunger on the control and on the stress day), external eating and dietary restraint. In a further repeated measures ANCOVA, we assessed changes in post-task hunger as the dependent variable (controlling for pre-task hunger) with emotional eating as a between-subjects variable and condition (control vs. stress) as a within-subjects factor.

Results
We first report the results of various manipulation checks. Immediately after participants’ arrival for the study, there were no differences between the control day and the stress day on hunger or any of the affect items of the PANAS. After the task, there were, however, differences on several PANAS items between the control day and the stress day: reports of irritation, shame, feeling upset and feeling scared were higher on the stress day compared to the control day (Mean [SD]; irritation: 2.43 [1.29] vs. 1.94 [1.17], p = .003; Cohen’s d = 0.38; shame: 2.13 [1.21] vs. 1.23 [0.48], p < .001; Cohen’s d = 0.74; feeling upset: 1.66 [1.51] vs. 1.40 [0.99], p = .038; Cohen’s d = 0.22; feeling scared:1.55 [1.06] vs. 1.23 [0.73], p = .006; Cohen’s d = 0.30). Additionally, reports of hunger were lower on the stress day compared to the control day (4.62 [2.31] vs. 5.85 [3.25], p = .003; Cohen’s d = 0.53).

The GLM (controlling for pre-task hunger, dietary restraint and external eating) showed a significant moderator effect for emotional eating. F (1,42) = 4.83, p = .033, partial eta squared = .103.

\(^{4}\) As part of an ongoing different and larger study we also collected at various time points data on cortisol (by taking samples of saliva), but the cortisol measures are beyond the scope of the present paper.

\(^{5}\) Like Appelhans et al. (2010), who also used the TSST to induce stress, we measured eating after the threatening experience had concluded, rather than while the threat was still anticipated. This decision is justified by Appelhans et al.’s finding that the highest cortisol levels were detected after than just before the speech and math tasks.
moderator effect was significant when the possible confounding variables dietary restraint and external eating were removed from the model, $F_{(1,44)} = 5.80, p = .020$, partial eta squared = .116. As expected, low emotional eaters tended to eat less after the stress task than after the control task (adjusted means, standard error [SE]: 121.29 [43.25] vs. 180.34 [33.41], $t_{(22)} = -1.68, p = .056$, Cohen’s $d = .35$) whereas high emotional eaters tended to eat more (225.91 [42.09] vs. 152.20 [32.50], $t_{(23)} = 1.70, p = .051$, Cohen’s $d = .35$).

There also was a significant emotional eating × stress interaction effect on post-task hunger (controlling for pre-task hunger), $F_{(1,44)} = 4.27, p = .045$, partial eta squared = .088. As expected, low emotional eaters reported less hunger after the stress task than after the control task (adjusted means [SE]: 3.96 [1.32] vs. 6.00 [1.33], $t_{(22)} = -3.99, p < .001$, Cohen’s $d = .99$), whereas high emotional eaters reported similar amounts of hunger after the stress and control tasks (5.24 [1.16] vs. 5.70 [1.32], $t_{(23)} = .82, p = .21$, Cohen’s $d = .16$).

Discussion

Study 2 demonstrated that the interaction effect of emotional eating is also found when using a within-subjects design and when emotional eating is assessed well before the actual study was conducted. This indicates that the moderator effect of emotional eating is robust for experimental design and assessment timing. A further interesting finding, which will be discussed in the general discussion, was the emotional eating × stress-condition interaction effect on post-task hunger.

General discussion

Earlier studies that assessed the possible moderator effect of self-reported emotional eating on the relation between stress and actual food intake have obtained mixed results. In two studies, we tested whether it is possible to predict distress-induced eating with a self-report emotional-eating scale by using only participants with extreme scores on the emotional-eating scale. The main finding of both studies was a significant moderator effect for self-reported emotional eating on the relation between stress and food intake. As expected, the food intake of the low emotional eaters was lower during the sad movie or in the stress condition than during the neutral movie or in the control condition, whereas the food intake of the high emotional eaters was (slightly) higher during the sad movie or in the stress condition than during the neutral movie or in the control condition.

This moderator effect of emotional eating was found when we assessed emotional eating after the food intake while watching the movie (Study 1) and when we only used females with scores at the extreme ends of the emotional eating scale for our main analyses. This moderator effect of emotional eating was also found in Study 2 when emotional eating was assessed at least 1 month before the experiment, and only people with extreme scores were invited to participate. It should further be noted that the moderator effect of emotional eating was also robust for the design of the study, because it was found when we used a between-subjects design (Study 1) or a within-subjects design (Study 2).

A remarkable finding in Study 2 was that high emotional eaters, in contrast to the low emotional eaters, did not report a substantial reduction of hunger immediately after the stress task compared to the control task. The question that now arises is: Do emotional eaters display an entirely different stress response in that they simply do not experience the typical post-stress reduction of hunger (because of a hypoactivation rather than a hyperactivation of the HPA axis)? In this case they would have neurovegetative symptoms that are the reverse of those associated with the typical stress response: they would display increased food intake (hyperphagia) and weight gain, instead of hypophagia and weight loss (Gold & Chrousos, 2002). Alternatively, it is possible that high emotional eaters did not report the normal post-stress reduction of hunger because they suffer from poor interoceptive awareness, i.e. difficulty in recognizing whether they are hungry or satiated or suffering from some other discomfort. The present finding that the increased food intake of the high emotional eaters in the stress condition was not paralleled by high post-stress hunger—in fact, high emotional eaters reported similar degrees of hunger after the control task and the stress task—suggests that high emotional eaters ate in response to stress-related emotional agitation rather than in response to internal hunger. This, in turn, would suggest support for poor interoceptive awareness. However, more research on this issue is needed.

A further possibility, suggested by results of a functional magnetic resonance imaging study by Bohon et al. (2009), may be that emotional eaters differ from non-emotional eaters in their activation of neural circuitry in response to food. For high emotional eaters, food may be more rewarding when they are in a state of negative mood. It as yet unclear, however, whether emotional eating reflects a deficit of reward (Volkow et al., 2003) or a heightened sensitivity to reward (Davis, Strachan, & Berkson, 2004). In a study on brain dopamine measures, emotional eating was negatively associated with baseline dopamine D2-receptor availability in the dorsal striatum (Volkow et al., 2003). This finding was taken to support the view that hypo-dopaminergic functioning underlies the development of emotional eating which would explain why emotional eaters are more receptive to the reinforcing value of food (Volkow et al., 2003), and use food as ‘self-medication’ to blunt effects of negative emotions. Reduced brain dopamine of emotional eaters has, however, also been explained as possible outcome of an adaptive down-regulation of the dopaminergic system, a reflection of a neuroadaptation secondary to overstimulation with food as result of a heightened sensitivity to reward (Bohon et al., 2009; Davis et al., 2004).

In Study 1 there was a moderator effect for emotional eating only when we examined participants with extreme scores on emotional eating and controlled for external eating as possible confounder. The fact that we found no such moderator effect when we used the entire sample and classified people into low or high emotional eaters by using the commonly used median-split procedure or when we used the full range of scores for emotional eating (even though the sample was in those cases more than twice as large, $n = 124$ vs. $n = 45$) would suggest that emotional eating may be best described as a categorical rather than a continuous variable. This notion would be consistent with the results of a functional magnetic resonance imaging study where extreme scores on self-reported emotional eating predicted important individual differences in reward response during negative moods (Bohon et al., 2009).

It should be noted that the validity of the emotional eating scale for predicting emotional eating should not be considered in isolation from the emotional cues to which it is related (Macht, 2008). Earlier it was found that experimental manipulations of physical fear (e.g., threats of electrical shock) reduced eating of non-dieting normal-weight individuals but did not markedly increase the eating of obese or dieting individuals (Herman & Polivy, 1975; McKenna, 1972; Schachter, Goldman, & Gordon, 1968). However, when anxiety was experienced as diffuse or when individuals were not able to label the source of their emotional arousal,
obese individuals were found to eat significantly more when distressed than when calm (e.g., Slochower, 1983). A highly similar pattern of results was found for emotional eaters with an experimental manipulation that involved ego threat (the anticipation of a public speaking task (Oliver et al., 2000; see also Wallis & Hetherington, 2004)). So it would seem that the moderator effect of emotional eating takes the form of low emotional eaters eating appreciably less and high emotional eaters eating appreciably more only in response to certain types of threats. This is also nicely illustrated by the results of the present two studies. Strictly speaking, distress did not produce a statistically significant increase in food intake among emotional eaters in either of the two studies; in both studies the effect of high emotional eating on intake was only borderline significant (ps = .063 and .051). Results did, however, suggest that high emotional eaters tended to eat more in response to the ego threat as induced by the Trier Social Stress Task (Study 2), and only slightly more in response to the negative mood (induced by the sad movie) (Study 1).

Alternatively, demand characteristics and socially desirable responding may have been responsible for the fact that emotional eaters are rarely observed to significantly eat more in response to stress in the laboratory. According to Krantz (1978), people struggling with overeating or weight problems may be concerned with their self-presentation and therefore less inclined to (over)eat in the laboratory. 7

Limitations

A possible limitation is that we cannot rule out the possibility that, for reasons of social desirability, people may have disavowed emotional eating. Still, scores on the emotional eating scale (at least extreme scores) showed predictive validity in these studies, reducing this concern. A further limitation is that the present experiments were conducted on predominantly normal-weight female students, so the present results need replication in overweight subjects. Other limitations may be the lack of assessment of palatability ratings and the presentation of a relative small number of food items. Finally, the present findings would need replication outside the laboratory.

Strengths

In the present studies we avoided the possibility that individuals with certain scores might be classified as high in one study but low in the other by using as cut-off points for low vs. high emotional eating the 20th and 80th percentiles of the latest norm group of Dutch females (Van Strien, 2011). A further strength is that in all analyses we controlled for restrained eating and external eating, so the moderator effect of emotional eating seems robust for the possible confounding effects of external and restrained eating.

Conclusion

By using only participants with extreme scores on emotional eating, it is possible to predict actual distress-induced food intake.

References


