Personality and Individual Differences 49 (2010) 565–569

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

I ate what?! The effect of stress and dispositional eating style on food intake and behavioral awareness

Justin D. Royal [a], Jaime L. Kurtz [b,*]

[a] Center for Human Genetic Research, Massachusetts General Hospital, 185 Cambridge St., Boston, MA 02114, USA
[b] Department of Psychology, James Madison University, MSC 7704 Harrisonburg, VA 22807, USA

ARTICLE INFO

Article history:
Received 12 October 2009
Received in revised form 7 April 2010
Accepted 29 April 2010
Available online 1 June 2010

Keywords:
Stress
Eating
Dietary restraint
Emotion
Awareness

ABSTRACT

Many studies have found that individual differences such as emotional eating and dietary restraint affect the relationship between stress and eating. However, little research examines whether people are differentially aware of how much they eat during a stressful situation. The current study placed 52 female undergraduate students in either a low-stress (solving easy anagrams) or high-stress (working on unsolvable anagrams) situation while having the opportunity to eat. Participants then guessed how much food they ate. Results showed that emotional eating and stress were related to overestimation of total food consumption, whereas dietary restraint partially mediated the relationship between stress condition and actual food intake.

Published by Elsevier Ltd.

1. Introduction

According to a well-regarded model of self-regulation (Baumeister, Heatherton, & Tice, 1994), attentional and cognitive resources play a key role in the ability to exercise self-control over numerous important life activities. When these limited resources are reduced by activities that are mentally taxing or stressful, self-regulation becomes a challenge. A clear application of this idea is seen in the relationship between food consumption and stress (Mann & Ward, 2004). Many people attempt to strictly regulate their food intake, with the goal of increased health or reduced body weight. However, these attempts can be thwarted by external stressors that tax people's attentional and cognitive resources. Whether snacking on fatty foods while watching a scary movie (Schotte, Cools, & McNally, 1990) or while being exposed to ego-threatening words (Wallis & Hetherington, 2004), there seems to be a strong relationship between stress levels and food consumption, whereby consumption increases in the presence of a stressor.

Although varying degrees of stress may be strong predictors of what people eat, surprisingly little research has examined people's awareness of the impact of external factors, such as stress and distraction, on food consumption. Determining whether people realize what they are eating has important implications for understanding individual differences in eating behavior, and is the focus of the present research.

1.1. Dietary restraint and emotional eating

Not everyone feels inclined to overeat when under stress (Baucom & Aiken, 1981). Therefore, rather than suggesting a one-size-fits-all explanation for the stress–eating relationship, we consider two important individual differences that might explain why some people overeat under stress when other do not. Over the past few decades, dietary restraint has emerged as an important individual difference that affects people's eating behavior. In fact, early work in the field (Baucom & Aiken, 1981; van Strien, Frijters, Bergers, & Defares, 1986) suggested that dietary restraint was actually a better predictor of the stress–eating relationship than was obesity, because restraint is a strong predictor of the tendency to eat due to external and often uncontrollable pressures. Later studies provided much more conclusive evidence for the relationship, and restrained eating has therefore replaced obesity as the interest of many researchers (Greeno & Wing, 1994).

Herman and Polivy (1980) defined restrained eating as being synonymous with chronic dieting and suggested that, whereas unrestrained eaters rely on internal hunger cues to determine when to eat, restrained eaters are more likely to curb their food intake, even when they are hungry. They count calories, plan for future meals, and deprive themselves of foods they consider "forbidden" or "bad," giving them strong cognitive control over their food choices (Ward & Mann, 2000). However, this seemingly

* Corresponding author. Tel.: +1 540 568 6114; fax: +1 540 568 3322.
E-mail address: kurtzjl@jmu.edu (J.L. Kurtz).

0191-8869/$ - see front matter Published by Elsevier Ltd.
doi:10.1016/j.paid.2010.04.022

advantageous ability to control consumption may backfire. Some researchers (e.g., Zellner et al., 2006) have suggested that when this cognitive control is interrupted by emotions or by the intake of "forbidden" food, restrained eaters are prone to overeating, particularly when under stress. In their study, restrained eaters who worked on a stressful, unsolvable anagram task during a laboratory study ate more than those who worked on a low-stress, solvable anagram task, presumably because the cognitively-demanding task required them to stop vigilantly monitoring their food intake.

Whereas restrained eating has received the bulk of recent research attention, van Strien et al. (1986) and van Strien, Engels, van Staveren, and Herman (2006) have also examined the tendency to overeat when feeling emotionally aroused. These researchers suggested that this is not unrelated to dietary restraint, since both restrained eaters and emotional eaters eat in response to external factors, rather than attending to their own internal hunger cues. However, while restrained eating describes monitoring and controlling of food intake, emotional eating describes how specific emotions (i.e. anger or irritation) or emotional states (i.e. boredom, loneliness) directly influence eating behavior (van Strien, Breteler, & Ouwens, 2002; van Strien et al., 1986).

Research examining stress eating, dietary restraint, and emotional eating has produced mixed results. Some research (Oliver, Wardle, & Gibson, 2000; Wallis & Hetherington, 2009) has suggested that, although dietary restraint and emotional eating behaviors may appear similar, they are distinct tendencies that are worth investigating independently. Both of these studies found that when participants were exposed to a stressor, there was no effect of restraint on consumption; however, emotional eaters ate more high-fat snacks than did non-emotional eaters. In contrast, a separate study by Wallis and Hetherington (2004) found that both dietary restraint and emotional eating were associated with increased consumption during a stressful task. Because of this ambiguity, the present study considers both restrained and emotional eating as being potentially important factors in the stress–eating relationship.

1.2. Stress, eating, and behavioral awareness

Ward and Mann (2000) found preliminary evidence that, in addition to overeating, restrained eaters may be unaware of how much food they consume under stress. Currently, this is the only study that adds a behavioral awareness component to the stress–eating paradigm. Participants were offered snack foods under either high or low cognitive load. Based on the assumption that high cognitive load leads to diminished behavioral awareness and that restrained eaters would be especially sensitive to this, they hypothesized that restrained eaters would not only eat more under high cognitive load, but would also be worse at recalling how much they ate. As predicted, high cognitive load was predictive of increased eating, even when controlling for stress. However, although those in the high cognitive load condition were slightly worse at recalling how much they ate, these results did not reach statistical significance.

The present research is designed to replicate and extend Ward and Mann's (2000) work, with greater attention paid to important individual differences. They included only restrained eaters in the study, who were identified before the study by completing the Dietary Restraint Scale-Revised (Herman & Polivy, 1980). The current study will include both restrained and unrestrained eaters, as classified by a different but also commonly-used measure, the Dutch Eating Behavior Questionnaire (van Strien, Engels, van Staveren, & Herman, 2006; van Strien et al., 1986). Also, because emotional eaters are likely to overeat under stress, the present study will examine potential differences between emotional and non-emotional eaters. Finally, Ward and Mann (2000) did not measure participants' baseline stress level, which may play an important role in consumption during an experimentally-induced stressful state. The current study will address this limitation by obtaining both pre- and post-test affect.

1.3. The present study

Currently, no literature exists that simultaneously examines the relationship between the amount of food eaten during a stressful task, the traits of dietary restraint and emotional eating, and awareness of how much was eaten. The present study will examine these relationships in a controlled laboratory setting. We hypothesize that there will be a main effect of stress on eating, such that those in the high-stress condition will eat more, and that highly restrained and emotional eaters will eat more in the high-stress condition, but will lack awareness of this fact.

2. Method

2.1. Participants

A convenience sample of 56 female students from a small liberal arts college in Southern California served as participants. Their mean age was 19.30 (SD = 1.11), and the mean Body Mass Index was 21.63 (SD = 2.65). Although they were not directly assessed, reactions to the experimental method suggested that no participants suffered from a clinical eating disorder. The racial/ethnic breakdown of participants was fairly representative of the college's demographic makeup: 35 European-American, 6 Asian-American, 4 African-American, 2 Hispanic, and 5 mixed race.

Participants were recruited through flyers distributed on campus and through ads in the student news bulletin. They were told they would be paid five dollars for participation. Four participants expressed a high level of suspicion of the procedure and were excluded from analyses. The final total was 52 participants.

2.2. Materials

2.2.1. Anagram lists

A list of 10 solvable anagrams (i.e. layer, meats) was given to participants in the low-stress condition, and a list of 10 unsolvable anagrams (i.e. radio, juice) was given to participants in the high-stress condition. Both lists of anagrams were taken from a previous stress-and-eating study by Zellner and colleagues (2006).

2.2.2. PANAS

Participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) both at the beginning of the study and after completing the anagram task. The PANAS is a commonly-used 20-item self-report that measures dispositional characteristics for both positive affect (10 items; e.g. enthusiastic, proud) and negative affect (10 items; e.g. hostile, irritable). The positive affect (PA) and negative affect (NA) scales are sensitive to momentary changes in mood, such as an increase in stress. Response categories range from 1 ('very slightly or not at all') to 5 ('extremely'). In the current study, Cronbach's alpha was .91 for the PA scale and .84 for the NA scale.

2.2.3. DEBQ

Participants completed the Dutch Eating Behavior Questionnaire (DEBQ; van Strien et al., 1986; van Strien et al., 2006) which has 33 items, forming three separate scales: emotional eating (13 items; e.g. "Do you have a desire to eat when you are irritated?"), external eating (10 items; e.g. "If food smells and looks good, do you eat more than usual?"), and restrained eating (10 items; e.g.

"Do you try to eat less at mealtimes than you would like to eat?"). Response categories range from 1 ('never') to 5 ('very often'). Each of the scales has been shown to be psychometrically sound in English (van Strien et al., 2002; Wardle, 1987). In the current study, Cronbach's alpha was .95 for emotional eating, .83 for external eating, and .91 for restrained eating.

2.2.4. Behavioral awareness questions

Participants were asked to estimate how much of each snack food they ate during the anagram task by indicating a specific number of pieces of food consumed. Participants were also asked to write approximately how many calories of each snack food they consumed, and to estimate the total number of calories consumed.

2.2.5. Demographics

Participants provided their age, race/ethnicity, and year in school. They were also asked to provide their height and weight. This information was later used to calculate a Body Mass Index (BMI) for each participant.

2.3. Procedure

After being recruited to participate, subjects were informed that they should not eat within 3 h of participating because the study involves a saliva sample that will measure their baseline cortisol level, and fasting for 3 h is necessary to obtain an accurate measure. Actually, this was done to ensure participants had roughly the same amount of hunger level at the beginning of the study. No participants reported eating anything in the 3 h preceding the study.

Participants were run individually. After providing informed consent, participants provided a saliva sample, then completed the PANAS. The researcher, who was blind to condition, then led the participants into individual testing rooms and seated them at tables with an envelope with one of the two sets of anagrams and four bowls of snack foods.

The four bowls contained M&M's, Reese's Pieces, cheese crackers, and peanuts. There was only one type of food in each bowl. Using an electronic scale, the bowls were weighed prior to the study. Participants were told that the researcher provided snacks because they were asked to abstain from eating for 3 h. The researcher informed the participants that a set of anagrams was inside the envelope, that they would have 10 min to work on it, and that the researcher would return in 10 min. Participants were also told that there were plenty of snacks and that they should eat however much they wanted while working on the anagrams. To minimize self-presentation concerns, each bowl was full enough that a participant could eat a good amount of food without it being noticeable.

After 10 min, the researcher returned and asked participants to place their anagrams back inside the envelope, and led them out of the room. Participants then completed the PANAS, the DEBQ, and the behavioral awareness and demographic questions. Upon completion, the researcher conducted a suspicion probe, and participants were debriefed and paid five dollars. The researcher then weighed each bowl of snack food and calculated how many pieces of each and how many calories of each were consumed.

3. Results

3.1. Preliminary analyses

To quantify how much food participants ate, the total number of calories consumed was calculated. In addition, the total number of pieces of food consumed was calculated. These measures were highly correlated ($r = 0.88$, $p < .01$), so for reasons of clarity, data are reported only in calories when effects were significant for both units.

To classify the participants as either restrained or unrestrained eaters, a median split was performed on participants' scores on the Restraint Subscale of the DEBQ (Yeomans, Tovey, Tinley, & Haynes, 2004). Participants scoring 28.5 and below were classified as unrestrained, and those scoring above 28.5 were classified as restrained. The same was done for the Emotional Eating Subscale of the DEBQ, with those scoring 42 and above classified as being high emotional eaters, and below 42 being low emotional eaters. There was a moderate correlation between restrained and emotional eating ($r(52) = 0.31$, $p < .05$). There were no clear hypotheses regarding the External Eating subscale. However, on an exploratory basis, the analyses below were also done using External Eating as a factor, and no significant differences were found.

3.2. Manipulation check

There was a significant difference between participants in the low-stress condition ($M = .37$, $SD = 4.73$) and those in the high-stress condition ($M = 3.76$, $SD = 4.67$) for pretest-to-post-test negative affect, $t(50) = -2.60$, $p < .05$, suggesting that the impossible anagrams did induce stress.

3.3. Food consumption

As predicted, participants in the high-stress condition ate significantly more than those in the low-stress condition, regardless of dietary restraint or emotional eating status. A significant difference was found between those in the high-stress ($M = 231.17$ calories, $SD = 167.09$) and low-stress condition ($M = 130.44$ calories, $SD = 143.90$, $t(50) = -2.33$, $p < .05$).

A 2 (Stress) $\times$ 2 (Emotional Eating Status) ANOVA revealed the aforementioned significant main effect of condition ($F(1, 48) = 5.42$, $p < .05$) on the total amount of food consumed. However, there was no significant main effect of emotional eating status (low: $M = 220.21$ calories, $SD = 143.15$; high: $M = 206.71$ calories, $SD = 171.68$), $F(1, 48) = .29$, $p = .59$. There was also no significant interaction ($F(1, 48) = .001$, $p = .99$). Similarly, a 2 (Stress) $\times$ 2 (Restraint Status) ANOVA revealed the main effect of condition ($F(1, 48) = 4.54$, $p < .05$) but no main effect of restraint status (low: $M = 202.21$ calories, $SD = 176.57$; high: $M = 155.52$, $SD = 145.94$) ($F(1, 48) = .41$, $p = .53$). There was also no significant interaction, $F(1, 48) = .002$, $p = .96$.

Based on Mann and Ward (2004), we tested the possibility that dietary restraint operates indirectly to mediate the relationship between condition and amount of food eaten. As a preliminary analysis, we calculated correlations between the dependent variables, number of calories consumed ($M = 178.87$, $SD = .51$) and pieces of food consumed ($M = 31.98$, $SD = 32.25$), and the proposed mediator, dietary restraint ($M = 28.73$, $SD = 8.84$). Unexpectedly, the correlation between restraint and calories consumed was not statistically significant, $r(52) = -.19$, $p = .16$, but the correlation between restraint and pieces of food consumed was statistically significant, $r(52) = -.33$, $p < .05$. In addition, the correlation between the independent variable (condition; dummy coded) and the mediator (restraint) was statistically significant, $r(52) = -.28$, $p < .05$, as was the correlation between independent variable (condition) and dependent variable (pieces of food consumed), $r(52) = .29$, $p < .05$.

Next, we tested for the mediating, or indirect, effect of dietary restraint on the effect of experimental condition on the amount of food eaten. Because the assumption of normality is called into question with a small sample size, we followed the recommendations of Preacher and Hayes (2008), using a bootstrapping technique with 10,000 bootstrapped samples. Although the total

effect of condition on amount of food eaten was significant ($t(51) = 2.11$, $p < .05$), the direct effect of condition, once adjusting for dietary restraint, on amount of food eaten was not ($t(51) = 1.52$, $p = .14$). The indirect effect, however, was significant, with a 95% CI of 0.02–16.53. Because the confidence interval does not contain zero, restraint does appear to mediate the relationship between condition and pieces of food eaten.

A similar analysis was conducted for emotional eating on an exploratory basis, and no evidence of mediation was found.

3.4. Behavioral awareness

Recall of the amount of food consumed was calculated by subtracting the total amount actually eaten from the amount participants estimated having eaten. (Therefore, positive numbers indicate an overestimation, and vice versa.) Eight participants did not eat anything and are not included in these analyses. Overall, participants were quite accurate at estimating how much they ate, with just a slight underestimation of calories ($M = -18.44$, $SD = 116.64$). There was no effect of dietary restraint or emotional eating on whether or not participants ate something. However, those in the high-stress condition were more likely to eat something (24/25) than were those in the low-stress-condition (19/26), $\chi^2 = 4.96$, $p < .05$.

To test for a predicted interaction, 2 (Condition) × 2 (Restraint Status) ANOVAs were calculated. There were no significant main effects of condition ($F(1, 48) = .38$, $p = .54$) or restraint status ($F(1, 48) = 2.35$, $p = .13$), nor was there an interaction for the total amount of food eaten ($F(1, 48) = .46$, $p = .50$).

Unexpectedly, a 2 (Condition) × 2 (Emotional Eating Status) ANOVA yielded a significant interaction ($F(1, 48) = 6.46$, $p < .05$), such that those high in emotional eating and in the high-stress condition significantly overestimated how many calories they ate ($M = 32.40$, $SD = 125.02$) relative to those in the low-stress condition ($M = -47.18$, $SD = 148.38$), whereas the opposite was true for those low in emotional eating. In the low-stress condition, these participants overestimated how much they ate ($M = 27.28$, $SD = 83.38$), whereas those in the high-stress condition underestimated ($M = -65.28$, $SD = 72.73$) (see Fig. 1).

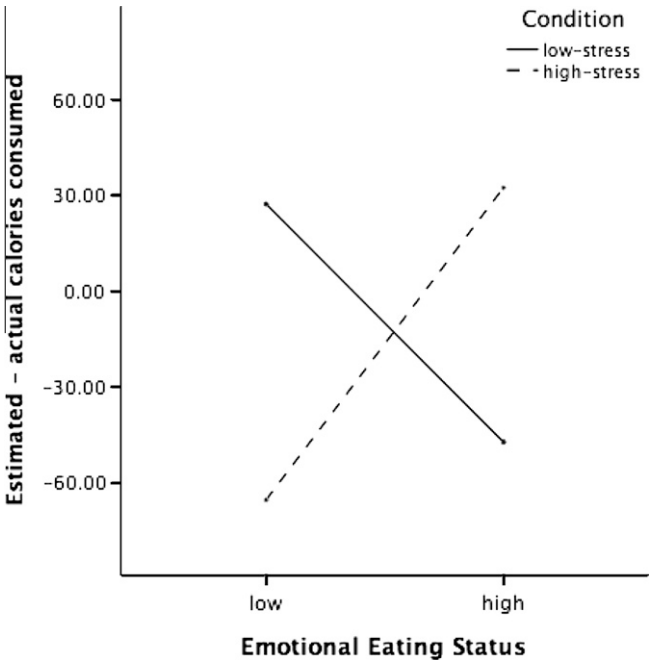

Fig. 1. Relationship between emotional eating status and experimental condition on the difference in estimated versus actual calories consumed (positive numbers indicate an overestimation).

4. Discussion

The present study extended previous literature on the stress–eating relationship by examining the role of stress and dispositional eating style on food consumption and awareness. As predicted, participants in the high-stress condition ate more than did those in the low-stress condition, successfully replicating the effects of Ward and Mann (2000) using the anagram task. Furthermore, it was found that dietary restraint mediated the relationship between condition and pieces of food eaten. This finding is similar to the results of previous studies that found a link between dietary restraint, eating behavior, and stress (Heatherton, Herman, & Polivy, 1992; Ruderman, 1985; Ward & Mann, 2000). Furthermore, these findings add support to the notion that the stress–eating relationship is consistent across a variety of stressors, including watching a scary film (Schotte et al., 1990) or completing reaction time tasks (Lattimore & Caswell, 2004).

An unexpected interaction was found for the effects of emotional eating status and experimental condition on the behavioral awareness measure, with non-emotional eaters in the low-stress condition and high emotional eaters in the high-stress condition both overestimating how much they ate during the anagram task. Although this finding initially seems counterintuitive, one reasonable explanation for the fact that high emotional eaters in the high-stress condition overestimated their food intake is that these participants were, by and large, quite successful at maintaining a healthy weight. If "successful" emotional eaters know from past experience that they are inclined to overeat when under stress, focusing on and overestimating the amount of food they are consuming might be one strategy that keeps them from overeating. Indeed, removing the six overweight participants from the analysis suggested an even stronger overestimation effect. On the other hand, the low-stress condition may not have been sufficient to trigger what seems to be emotional eaters' defense against emotional overeating. As a result, these participants did not overestimate their food intake.

The effect for non-emotional eaters is harder to interpret, with those in the low-stress condition overestimating their intake relative to those in the high-stress condition. One possibility is that the food may have been more focal for non-emotional eaters in the low-stress condition, as they were sitting in a room with presumably nothing to do after solving the easy anagrams. This could lead them to overestimate their intake. This would not be the case in the high-stress condition, in which the unsolvable anagrams are the primary focus. Future studies should examine the effect of overestimation of food intake as a correlate of individual differences in eating, and – more practically – as a strategy for maintaining healthy body weight, both in and out of the laboratory setting, with a broader range of BMIs.

This raises a shortcoming of the present study. As is often the case when studying body weight in a college population (e.g., Ward & Mann, 2000), the average BMI of our participants ($M = 21.63$, $SD = 2.65$) is within the normal weight range of 18–25, but is noticeably lower than that of the average American woman, which is 24 (Ogden, Fryar, Carroll, & Flegal, 2004). Only 11.54% ($n = 6$) of the participants were classified as overweight, with a BMI greater than 25, and none of the participants were classified as obese, with a BMI greater than 30. These statistics are in stark contrast to the general American population, in which a majority of women are overweight or obese. Recruiting women outside of the college set-

ting to participate in future studies would help ensure that the group's average BMI is more representative of the general population and will shed more light on the present findings.

On the other hand, the fact that we had a rather restricted range of body types in this study yet still found significant effects suggests that stable individual differences – over and above weight status – really are quite predictive of eating behavior. This is consistent with previous research (e.g., Baucom & Aiken, 1981; Greeno & Wing, 1994) and supports the notion that successful weight management involves a complicated interplay of both internal traits and situational factors.

The results of this study suggest many implications for future research on individual differences, stress-induced eating, and behavioral awareness. Future studies may benefit from tracking participants' awareness of food choices that occur during normal, everyday stressors. Participants in the current study had only four snack choices, none of which they personally selected beforehand. Furthermore, while the anagram task did reliably increase stress, it would be interesting to examine how people respond to food when under more severe, higher stakes stressors.

Also, while the majority of research on nonclinical eating behavior has focused on the individual differences of dietary restraint, emotional eating, and external eating (van Strien et al., 1986; van Strien et al., 2006), there are certainly others worthy of future study. For instance, neuroticism appears to be positively correlated with dietary restraint (Provencher et al., 2008). Because neurotic individuals are more susceptible to negative emotions such as stress, they may also overeat more frequently in response to these emotions. Another relevant trait is that of mindfulness, which is defined as the tendency to attend to the present moment (Brown & Ryan, 2003). Mindful people are more likely to eat in response to bodily cues rather than in response to stressors. They are also likely to have an accurate awareness of how much food they are consuming. The relationship between these traits, food consumption, and BMI is an exciting avenue for future research.

These results may lend advice to clinicians whose patients struggle with weight and eating-related concerns. They may also be applicable to nonclinical populations who are concerned with weight management and have difficulty controlling their food intake when stressed. In general, a greater focus on individual differences may lead to eating-related advice that is tailored to the individual. Those who are high in dietary restraint, for instance, might avoid exposure to tempting foods during a stressor. This sort of advice is particularly timely, as people report ever-increasing levels of stress, as well as greater instances of overweight and obesity (Ogden et al., 2004; Wansink, 2004).

In conclusion, the present study extends previous work on stress and eating by paying particular attention to important individual differences in food intake and awareness under varying degrees of stress. Although recent research describes a pervasive trend to eat "mindlessly" (Wansink, 2004), few studies have investigated who is most susceptible to this, and when it is most likely to occur. The results of the present study demonstrate the danger of overindulging that restrained eaters faced when stressed, as well as a possible explanation for why normal weight emotional eaters may be successful at weight management.

References

Baucom, D. H., & Aiken, P. A. (1981). Effect of depressed mood on eating among obese and nonobese dieting and nondieting persons. *Journal of Personality and Social Psychology, 41*, 577–585.

Baumeister, R. F., Heatherton, T. F., & Tice, D. M. (1994). *Losing control: How and why people fail at self-regulation?* San Diego, CA: Academic Press.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822–848.

Greeno, C. G., & Wing, R. R. (1994). Stress-induced eating. *Psychological Bulletin, 115*, 444–464.

Heatherton, T. F., Herman, C. P., & Polivy, J. (1992). Effects of distress on eating: The importance of ego-involvement. *Journal of Personality and Social Psychology, 62*, 801–803.

Herman, C. P., & Polivy, J. (1980). Restrained eating. In A. J. Stunkard (Ed.), *Obesity* (pp. 208–225). Philadelphia: W.B. Saunders.

Lattimore, P., & Caswell, N. (2004). Differential effects of active and passive stress on food intake in restrained and unrestrained eaters. *Appetite, 42*, 167.

Mann, T., & Ward, A. (2004). To eat or not to eat: Implications of the attentional myopia model for restrained eaters. *Journal of Abnormal Psychology, 113*, 90–98.

Ogden, C. L., Fryar, C. D., Carroll, M. D., & Flegal, K. M. (2004). *Mean body weight, height, and body mass index, United States, 1960–2002*. Hyattsville, MD: National Center for Health Statistics.

Oliver, G., Wardle, J., & Gibson, E. (2000). Stress and food choice: A laboratory study. *Psychosomatic Medicine, 62*, 853–865.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879–891.

Provencher, V., Begin, C., Gagnon-Girouard, M., Tremblay, A., Bolvin, S., & Lemieux, S. (2008). Personality traits of overweight and obese women: Associations with BMI and eating behaviors. *Eating Behaviors, 9*, 294–302.

Ruderman, A. J. (1985). Dysphoric mood and overeating: A test of restraint theory's disinhibition hypothesis. *Journal of Abnormal Psychology, 94*, 78–85.

Schotte, D. E., Cools, J., & McNally, R. J. (1990). Film-induced negative affect triggers overeating in restrained eaters. *Journal of Abnormal Psychology, 99*, 317–320.

van Strien, T., Breteler, M. H. M., & Ouwens, M. A. (2002). Restraint scale, its subscales concern for dieting and weight fluctuation. *Personality and Individual Differences, 33*, 791–802.

van Strien, T., Engels, R. C. M. E., van Staveren, W., & Herman, C. P. (2006). The validity of dietary restraint scales: Comment on Stice et al. (2004). *Psychological Assessment, 18*, 89–94.

van Strien, T., Frijters, J. E., Bergers, G. P., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders, 5*, 295–315.

Wallis, D., & Hetherington, M. (2004). Stress and eating: The effects of ego-threat and cognitive demand on food intake in restrained and emotional eaters. *Appetite, 43*, 39–46.

Wallis, D., & Hetherington, M. (2009). Emotions and eating. Self-reported and experimentally-induced changes in food intake under stress. *Appetite, 52*, 355–362.

Wansink, B. (2004). Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annual Review of Nutrition, 24*, 455–579.

Ward, A., & Mann, T. (2000). Don't mind if I do: Disinhibited eating under cognitive load. *Journal of Personality and Social Psychology, 78*, 753–763.

Wardle, J. (1987). Eating style: A validation study of the Dutch Eating Behavior Questionnaire in normal subjects and women with eating disorders. *Journal of Psychosomatic Research, 31*, 161–169.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 47*, 1063–1070.

Yeomans, M., Tovey, H., Tinley, E., & Haynes, C. (2004). Effects of manipulated palatability on appetite depend on restraint and disinhibition scores from the Three-Factor Eating Questionnaire. *International Journal of Obesity, 28*, 144–151.

Zellner, D. A., Loaiza, S., Gonzalez, Z., Pita, J., Morales, J., Pecora, D., et al. (2006). Food selection changes under stress. *Physiology and Behavior, 87*, 789–793.